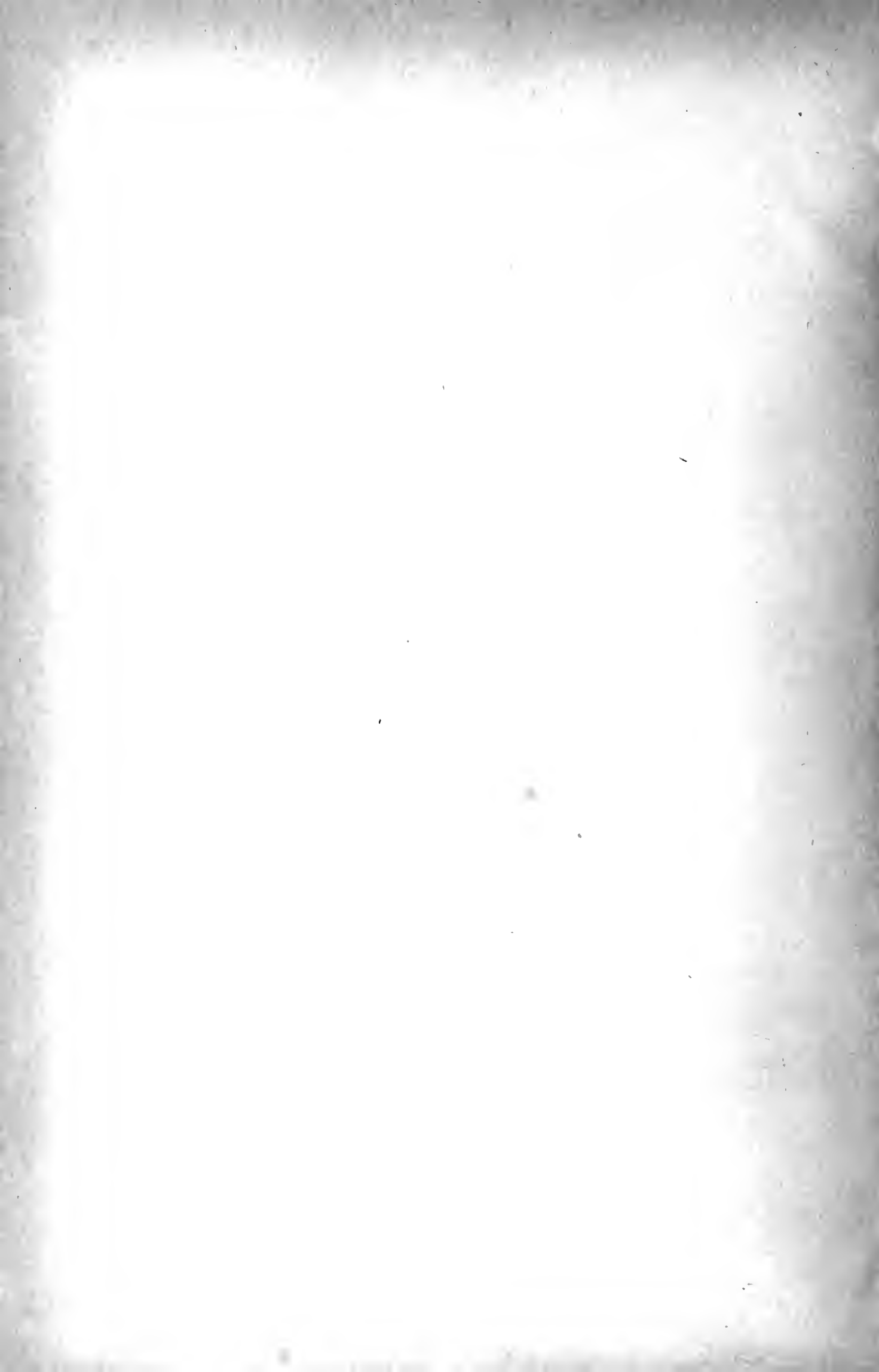


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THE
ELECTRICAL REVIEW.

Vol. LXXXI.

JULY 6 — DECEMBER 28, 1917.

LONDON :
H. ALABASTER, GATEHOUSE & KEMPE,
4, LUDGATE HILL, E.C. 4.



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THE ELECTRICAL REVIEW.

VOL. LXXXI.

JULY 6, 1917.

No. 2,067.

ELECTRICAL REVIEW.

INDUSTRIAL RECONSTRUCTION.

Vol. LXXXI.]

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[No. 2,067.

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It is announced that the Ministry of Labour has placed before the leading Associations of Employers and before the Trade Unions a number of proposals respecting the future relations of Capital and Labour. The proposals are the outcome of the investigations and study upon which a sub-committee of the Reconstruction Committee of the Government has been engaged for some time. The *personnel* of the Committee does not matter greatly, for the recommendations have to pass through the mill which is composed of the minds of authorities of practical experience on both sides, and it is upon the conclusions arrived at by these authorities that so much must depend. We are all in real earnest in our search for ways and means whereby in the new industrial situation that must inevitably follow the war, there shall be as near an approach to industrial peace as is possible in a human state of existence. We shall show our sincerity best by approaching all proposals that are authoritatively advanced with reason and with sympathy, and one of the first things that we have got to recognise is that the Government in war-time has given the workers, upon whom we have had to rely to furnish the wherewithal to wage successful warfare against a common foe, the most definite undertakings for the after-the-war period. These undertakings took the form of Government guarantees, sanctioned by Parliament, which, of course, represents all manufacturing industry concerned in the compact, whatever may be the likes or dislikes of individual firms or persons. All concerns that received the benefits of the temporary suspension of trade union provisions which made for limitation of output and other things of a like character dear to the heart of Labour, whether they will or no are bound by the guarantee.

The agreements thus arrived at have been adhered to during the war, but it was not foreseen how great would be the effects of the European upheaval upon all industrial conditions. It was not foreseen then that there would come a time when practically everybody would recognise, as the sub-committee suggests in its interim report is the case, that the war enforced some reconstruction of industry. That we shall not for perhaps a generation, if ever again, be able, even if we so desired, to return to the industrial state of affairs that obtained before the war is as certain as anything well can be in these moving times. We have, therefore, to look forward to a new period altogether, in which arrangements of all kinds made in the past will

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The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 6d.; Canada, £1 3s. 10d. (\$5.80). To all other countries, £1 10s.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.

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MELBOURNE: The Mining & Engineering Review, 90, William Street; Gordon & Gotch, Queen Street.

MILAN: Fratelli Treves.
NEW YORK: D. Van Nostrand, 25, Park Place.

PARIS: Boyveau & Chevillet, 22, Rue de la Banque.

PERTH, W.A.: Gordon & Gotch, William Street.

ROME: Loescher & Co., Corso Umberto I° 307.

SYDNEY: The Mining & Engineering Review, 273, George Street; Gordon and Gotch, Pitt Street.

TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.

WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

THE "ELECTRICAL REVIEW'S"
ELECTRICAL & ALLIED TRADES DIRECTORY
(THE RED BOOK),

1917 EDITION

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H. ALABASTER, GATEHOUSE & KEMPE,
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come under revision. The very guarantees which have been so definitely given will naturally be among the arrangements calling for attention. It is most necessary, as well as being desirable on other grounds besides that of sheer necessity, that there should be no ground for suspicion or apprehension on the part of Labour that the nation desires to avoid obligations that have been shouldered by its official representatives. We are unitedly fighting the most dishonourable foe that history has ever made infamous, and it is not likely to be the will of the nation to have any taint of dishonour besmirching its own record when it comes to settle the problems arising for settlement among ourselves. The question, then, arises how, in this period of industrial reconstruction, these coming days of new relationships, we can all work together so that the industrial well-being of the people shall be protected by industry being made prosperous, and so that, at the same time, Labour conditions shall be so revised as to make the position of the workers no less, and perhaps far more, satisfactory than it could possibly have been if they had been able to return to the state of affairs that existed before the Unions agreed to the suspension of the rules.

It is recognised by the Reconstruction Sub-Committee, in what is described as its Interim Report on Joint Standing Industrial Councils, that there must be the largest possible measure of co-operation between employers and employed; also that any proposal put forward for securing that end should offer to the workpeople the means of attaining improved conditions of employment and a higher standard of comfort generally. Such proposals should also involve "the enlistment of their active and continuous co-operation in the promotion of industry." In order to attain these ends it is necessary that each industry should have its own organisation, representative of its employers and workpeople, such organisation to have as its object the regular consideration of matters affecting the progress and well-being of the trade from the point of view of all those engaged in it, so far as this is consistent with the general interest of the community.

The principal recommendation of the sub-committee is that if, after the representatives of employers' associations and trade unions have considered the propositions, they approve of them so that Government may legislatively act in the same direction, Joint Standing Industrial Councils shall be set up in the several industries in which they do not already exist, composed of representatives of employers and employed. It is further suggested that in the well-organised industries local and works organisations may supplement and make more effective the work of the central bodies. There should be triple organisation—works, districts, and national. The various questions that the National Council should handle are detailed in the *Times* of June 29th, to which we refer our readers who have an interest in the matter, but have not officially received the interim report.

It is obvious that efficient and suitable organisation is the very first requirement of the situation. Many of the points covered in the report will come under discussion in the coming months, but this question of organisation, upon which we have so often and so emphatically dwelt in these pages, is essential in the earliest stage of our approaches toward permanent industrial peace. The efforts of the past year toward that end, including the establishment of the Alliance of Employers and Employed, will not have been wasted.

There is not the least room for doubt that if employers and employed are afforded better facilities for meeting and discussing industrial questions together, causes of friction may often be removed,

reducing materially the number of occasions on which it will be necessary, in the words of the committee, "to contemplate recourse to a stoppage of work." The necessity of providing some method of ensuring the due observance on both sides of agreements thus arrived at must not be overlooked.

The appearance of the report, in our opinion, is most timely, and the general tenor of its proposals is satisfactory. We hope that the employers' and unions' organisations which now have it before them will find it convenient to advance their criticisms and suggestions for the improvement of the scheme, wherever such may be necessary, without delay.

Cheshire Water-power Proposals.

Up to the present the water powers of this country have occupied a very secondary position in the public estimation; we have not, of course, any spectacular powers, judged by American standards, and, on the other hand, we have, or had, an abundant supply of cheap coal, both of which considerations have tended to obscure the fact that there are a good many low-head water powers possessing certain economic possibilities in this country, especially if the price of coal remains at a high level. In this connection, considerable interest attaches to the recent decision of the Chester Town Council to apply for a grant of £200 under the Development Fund Act of 1909, for the purpose of investigating the water-power possibilities of the River Dee above Chester, with a view to generating electricity to be used for agricultural purposes and for the development of rural industries.

It will be remembered that the Chester Corporation has now experienced the benefits of its own hydro-electric development, at the Chester Weir, for some 3½ years, the system of operation being such that electrical energy can be generated with a fall of 2 ft. or more, resulting in the production of 30 per cent. more energy than is usually obtained in developments of this nature. Up to March last some 5½ million units had been obtained from this plant at an average cost per unit of .0876d. for labour, repairs, &c., and .1483d. for interest and loan charges.

The inception and carrying out of the above project is to the credit of Mr. S. E. Britton, the city electrical engineer, who, in view of the success attending the original scheme, and the prospective advantages of an adequate supply of electricity to the thriving agricultural and rural communities of Cheshire, has now brought forward a proposal for the further development of the water power in the higher reaches of the river. It is considered that upwards of a dozen hydro-electric plants could be provided in 40 miles of river, and that some 10 million units per annum could be supplied to the adjacent farms and villages. Rough estimates based on the Chester scheme show that with operating costs at about ¼d. per unit generated, and an average income of 2d. per unit sold, the available surplus would allow of a capital expenditure far in excess of the probable cost of the works; moreover, such a development would utilise a natural source of energy now running to waste, and to produce the equivalent from coal would require some 20,000 tons a year of that now precious commodity. The matter has been placed before the Board of Agriculture and Fisheries, which is obviously a much interested party, and it is on the suggestion of the Board that the City Council has now decided to apply for a Government grant towards the cost of the necessary surveys and investigation of the proposal.

We congratulate Mr. Britton on having brought forward and secured official consideration of a project which combines so many features of economic advantage to the people of Cheshire.

THE TRAMWAYS AND LIGHT RAILWAYS CONGRESS, 1917.

On Friday last the annual meeting of the Tramways and Light Railways Association took place at the Institution of Civil Engineers, the Hon. Arthur Stanley, M.P., occupying the chair during the preliminary stages. The chairman, in a short speech, welcoming those present, mentioned that the revenue from subscriptions had amounted to £730, and that the expenses had been £647, showing, after allowance is made for certain items, a balance to the good of £91 on the year, and giving, with the balance in hand, a total balance of £522 to carry forward.

Amongst the matters which had occupied the Association during the year were the questions of "leaving certificates" and "substitution": leaving certificates had been abolished and the results of substitution had been somewhat disappointing. The supply of materials had been the most difficult subject, and some relief had been given by the Government offering them materials ready for shipment abroad, also by enabling them to import from America. Negotiations with the authorities in regard to a standard rate of depreciation allowance for motor-buses had, he was glad to say, resulted in an acceptable arrangement.

The balance-sheet having been approved, the following new Members of Council were elected in place of those retiring this year:—Mr. R. J. Howley (B.E.T. Co.) as vice-chairman; Mr. A. Good (Cammell Laird & Co.); Mr. T. B. Goodyer (Croydon); Mr. G. W. Holford (Salford); Mr. C. G. Tegetmeier (Swansea); Mr. W. Thom (Potteries); and Mr. W. E. Hardy (Bath).

After a few words from Viscount Chilston, President of the Association, who occupied the chair during the remainder of the proceedings, Mr. Arthur Norton read a paper on "The Manufacture, Life and Maintenance of Tramway-car Tires," which was illustrated by numerous lantern slides.

In this the author outlined briefly the processes of manufacture from the ingot stage, referred to the importance of accurate gauging of the bore, and described the methods of heating tires prior to shrinking on to the wheel centres, and of removing worn tires, by the use of gas. A safe temperature limit, beyond which it is undesirable to go, is 420° C. The most important section of the paper dealt with the maintenance of tires: the author urged the importance of observing and recording wear, and of maintaining flanges. Less material is cut away from the body of the tire to reform the profile, if differences in wheel diameter are corrected as soon as possible.

Tire wear is adversely affected by (1) systems which operate in very hilly districts; (2) in narrow streets, where sharp curves obtain; (3) narrow-gauge tracks; (4) single tracks with loops; (5) worn condition of tracks; (6) maintenance of car frames; (7) and motors running against each other. The life of a tire is generally concluded when its thickness is reduced to $\frac{3}{4}$ in. or $\frac{1}{2}$ in., although there have been cases where pony tires have been worn to about $\frac{1}{8}$ in.

The author's firm have carried out a considerable number of tests on tramway tires rolled to standard section, some being untreated, while others were subjected to a regular form of heat treatment. The results of falling-weight tests on such tires are shown graphically, being much in favour of the heat-treated tires. The paper contains a number of diagrams of unequal wear in both tires and rails. In conclusion, the author urged on the members the advantages of adopting standard tire-sections.

In the discussion which followed, Mr. Good welcomed the paper, remarking that if it led to managers looking nearer home for the causes of defects instead of blaming the tire makers, it would not have been in vain. The smaller the nip and tension in the tire when in position the better, provided a sufficient margin was allowed. In a particular case, a reduction of $\frac{3}{4}$ in. down to $\frac{1}{2}$ in. nip had solved the question of tires bursting. Cooling tires by water was a dangerous process, particularly with hard tires, and air cooling, which took but little time, should be adopted.

Mr. MOZLEY (Burnley) said they only used bogie cars, and their records showed only negligible variations in tire wear, and flanges gave no trouble. They had scrapped their old trucks, and now obtained excellent results from their own trucks: he wondered at the persistence of the four-wheel car.

Mr. A. R. FEARNLEY (Sheffield) pointed out that the sectional views, showing tire and rail wear at Sheffield, were intentionally bad cases. The uneven and bad wear did suggest that great care was required in selecting the right section of rail: in their case, unfortunately, they could not, under present conditions, replace

the rails of inadequate section, which had been decided on many years ago. It was necessary to turn the tires on the wheels before placing them in service, and a more convenient method of removing used tires was to saw them through. In maintaining tires, they expected to get 5,000 miles' use for $\frac{1}{2}$ -in. wear, and to turn the tires up once or twice to secure a good flange. He thought tire wear was due to some other reason than had yet been found, judging by the different results obtained on systems which operated under practically similar conditions.

Mr. IRELAND (L.C.C.) agreed that a very small percentage of new tires was good enough to go straight on to the road. The question of gauges was very important when many wheels and tires had to be dealt with and interchangeability was required. He agreed with the author that the temperature for shrinking purposes should not exceed 100° C., and did not consider that the use of water for cooling tires was justified. It was much quicker and cheaper to saw old tires off. Experience showed that two tires from the same cast gave very different results: one would wear $\frac{1}{2}$ in. more than another. It was important to keep equal diameters, and in the L.C.C. service, cars were turned daily to equalise wear and tear. He thought the author had not sufficiently mentioned the results obtained with heat and oil-treated tires: tests showed an increase in tensile strength from 55 to 78 tons, and under an abrasive test, while 24 gr. was removed from the untreated, only 142 gr. was removed with the treated tires, showing the remarkable results obtained by oil treatment.

Mr. WILKINSON (Huddersfield) referred to the effect of the differential gear (introduced by himself) on tire wear. It was fully expected that a substantial reduction would occur in wear and energy consumption, but they found, so far, very little saving—only 3,000 miles, in tire life. The track was mostly single; the flanges all wore in the same manner, from tread to flange, and the diameter of tires varied but little, showing not more than $\frac{1}{8}$ in. difference when discarded. No studs were employed to fix tires, but the latter were caulked on the inside to secure them. The band brake employed experimentally had practically doubled the life of tires: it had been in use 2½ years on one route. The gears were adopted to overcome corrugation trouble, and in that respect they promised very well.

Mr. A. V. MASON (South Metropolitan Tramways Co.) introduced the subject of "Return Fares" for discussion, mentioning that women made excellent conductors: that time was saved by platform fare collection, and that return fares and weekly tickets were a convenience to passengers and conductors. He felt that after the war receipts would drop while expenses would remain high, and that the public would have to pay the extra money. One method of securing this, he suggested, was to charge 1d. per mile, divide the mile into four portions, so that overlaps were frequent, and issue single fares at the sums of the 1d. stages—no odd $\frac{1}{2}$ d. values—and return journeys: cheap return tickets would be issued for all fares above 1d.

The 1d. fares were usually over 75 per cent. of all fares taken, and the bulk of the rides were under the mile, so that a fairly drastic proposal was necessary.

The workman was protected by the $\frac{1}{2}$ d. per mile, and a sufficient service before 8 a.m. and after 5 p.m. had to be given. What was wanted was some method of making the short-distance passenger pay who had only the alternative of walking, and to offer competitive attractive fares for long-distance passengers and joy riders.

Mr. C. D. STANLEY (St. Helens) thought it was very necessary to do away with workmen's and similar reduced fares: he did not quite see why getting up early should entitle a passenger to a reduced fare. He thought there was one undertaking which gave no preferential rate, but provided a long stage for 1d. It was very difficult to answer the argument that a man getting less wages than a "workman" had to pay more fare.

Mr. H. ENGLAND (Wakefield) considered the author's ideas were entirely wrong. He disagreed that women were excellent conductors, and with return or exchange tickets. They must run a tramway on a cash basis. He did not agree that receipts would necessarily decrease after the war, and would be glad to join in an agitation for the revision of workmen's fares, as it was unreasonable to carry a man earning £4 or £5 a week at reduced rates.

Mr. HOLFORD (Salford) said his Corporation had abolished return fares, and endeavoured to do the same with all concessions. He could not see why fares should come down again: many towns were shortening the stages, and efforts had been made to raise the statutory fare limits.

Mr. HOWLEY (B.E.T. Co.) hoped that tramway revenues would be maintained after the war, as expenses almost certainly would. Practically the only industry which could not increase the price of its commodity was the tramway industry, and efforts were now being made to obtain sanction to the raising of the statutory limits of fares.

Mr. E. H. EDWARDS introduced the question of "Standardisation of conditions of labour and rates of pay" for discussion. He said that labour long ago came to the conclusion that the best and most satisfactory method of

dealing with conditions of labour and rates of pay was to become united.

It must be admitted that the tramway industry throughout the country was most disjointed. Even the various negotiations with Government Departments had to be carried through by the two Associations instead of one, which involved a considerable amount of overlapping. Further, each authority, without consultation with one another—even in cases where inter-running arrangements were in force—settled its own labour troubles independently, often with disastrous results, which were becoming more and more obvious every day. He suggested the possibility of forming a united tramway federation to deal with these complex problems. There was nothing original in the idea, and he saw no reason why it should not be accomplished in the tramway industry, which was becoming more and more important every year.

It must not be assumed that the proposal was that a standard rate of wages should be established for the whole country, but that the country should be divided into areas, and the rates of wages fixed in such areas in accordance with the cost of living, &c., in such localities. This was the system adopted by such trades as engineering, building, &c.

At the suggestion of the Committee on Production, such a federation was in course of formation, the authorities in question comprising Lancashire and Cheshire Municipal Tramways, and practically all the undertakings in that area, including the companies, had promised to join, and a Sub-Committee had already been appointed to formulate a scheme: he felt confident that the great majority of tramway undertakings throughout the remainder of the country would be equally pleased to join a central federation, should one be formed.

Mr. HOLFORD (Salford) supported the proposal: it was felt that such a federation would be advantageous both to the undertakings and men, and that many troubles would disappear if an area were dealt with.

Mr. HOWLEY (B.E.T. Co.) suggested that the proposal amounted to the standardisation of wages and conditions of work. He doubted whether their Association could deal with wages, but it could render assistance in equalising conditions of work.

Mr. WHITE (Grimsby) said the Trade Union officials did make some allowance to company undertakings which had no ratepayers behind them. He saw difficulty in getting uniformity in wages, though that might be arranged in regard to conditions of labour.

Mr. RONSON (Southampton) thought there would be difficulty in arranging uniform rates of pay even in small areas, but uniform conditions of work could be arranged; he hoped the Association would take the matter up. The author, in reply, said it was difficult to separate wages and the conditions of labour, and he thought it quite feasible to copy the engineering trades in regard to uniformity in certain localities.

Women Drivers.—MR. A. ROBERTSON then gave a brief résumé of the Greenock and Port Glasgow Tramway Co.'s experience with women drivers, who represent 62 per cent. of the total. The earlier ones were the better trained, and had scarcely any accidents. The necessity of time-keeping was not always recognised by them, and they were not so satisfactory in emergency as the men.

Mr. FRED COUTTS (Paisley) said his experience was the opposite to that given by Mr. Robertson. While women made good conductors, his experience with them as drivers had been unfortunate: only 13 out of 39 passed out after training, and those who qualified had, owing to physical disabilities, dwindled down to one, who had been driving 18 months. From an inspection of the Glasgow service he found that about 8 per cent. of the cars were driven by women, which was nothing to boast about. They had a heavy workmen's service in the morning, some 14,000 early passengers being carried each day, and, if the women drivers failed to turn out, it would be a serious matter. He had greatly improved time-keeping by introducing a bonus arrangement, with considerable deductions for broken time.

Mr. STANLEY (St. Helens) said he thought there was a labour objection to the use of women drivers, and Mr. MASON (Sutton) said he felt that the only way out of the labour shortage was to employ women as drivers on level roads.

ERRORS OF REGISTRATION OF ELECTRICITY METERS WITH VARYING LOADS.

By G. W. STUBBINGS.

THE errors of registration of electricity meters over periods during which there is a variation of the current passing are a matter of considerable interest. The problem of obtaining the errors of meters on constant loads is one of great sim-

plicity, but this information gives no *prima facie* indication as to the degree of accuracy with which a meter will register over a period during which the load may vary between wide limits. An interesting case of this question is that of a house in which a moderate load is used for a few hours in the evening, one light through the night, and an occasional use of one light, an electric iron, or some similar device throughout the day. The inaccuracy of the meter on one light may be considerable, but the important point is the extent to which this error will affect the total inaccuracy over such an extended period as one day. The present article is an attempt to investigate this question theoretically, and it may be observed that the results apply equally to cases of rapidly varying loads, such as are taken by certain machines. The investigation is concerned with ampere-hour meters only, and variations of voltage have not, therefore, to be taken into account. The performance of a theoretically accurate meter with varying currents has been previously investigated, and it is now well known that such a meter with eddy-current braking, whether shunted or not, correctly records the total quantity of electricity, notwithstanding any variation of the current.

The case of a meter of the commutator type may first be considered. With such a meter the error is due to an approximately constant frictional torque, and the percentage error curve is of the form $\eta = \kappa - n/c$, η being the percentage error; n a constant depending on the frictional torque; κ , the percentage difference between the correct and ideal speeds of the meter; and c , the current passing. Since the meter is inaccurate, the speed of the meter rotor will correspond to an inaccurate value of the current, which will be—

$$c_m = c(1 + \kappa/100 - n/100c), \\ = c + \kappa c/100 - n/100.$$

This expression refers to instantaneous values of the current, which may be any function of the time. The quantity recorded by the meter will, therefore, be obtained by integrating the expression between the limits 0 and t' , t' being the time during which current has been passing.

$$\int_0^{t'} c_m dt = Q + \kappa Q/100 - nt'/100,$$

Q being the correct quantity. The percentage error will accordingly be $\kappa - n/c_a$, c_a being the average current over the period t' . It therefore follows that in the case of a meter with an error curve of the form given, the error of registration over a period will be the error at the average current over the same period, whatever be the nature of the variation of the current.

A simple numerical example may be taken of a meter with a percentage error of $2 - 2/c$, used for four hours per day on a constant load of 2 amperes when the error is 1 per cent. fast, and for the remaining 20 hours on a load of 0.2 ampere when the meter is 8 per cent. slow; the average load being $\frac{1}{2}$ ampere, the inaccuracy of registration over the period of one day is 2 per cent. slow.

It will be immediately apparent that t' in the above investigation refers only to times during which current is passing through the meter, and that, therefore, the average current is to be reckoned on this time only, and is not to be taken over periods of no load. This follows, of course, from the fact that however bad the performance of a meter may be, on even moderately low loads, it is always quite accurate on no load. The assumption has also to be made that the lowest current passing is greater than starting current, otherwise the expression for percentage error will not be applicable.

The case of a meter having fluid as well as solid friction, may now be considered. With such a meter the error curve will be of the form $\eta = \kappa - n/c - m c$, m being a constant depending upon the magnitude of uncompensated fluid friction. We have therefore—

$$c_m = c + \kappa c/100 - n/100 - m c^2/100 \\ \int_0^{t'} c_m dt = Q + \kappa Q/100 - nt'/100 - (m/100) \int_0^{t'} c^2 dt, \\ \text{the percentage error being } \kappa - n/c_a - (m/Q) \int_0^{t'} c^2 dt.$$

The portion of the error due to fluid friction is therefore proportional to the ratio of the mean square of the current,

to the average value of the same, and such value of the fluid friction error will thus always be higher than that at the average load. In the case of most house-service meters, not only is the compensation for fluid friction fairly complete, but the effect of such friction is at the usual loads very small; the value of κ is also, owing to the different shape of the error curve, higher than in the case of a meter with solid friction only. It is therefore legitimate to assume that the accuracy of a house-service mercury meter over extended periods will be equal to that of a commutator meter under similar conditions, the circumstance of variation of current only being taken into account.

The effect of fluid friction with meters of higher capacities will become more important with varying loads, the magnitude depending upon the nature of the variation. With a load corresponding to $c = c_a (1 + a \sin pt)$, the ratio of the mean square to the mean current will be $c_a (1 + \frac{1}{2} a^2)$, and the effect of fluid friction is sensibly increased. An example may be taken of a 25-ampere meter having the values $\kappa = 4$, $n = 2$, $m = \frac{1}{2}$ in the above formula. The errors at full, half, one-quarter, and one-twentieth loads will be respectively 2.1 per cent. slow, 0.8 per cent. fast, 2.2 per cent. fast, 2.0 per cent. fast. Assuming $c_a = 16$ and $a = \frac{3}{4}$, the current will vary between 4 and 28 amperes. The percentage error being $\kappa = n/c_a - m/c_a (1 + \frac{1}{2} a^2)$, substitution of the assumed values gives a figure of 1.25 per cent. slow, corresponding to the error for a constant current of about 20.6 amperes.

THE MEETING OF THE INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION, 1917.—III.

Fuel Economy.

Abstract of paper by J. A. P. JATSON (Salford).

THE necessity for fully utilizing our national resources to meet the economic conditions arising out of the war has made the question of fuel economy one of urgent and vital importance. The subject is under consideration at the present time by a sub-committee appointed by the Advisory Council of the Department of Scientific and Industrial Research, of which Sir George Beilby is chairman, and will no doubt also receive attention from the Departmental Committee on Electricity Supply recently set up by the Board of Trade.

It goes without saying that any proposals on national lines for economising fuel must necessarily include a large co-ordinate scheme for the cheap production of electricity, and the time is therefore opportune for consideration of the question by this Association, representing electrical undertakings whose output amounts to 70 per cent. of the total output from statutory undertakings in this country.

It is proposed to discuss in the paper the possibility of economising fuel:—

- (a) By centralising the production of power; and
- (b) By combining the carbonisation of coal and by-product recovery with the generation of electricity.

For the present purpose the discussion may be confined to the better utilisation of coal.

After deducting the amount of coal exported, the home consumption of coal in 1911 was 184 million tons. It remains to be considered in what directions economy is possible.

With regard to the fuel used for blast furnaces and iron and steel production, considerable economies have been effected in recent years. The employment of modern coke ovens with by-product recovery plants, referred to later in the paper, has extended rapidly, and as a considerable amount of surplus heat is available for the production of power, a modern coke oven installation may be regarded as an extremely economical method of coal utilisation. While the electrification of railways would, in addition to other advantages, improve their working efficiency, it would not, the author thinks, greatly affect the amount of fuel consumed. There is much room for economy in the fuel consumed at mines and also in chemical trades. For power-station engineers the two items of outstanding interest are "Factories" and "Domestic Purposes," representing a consumption of 45 million tons and 39 million tons per annum respectively.

In view of the growth of power-using industries since 1907, the horse-power now installed for factories, including electric motors, cannot be less than 13 million horse-power, and is probably more.

It will be fairly safe to estimate that at the present time each horse-power hour produced entails a consumption of 4½ lb. of fuel.

To engineers who consider this a high figure, it may be pointed out that for the central stations furnishing returns

for the 1907 census of production the consumption of coal comes out at 5.1 lb. per unit, or about 3.9 lb. per electrical horse-power hour.

In considering these fuel consumptions, regard must be had to the low price at which fuel could be purchased up to recent years.

In the matter of fuel consumption, the central station has enormously improved its position relatively to the private power plant during the last few years. The development of the steam turbo-generator, the general adoption of extra high-tension transmission, the increased output, and the improved load factor, have undoubtedly effected a considerable reduction in the 1907 figure of 5.1 lb. per unit.

In a census taken last year of four groups comprising 26 electrical undertakings in Lancashire and Cheshire ranging in capacity from 500 kW. up to 90,000 kW., it was found that the consumption of coal varied from 2½ lb. to 8 lb. per unit sold; the average consumption of all the undertakings in the groups (including the largest municipal undertaking in Britain) being 3.2 lb. The average calorific value of the coal may be taken as 12,500 B.T.H.U. This figure, equal to 2.4 lb. per horse-power hour, represents a reduction of 52 per cent. compared with Sir George Beilby's estimate in 1905, and 37 per cent. compared with the average consumption in central stations in 1907.

Very little consideration of these figures is required to show that a considerable fuel saving could be effected by an immediate transference of the factory power load from private plants to central stations. Even admitting that as much as one third of the total coal consumption in factories is required for direct heating purposes, it will be observed that the transference of the remaining two thirds of the load to central stations under existing conditions would effect a saving of not less than 15 million tons of coal per annum.

With a consumption of 3.2 lb. per unit of fuel containing 12,500 B.T.H.U. per lb., the thermal efficiency comes out at only 8½ per cent. There are several power stations in the United States claiming an overall efficiency of 17 to 18 per cent. Under a centralised system of production operating with power stations equipped with generators of 15,000 or 20,000 kW. capacity, combined with water-tube boilers of 10,000 kW. each, and auxiliary plant designed and arranged so as to reduce the heat losses to the absolute minimum, a continuous thermal efficiency of 18 per cent. is well within the range of possibility. In support of this claim the following estimate prepared by a well-known firm of manufacturers for a combined generator and water-tube boiler unit of 15,000 kW. capacity is submitted.

Steam pressure at stop valve	200 lb.
Initial steam temperature	650° F.
Vacuum at turbine exhaust (30-in. barometer) ...	29 in.
Feed-water temperature to economiser ...	160° F.
Steam consumption at full load per kW.-hour ...	10.4 lb.
Power required for condenser auxiliaries ...	2 per cent.
Thermal efficiency of turbine, generator, and auxiliaries	25.19
Boiler efficiency	84
B.T.H.U. per kW.-hour	16,120
Thermal efficiency, boilers, economisers, turbine, generator, and condenser plant ...	21.15

If we add the power required to operate artificial draft plant, coal and ash conveyors, and circulating water pumps (this should not under normal conditions exceed 3 per cent.), the efficiency of the plant, i.e., the ratio between the heat units contained in the coal consumed and their equivalent in kW.-hours delivered at the switchboard is 20.5 per cent.

Further economies in fuel consumption are possible by increasing the pressure and temperature of the steam. The boiler manufacturers are satisfied that there will be no trouble in constructing boilers for pressures as high as 500 or 600 lb., and the turbine manufacturers are prepared to guarantee turbines to operate at this pressure with steam superheated up to 750 deg. F. Boilers have already been constructed for 350 lb. pressure, and the following estimates which the British manufacturers guarantee may be compared with the figures in the previous table.

Steam pressure at stop valve	350 lb.
Initial steam temperature	700° F.
Vacuum at turbine exhaust (30-in. barometer) ...	29 in.
Feed water temperature to economiser ...	160° F.
Steam consumption at full load per kW.-hour ...	10 lb.
Power required for condenser auxiliaries ...	2 per cent.
Thermal efficiency of turbine, generator, and auxiliaries	26.39
Boiler efficiency	84
B.T.H.U. per kW.-hour	15,370
Thermal efficiency boilers, economisers, turbine, generator, and condenser plant ...	22.17

The increased efficiency due to increased pressure and super-heat is approximately 5 per cent. Allowing 3 per cent. for operation of auxiliaries and 12 per cent. for transmission and transformer losses, it is possible to obtain an overall efficiency of 18.8 per cent. for energy delivered to the consumer. The coal consumption on this basis would amount to 1.15 lb. per kW.-hour sold, or 1.00 lb. per electrical horse-power.

If several large stations are interconnected, it will be quite

possible to operate the plant in commission continuously at or nearly at full load. Under these conditions, the author is of the opinion that 10 per cent. would be ample to cover stand-by and light-load losses.

Turning again to Sir George Beilby's estimate, and assuming a consumption of fuel at the present time for factory purposes of $4\frac{1}{2}$ lb. per horse-power hour, the possible saving is about $3\frac{1}{2}$ lb. of fuel, or nearly 75 per cent. It follows that if two-thirds of the factory load was transferred the saving in fuel would amount to approximately 22 million tons per annum.

With regard to the consumption of fuel for domestic purposes amounting to 39 million tons per annum, it is questionable if the efficiency, i.e., the ratio of heat units actually utilised to the heat units contained in the coal consumed is more than 5 per cent. The use of gas fires and gas cooking appliances is undoubtedly on the increase, and although some may be inclined to disagree, it must be admitted that for convenience and cleanliness they possess distinct advantages. On the other hand, the products of combustion must be got rid of at the expense of heat in the fuel, and it is doubtful if the actual efficiency of gas fires is more than 10 or 12 per cent.

Taking the same basis of comparison, the efficiency of electric radiators and cooking devices may be as high as 85 to 90 per cent., while for convenience and cleanliness they far surpass the gas fire or gas cooking stove. The author is familiar with a cooking installation of 150 kw. capacity at a cotton mill providing 700 meals per day, which has given complete satisfaction both on the score of reliability and economy, with energy costing 1d. per unit. If energy can be sold at prices from $\frac{3}{4}$ d. to $\frac{1}{2}$ d. per unit, electric cooking would undoubtedly become universal.

In a particular case a domestic consumption of 13 tons of coal per annum was reduced to 2 tons by the adoption of electricity for cooking and partial heating. The increased consumption of electricity for four quarters of one year amounted to 6,820 units. Assuming a consumption of $1\frac{1}{4}$ lb. of coal per unit, the total amount of coal consumed at the central station for this output would amount to 11,900 lb., or approximately $5\frac{1}{4}$ tons per annum, as compared with 11 tons saved, or a reduction of nearly 52 per cent. If only one half the cooking and heating for which coal is now used was performed by electricity supply from central stations, there is a possible saving of nearly 10 million tons per annum.

It is outside the scope of this paper to estimate the cost of a national centralised system of electricity production, but it appears beyond question that the saving in fuel, amounting to not less than 30 million tons per annum for factories and domestic purposes alone, would be amply sufficient to meet the charges on the capital expended, and also to compensate those existing interests which might be adversely affected.

If British manufacturers are to have a fair chance a cheap supply of power is absolutely necessary. The benefits to the nation, direct and indirect, would be so great that the Government would be justified in supporting a centralised scheme of power production with the national credit, and in making such regulations as might be required to ensure its successful operation.

Interconnection of Electrical Undertakings.—The original object of the linking-up proposal was to meet the special conditions arising out of the war. While fuel saving was put forward in the Board of Trade circular letter as the object of linking-up, its chief advantage, in the author's opinion, is that it will permit the capacity of existing stations to be more fully utilised to meet the increased demand for power which may be expected after the war. As a means of fuel saving it will, however, exercise an important effect, as it will be possible with a system of linked-up stations to utilise the more efficient plant to its fullest extent, shutting down the less efficient plant during the night, at week-ends, and other times of light load. In the case of the 26 Lancashire undertakings already referred to, it was estimated that 110,000 tons per annum could be saved.

Linking-up proposals must, however, be considered with relation to the bigger scheme of centralisation, and it will be necessary for the local joint boards who operate such schemes to possess powers with regard to extensions of plant in all the undertakings in their group, and so ensure that extensions will only take place at those stations which are favourably situated for economical generation. If only stations which are favourably situated for economical generation are permitted to install new plant, many of the smaller stations could shut down immediately, while others might retain a portion of their plant to meet peak load demands.

In no case should financial considerations alone prevent the supersession of inefficient generating plant. In those cases where the financial burden would be temporarily increased, it will be sound policy in the national interest to extend the repayment period, or even to suspend the payment of outstanding loans, until such times as the economies from the new system can be fully realised.

Carbonisation of Coal.—It is common knowledge that from a purely thermal efficiency point of view, the carbonisation of coal in gas works is a much more efficient process than the direct burning of coal in central power stations. The thermal efficiency of a gasworks may be as high as 65 or 70 per cent., whereas the average thermal efficiency of central power stations is in the neighbourhood of 8 or 9 per cent., although several large power stations are obtaining efficiencies of

between 12 and 15 per cent. The following comparison will illustrate this point:—

ELECTRICITY WORKS.	GASWORKS.
1 ton of coal (12,500 B.T.H.U.) burned direct in boiler furnaces will produce, at $2\frac{1}{2}$ lb. consumption per unit, 896 units of electricity.	1 ton of coal (12,500 B.T.H.U.) will produce 11,000 cb. ft. of gas = 6,050,000 B.T.H.U., 9 cwt. of coke of 9,500 B.T.H.U. per lb. = 9,576,000 B.T.H.U., 10 gallons of tar = 1,550,000 B.T.H.U.
Thermal value = 2,965,000 B.T.H.U.	Total, 17,176,000 B.T.H.U.
Thermal efficiency, 11 per cent.	Thermal efficiency, 64 per cent.
Total heat in coal 26,992,000 B.T.H.U.	

There is no direct economy in carbonising coal for the purpose of producing gas to be utilised for firing steam boilers. The amount of coal consumed by such a process must always be greater than the amount of coal required to produce an equivalent amount of heat by direct firing. The whole question turns on the value of the by-products produced, and before any general scheme of coal carbonisation is adopted it will be necessary to ascertain if there is a permanent and remunerative market for these. If the cheap production of electricity will lead to its universal adoption, it would be a mistaken policy, for instance, to carbonise coal with the sole or primary object of producing a smokeless fuel for domestic purposes.

To obtain the highest possible efficiency in power production from the carbonisation of coal involves the employment of internal-combustion engines. The high thermal efficiency of gas engines (about 27 per cent.) has often attracted power engineers, but although enormous sums have been spent on their development in large sizes, they can hardly be claimed as a commercial success.

There are two systems apart from the carbonisation of coal in gasworks (where illuminating gas is the chief product) which may be considered. These are:—

(a) Producers of the "Mond" type, in which coal or coke is burned to an ash with or without the production of by-products.

(b) Coke oven installations, which distill coal at a low temperature producing metallurgical coke as the chief product, with a certain amount of surplus gas and other by-products.

The "Mond" producer has been in use for gas engine installations with and without by-product recovery plants for at least 20 years. It produces gas at the rate of about 120,000 cu. ft. per ton of coal carbonised, having a calorific value of 150 B.T.H.U. per cu. ft.

When employed for by-product recovery, sulphate of ammonia is obtained equal to about 4 per cent. of the weight of coal carbonised, and about 3 per cent. by weight of a somewhat inferior tar. The thermal efficiency of a "Mond" producer may be taken at 65 per cent. when employed solely for the production of gas. If employed with by-product recovery, the efficiency is reduced, owing to the larger amount of steam—about two and a half times the weight of coal carbonised—which is required for the furnace. It will be a fair estimate to assume that the efficiency under these conditions is about 57 per cent.

Gas Firing of Boilers.—Considerable difference of opinion appears to exist regarding the efficiency of gas-fired boilers, some authorities placing it as low as 75 per cent., while others claim 85 or 90 per cent. The lower efficiency is probably the result of tests made with boilers and furnaces originally designed for the direct burning of coal. Prof. Bone, in his address to the Royal Institution last year, put forward the following comparison between the Bone-Court surface combustion gas-fired boiler and direct firing.

	Gas-fired surface combustion boiler.	Coal-fired boiler.
Heat utilised	92.7	75.1
Heat lost:—		
In burnt gases	3.0	18.1
In unburnt gases, &c.	Nil	2.8
By radiation	4.3	4.0
	100	100

*Assuming an efficiency of 90 per cent. for gas firing and 80 per cent. for direct coal firing, we obtain the following results:

	Per cent.
Efficiency of gas-fired producer with by-product recovery	57
Efficiency of gas-fired boiler	90
Combined efficiency	51.3
Efficiency of direct-fired boiler	80

In other words, for every 100 tons of coal consumed for direct firing we require 155 tons to produce the same amount of heat from producer gas-fired boilers, against which we recover 4 per cent. by weight of sulphate of ammonia, and 4 per cent. by weight of tar.

An incidental advantage of gas firing is the cleanliness of the boiler house and the better control of the fuel supply. There should also be a slight reduction in the labour and maintenance costs. On the other hand, the efficiencies claimed for gas producers are only possible with a high load factor, and in the case of central stations it would be necessary in most cases to supplement gas firing with coal-fired boilers for dealing with fluctuations of load.

It is apparent, therefore, that the whole case for gas firing from producer plant rests on the production of by-products. The most valuable of these is sulphate of ammonia. The amount of this by-product depends upon the percentage of nitrogen present in the fuel. The average for British coals may be taken at 1.3 per cent., yielding in a "Mond" producer from 80 to 90 lb. of ammonia sulphate per ton carbonised.

The following estimate, based on results obtained from smaller plant, is put forward as an illustration of what might be expected from a producer gas-fired boiler installation of 25,000 kw. capacity, dealing with a maximum demand of 15,000 kw. and operating with a 40 per cent. station load factor.

DIRECT FIRING. (Boiler efficiency 80 per cent.)

53,000,000 units at, say, 2 lb. of coal per unit generated; tons	...	...	...	...	=	48,000
Coal at 15s.	...	...	...	...	=	£36,000

GAS PRODUCER AND GAS-FIRED BOILERS WITH BY-PRODUCT RECOVERY.

Boiler efficiency 90 per cent.	
Combined efficiency 52 per cent.	
74,000 tons of coal at 15s.	...
2,960 tons of acid at £2	...
Extra labour on gas plant at 1s. 3d. per ton carbonised	...
Extra stores	...
Extra labour on by-product recovery, including bagging sulphate of ammonia	...
Interest, depreciation, and maintenance on cost of producer and recovery plant, 15 per cent. on £52,000	...
	= 7,800
	£78,195
Less 2,960 tons ammonia sulphate at £14 per ton	...
Less 2,960 tons of tar at £1 per ton	...
	44,400
	£33,795

A saving per annum over direct firing of ... £2,205

The figure of £14 for ammonia sulphate is above the average price received during the last 10 years, but about £2 less than the present war price of £16 per ton. If the present price is taken, the saving would be increased from £2,205 to £8,125. On the other hand, on the basis of £12 per ton, which approximates to the average pre-war price, the saving of £2,205 would be converted into a loss of £3,715.

Although producers have been in operation for 20 years, it is not suggested that finality of design has been reached. Experiments have recently been made with a view to utilising the heat generated by the producer to supply the steam required for by-product recovery, and it is possible that developments in this direction may increase the producer efficiency by 8 or 10 per cent. It has also been shown that producers can deal successfully with the lower grades of fuel, and as these poorer grades frequently contain as high a percentage of nitrogen as the richer grades, it may be possible to utilise the producer with by-product recovery for burning grades of coal which it is not profitable under present conditions to bring to the surface.

Coke Oven Gas.—The distillation of coal at low temperatures for the primary purpose of producing metallurgical coke, and yielding in addition a quantity of surplus gas of high calorific value in addition to other by-products, has been advocated in certain quarters as a universal solution of the fuel economy problem. The low temperature at which the coal is distilled permits of the recovery of by-products which are lost in the producer system. The chief of these are benzol and a rich quality of tar, from which are derived toluene, naphtha, picric acid, and the basic materials for the manufacture of aniline dyes.

Each ton of coal distilled produces about 15 cwt. of hard blast furnace coke, which at present has a higher market price than its equivalent weight in coal. On the other hand, the yield of ammonia is less than from gas producers, being about 25 to 30 lb. per ton of coal. Hitherto the industry has been confined to steelworks and collieries, where its advantages are unquestioned, but the importance of the by-products recovered and the possibility of utilising the surplus gas has drawn attention to the possibility of combining low temperature distillation with the production of power. The amount of surplus gas is equal to 4,000 to 5,000 cu. ft. per ton, having a calorific value of 550 B.T.H.U. per cu. ft. The expense of the installation, however, is very great, and the amount of coal consumed to produce a given amount of heat in the form of surplus gas is about 12 to 14 times as much as would be required for direct firing.

Very little consideration is required to show that as a means of producing power, the coke oven can only have a limited application. The demand for electricity in the form of light, power, and heat is bound to exceed enormously the demand for coke and by-products, and while the surplus heat from coke oven gas should be fully utilised, either in independent power stations or where convenient in conjunction with

larger power systems, the process cannot be looked on as more than a partial solution of the fuel economy problem.

It is claimed that instead of metallurgical coke, a soft smokeless fuel can be produced which is suitable for domestic purposes; the author is of opinion that an arrangement of this kind can only have a local and temporary application, and that the burning of fuel for domestic purposes must ultimately be superseded by electricity.

Coal Supplies.—While it is proved beyond doubt that vast economies are possible by the better utilisation of coal, there is also an enormous wastage going on in mining operations. Coal should be regarded as our national capital—a vanishing capital, unfortunately—and the greatest natural source of the country's wealth. The proper grading and classification of coals and their treatment by washing and sorting is a subject which is worthy of the continuous attention of a committee of scientific experts.

The saving already estimated through better utilisation would probably be doubled under a scientifically organised system of coal production.

Conclusions.—To secure the most economical utilisation of the national coal supplies, it is necessary to centralise the production of electricity on a large scale, and to adopt a scheme for its distribution over suitable areas formed without regard to existing municipal boundaries. The consequent cheapening of production would ensure the general use of electricity, and would result in a saving in fuel now consumed in factories, and for domestic purposes of not less than 30 million tons per annum.

That the erection of large power stations on sites selected for economical working, and equipped with turbo-generators and direct-fired boilers, is at present the only proved method of economical power production on a large scale.

That careful investigation should be made of the present and potential demand for sulphate of ammonia and other by-products, and the sources from which such by-products are likely to be available in future. That in some cases the generation of electricity can be combined with the production and manufacture of by-products.

In the case of coke oven installations producing blast furnace coke, the surplus heat should be fully utilised in gas-fired boilers for the generation of electricity.

That in order to organise the economical production and distribution of coal, the control and operation of all coal mines in the United Kingdom should be placed under a central expert authority, the object being to prevent wastage in producing coal, and also to avoid unnecessary transport in conveying coal from the collieries to the users.

DISCUSSION.

Dr. FERRANTI, in opening the discussion, said the coal consumption was the vital question, the by-products were the other vital matter, though a solution of the latter question was not perhaps feasible now. He took it that distribution costs would also come down with greatly extended use of electricity. When he discussed the matter before the Institution of Electrical Engineers in 1910, he had hoped that greater economy would be obtained generally, and had suggested a thermal efficiency of 25 per cent., while the author took 18 per cent. as a possible figure. In the cheaper generation of electricity to-day there was, unfortunately, no by-product; the gas engine was handicapped by the inefficiency of gas making, as the cost of obtaining by-products absorbed the profit. In any case, at its present price sulphate of ammonia was too costly, though if the price were, say, £8 a ton, as he estimated it in 1910, there would be a great demand for it. By improving the efficiency of the conversion of coal into power, and realising to the necessary extent the by-products, the process of providing a general supply of electricity was automatically started. He congratulated the Association on the work it had done, and on the paper under discussion; nothing so vitally affected the welfare of the country as a cheap supply of electricity.

Baillie SMITH (Glasgow) said he was specially interested in the carbonisation of fuel and by-product recovery, in which his Corporation had had three years' experience. The plant dealt with about 20 tons a day, and it had proved practicable to make power gas for boilers and recover by-products on a commercial basis. The results were better than those indicated in the paper; although there was no tar, they got £14,800 for the liquid obtained, as against only £2,000 for tar, and the saving was about £20,000, as against £2,200 shown by the author in his paper. Much cheaper coal could be used, and only 1 lb. of steam per lb. of coal, as against 2½ lb. in the Mond process, was required. The liquid by-product divided into a series of resins which gave them a number of dyes direct, and they could dispose of sulphate of ammonia at £4 per ton, and still make a profit. The equipment could be arranged to produce gas or gas and smokeless fuel; the latter was an amorphous coke, while gas coke was more graphitic, and less easy to burn. Experiments showed that 13 cwt. of this smokeless fuel gave more heat than a ton of ordinary coal, in addition to chemicals and gas of 300 B.T.H.U.

Mr. DICKINSON (Liverpool) drew attention to the necessity of solving the difficulty of heating water electrically, if domestic heating by electricity was to be developed. The

question of interlinking supply undertakings must be looked at broadly.

Mr. C. H. WORDINGHAM (President-elect, Inst. of Electrical Engineers) thought no sane person would dispute the value of the super-station; he felt strongly that general power supply would be brought about by linking-up, co-ordination of supplies, and the use of super-stations. On the whole, he agreed with the author. Was the primary object very economical use of coal or to make the most of the coal by extracting the by-products? He had been much criticised for advocating the combination of the gas and electrical interests, but it was foolish to throw away the gas engineers' knowledge, and they should strive to get the maximum possible out of the coal. He firmly believed that progress would be slow unless there was agreement between the public and private supply interests, and a scheme on a sound financial basis was carried out. He thought it would be preferable to set up a controlling authority to ensure that future development was on correct lines. He agreed with the author's views in regard to electric cooking.

Mr. SELWY agreed with the author practically throughout, and with his conclusions. There were matters affecting the use of coal which were not referred to in the paper. If a poorer coal were worked generally, the cost per B.T.U. to the public would be increased. The increased use of power in the pit did not necessarily mean an increased output from the mine. Coal carbonisation resulting in by-product recovery meant additional supplies, and they must move cautiously in the matter.

Mr. S. J. WATSON (Bury) suggested that station engineers should find out what power was used in their areas; in his case, he found that he supplied about 20 per cent. of the industrial load, and he thought it would be found that great increases had occurred during the last three years. He agreed that the thermal efficiency of electric heating was high compared with other means. Carbonisation schemes required more coal, labour, and money, and were not likely to be adopted during the war; he thought they should strive for simplification rather than complication of processes.

Mr. H. S. ELLIS (South Shields) drew attention to the average figure of 5 lb. coal per H.P.-hour for factories, mentioned in the paper, and said that in the case of Bradford, he considered it should be nearer 2 lb.; he also asked whether coal for heating purposes was included in the figure.

Mr. GEOFFREY PORTER (Bexhill) complained that oil fuel had been neglected by the author. He and others were now using coal tar oils, produced in this country, with Diesel plant, and no difficulty was experienced in obtaining overall thermal efficiencies of 25 to 28 per cent. They obtained 2,000 units per ton of oil, as against only some 800 units in the case of turbine plant. There was an extensive shale belt in this country available for oil production, and he thought the smaller isolated supply areas would be more economically worked by using oil engines than by linking-up with bulk suppliers.

Mr. CLEGG (Accrington), speaking from experience of Mond plant and large gas engines, modified some of the author's figures for by-products, and agreed with him that the large gas-engine installation was not suited for the requirements of a centralised power scheme.

Mr. ROBERTSON, in reply, said the figures for the Glasgow experimental gas plant were very interesting, but he rather doubted the capital cost of £13,000. He had an open mind in regard to coal carbonisation processes, and had not considered the combination of gas and electricity works, but if that would result in national fuel saving, he felt that it must be considered. He was interested in the estimate (by Mr. Selvey) that only half the factory power in the country would utilise some 8,000 million units per annum; the present output for all purposes was about 2,000 million units. No doubt Mr. Clegg's results from by-product plant were not unusual at the present time, and as between them and those given by Bailie Smith, they must keep an open mind. He thought that the available oil fuel would not be much more than sufficient for naval and mercantile marine purposes for some time to come.

Electric Vehicle Committee of Great Britain.

(Formed under the auspices of the I.M.E.A.)

ANNUAL REPORT (abstract).

Constitution of the Committee.—During the period covered by this report, the constitution of the Committee has been broadened by including representatives of the following bodies:

- The Society of Motor Manufacturers & Traders, Ltd.
- The Royal Automobile Club
- The Institute of Cleaning Superintendents.
- The British Rubber Tire Manufacturers' Association.
- The Institution of Automobile Engineers.

Journal. The Committee's journal, *The Electric Vehicle*, has been published each quarter, and continues to gain in popularity, as evinced by increased sales.

In regard of Electric Vehicles. As the result of negotiations, the Car and General Insurance Corporation, Ltd., agreed to make certain alterations in their Special Electric

Vehicle Policy in order to bring it into line with the Committee's views.

Charging Plug and Receptacle.—In regard to the British standard charging plug and receptacle, it was decided to suggest to the Engineering Standards Committee that the length of the encasing shell of the receptacle should be increased by 11/16 in. (18 mm.). This alteration does not entail any change in the dimensions of the contacts or insulating shield, nor will it prevent the receptacle with the increased dimension receiving the plug as at present standardised.

The design is not covered by any patent, consequently any manufacturer in this country is at liberty to make it.

Government Regulations.—The Committee has paid close attention to orders and regulations issued by Government Departments affecting the manufacture and employment of motor vehicles. At the present time, no vehicle can be made or imported unless for purposes directly or closely connected with war work.

Local Government Board Loans.—The Committee has had under consideration the short-loan periods recently granted by the Local Government Board for the purchase of motor vehicles, and a communication was sent to the Board expressing the hope that upon the termination of the war the latter would be prepared to consider evidence, showing that the actual useful life of the electric vehicle was such as to justify a considerably longer period than five years.

Tire and Roadwear Research Committee.—Through the courtesy of the Society of Motor Manufacturers and Traders, the Committee now has a representative upon the Tire and Roadwear Research Committee that has been formed by the Society. The Committee's representative is Mr. E. W. Curtis.

Charging Facilities.—A list of charging stations in England, Scotland and Wales has recently been compiled. The list contains the names of over 200 stations, and gives particulars as to maximum charging current available, hours during which charging can be done, tariff, garaging accommodation, &c.

Progress in the Adoption of Electric Vehicles.—The total number recorded as being in use or on order at the end of March, 1917, was 914; this compares with 680 in the previous year.

Manufacture of Vehicles and Equipment.—In view of the probable demand for electric vehicles after the termination of the war, the Committee sent to all automobile manufacturers in Great Britain a circular letter suggesting that the manufacture of electric vehicles should be given consideration as a branch line to the manufacture of petrol vehicles. A somewhat similar letter was addressed to electrical manufacturers suggesting the advisability of producing, after the war, the electrical equipments for electric vehicles.

The Committee wishes again to place on record its high appreciation of the voluntary services of its Hon. Secretary, Mr. F. Ayton.

AN ENLARGED ELECTRON OF PRACTICAL SIZE: THE FARADAY.*

By CARL HERING.

It is the fashion to-day to talk in terms of electrons, the entities which compose the atoms. Physicists tell us that the smallest atoms are about one-three-hundred-millionth of an inch in diameter, and the largest not many times this; that there would have to be a row of about 200 of them to form something large enough to be visible in the most powerful microscope known; that if a drop of water were enlarged to the size of the earth, the atoms in it would be about the size of a base-ball; that helium gas contains 77 billion-billion atoms per cubic inch, presumably meaning at atmospheric pressure. And still further straining our abilities of conception, they tell us that the negative electrons, which are supposed to be all alike, are about a one-hundred-thousandth part of an atom; that if an average atom were enlarged to a sphere 100 yards in diameter, the electron would be about the size of a pin-head, though its density is said to be a million-million times that of the atom.

Such staggering and bewildering figures, and the fact that they are not yet accurately known, make it impossible to talk quantitatively about electrons in practice, yet if the engineer is supposed to deal with electrons he must know something more precise about the quantity of negative electricity which an electron represents.

The chemist, who has had to deal with these tiny atoms in a quantitative way, has solved this difficulty in practice by the ingenious and perfectly satisfactory and accurate method of imagining a practical substantial form of atom, or "life-size" atom, to consist of a certain number of millions of the real atoms; the exact number is not known, nor is it necessary to know it, as long as all of them have been increased exactly the same number of times. If the atomic weight of hydrogen is 1, then this aggregation, or enlarged, practical

* From *Metallurgical and Chemical Engineering*.

atom is by definition such that it weighs 1 gram, and when the atoms of all the other elements are increased in number the same number of times the practical atoms will weigh as many grams as are represented by their atomic weights; these enlarged, practical atoms are the well-known gram-atoms of the chemist, the gram-molecules being similarly defined. These practical atoms are quite substantial and workable amounts, being easily weighed and measured. Thus a gram-atom of copper weighs 63.57 grams, a piece of copper about the size of a large marble, and a gram-molecule of hydrogen under normal conditions measures 22.39 litres, or a little less than a cubic foot.

This ingenious and quite satisfactory scheme of the chemist to get over this difficulty naturally suggests that a similar method might be used to establish a substantial, workable, "life-size" electron. Fortunately a simple relation exists which makes this quite practical.

It is known from Faraday's law that an atom of every element requires exactly the same quantity of electricity to oxidise or reduce it electrochemically per unit change of valence, hence the gain or loss of the same number of electrons, whatever that number is. For the chemist's enlarged, practical gram-atom, it is known definitely that this quantity is equal to 96,494 coulombs or 26.80 ampere-hours, which is also a substantial, easily measured quantity, and like the gram-atom requires no straining of the imagination to conceive it; it is, in fact, a very large amount for a gram-atom to carry when we conceive that it means a charge which could cause a steady flow of nearly 27 amperes for one hour. This constant quantity has received the name of a faraday and is now beginning to be referred to in literature by that name.

It will be seen, therefore, that if the constant (the unknown) quantity of electricity which is gained or lost when one real atom is oxidised or reduced electrochemically, be multiplied by the same (unknown) number that the real atoms have been multiplied by to make the practical gram-atoms, it will be equal to the faraday. Hence this definite quantity of electricity (the faraday) is obtained quantitatively in exactly the same way from the minute, unknown quantities of electricity, as the definite quantity of matter (the gram-atom) is obtained from the minute, unknown quantity of matter in a real atom, thus deducing a real, definite, substantial quantity from the realm of the unknown and inconceivable. Even another unknown quantity is eliminated thereby, namely, the number of real electrons which a real atom gains or loses in being oxidised or reduced; this need not be known either in establishing these substantial, workable units in this way.

The faraday may, therefore, quite consistently and correctly be called a *gram-atom-electron*, or enlarged electron, or popularly, a life-size electron, and with this understanding this enlarged electron can be rationally and correctly used in calculations and in literature; and as its size is so inconceivably larger than the real electron, no confusion could ever arise in the intelligent mind as to whether the real or the enlarged electron is meant if the latter is referred to more briefly as an electron, just as the chemist may, and often does, refer briefly to the atom when he really means the enlarged gram-atom.

Thus it is quantitatively correct to say that a gram-atom of hydrogen (1.008 grams) loses one enlarged electron (one faraday, or 26.8 ampere-hours) on being reduced, or that one gram-atom of iron (55.84 grams) gains three enlarged electrons (3 faradays or 80.4 ampere-hours) on being oxidised from iron to the ferric state. Each of the + and - signs often placed over the symbols of atoms showing the free charges carried after dissociation, and every unit of valence, therefore, represents an enlarged electron of one faraday if the symbol represents a gram-atom. Similarly, each bond then represents quantitatively the attraction of one negative faraday or enlarged electron on one element to one positive electron on the other.

Whether chemical reduction is a loss of negative electrons, as stated above, or a gain, is perhaps still controversial, and not yet proved physically; whichever it is, oxidation is the exact reverse; this does not affect what has been said above about the quantity of the enlarged electron, but merely the direction of its flow.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Induction Methods of Fault Localisation.

Having read with interest Mr. H. E. Blake's article in your issue of June 15th on the above subject, I should like to make a few remarks.

With a medical coil on a high-resistance fault one has to connect the secondary to the faulty cable, but on a low-resistance fault, or when locating the position of a buried cable, the primary connected up instead is very much louder.

A clearer sound is obtained with a condenser shunted across the telephone receiver.

I find that ordinary watch telephone receivers are quite satisfactory if the search coil is wound to get maximum sound with the receivers you intend using. A good method in winding is to bring out the ends of the various layers, and then experiment by connecting them in series or parallel.

You should be able to hear the hum (or tap, using a single-stroke arc-interrupter) with the receivers held slightly away from the ears. I think a search-coil with a 3-ft. base is most suitable, not so cumbersome, and brings the location of the fault within that length.

I have made a coil with a base of 1 ft. 4 in., which has enabled me to mark out faults within that length; also, it is handy for using on cables inside draw-boxes where cables are laid on that system.

While on the subject of fault localisation, I would like to mention that in this district we now and again have cables drawn apart $\frac{1}{2}$ to $\frac{3}{4}$ in. at joints due to mining subsidence. I have wondered whether it would hurt a good cable to connect the secondary of a petrol engine type ignition coil to one end of the open-circuited cable and earth the other end, thereby obtaining a spark-gap at the drawn-out joint.

If not detrimental to the cable, would it be feasible, with the aid of a wireless coherer, detector, or other instrument, to go over the surface where each cable joint is situated, and locate the sparking-gap joint?

North Staffs.

Lanu, July 2nd, 1917.

Electro-Culture.

With reference to your leading article in last week's issue, can any reader say why some form of Armstrong's machine for developing frictional electricity, by means of effluent steam, should not be used for charging the field network? The escaping steam would not be objectionable in open situations.

Leslie Miller.

London, E.C., July 2nd, 1917.

LEGAL.

THE ELECTRIC LIGHTING OF CHIPPING WYCOMBE.

IN the King's Bench Division on Tuesday last, before Mr. Justice Bailhache, an action was brought by the Wycombe Borough Electric Light and Power Co., Ltd., to recover £1,290 under an agreement for public lighting from the Mayor and Burgesses of Chipping Wycombe, and there was a counterclaim.

Counsel for the plaintiffs, Mr. E. Pollock, K.C., and Mr. C. R. Dunlop; for the defendants, Mr. J. B. Matthews and Mr. A. E. Hughes.

MR. POLLOCK, K.C., in laying the plaintiffs' case before the Court, said they claimed £1,290 under an agreement, dated October 3rd, 1911, for electric current for, and maintenance and repair, and renewal and cleaning of, electric lamps used in the street lighting of the Borough of Chipping Wycombe. There were due four quarters' instalments, the amounts being £332 10s. each, and the plaintiffs further claimed interest at the rate of £4 per cent. per annum from the date of the writ to judgment.

The defendant Corporation denied that £1,290, or any part of that sum, was due to the plaintiffs under the agreement, by which it was provided that payment should only be made in respect of each lamp lighted, at the rate of £13 per annum for each arc lamp, and £3 per annum for each wire lamp. The number of lamps lighted during the period referred to in 1916, and the times when they were so lighted, and the amounts payable, were stated, the total being £86 15s. 2d. It was provided in the agreement that if the lamps should not be lighted the defendants should be at liberty to deduct from any payment 3s. per night for each arc lamp, and 8d. per night for each wire or other lamp. The number and description of lamps which remained unlighted during 1916 were stated, and the defendant Corporation claimed to be entitled to deduct from the payments to the plaintiffs, under the agreement, a sum in excess of the £1,290 mentioned in the statement of claim, and pleaded that the statement of claim did not disclose any cause of action. It was an implied term of the agreement that the plaintiffs should only receive remuneration in respect of each lamp actually lighted. The non-lighting was due to the Defence of the Realm Act, by which lighting was made impossible, and the defendants were thereby discharged from their obligations, and the provisions had thereby become unenforceable by the plaintiffs as against the defendants.

MR. POLLOCK then dealt with the legal aspects, especially mentioning the Leiston case in support of the plaintiffs' claim, and said they were entitled to recover the full amount.

MR. MATTHEWS, for the defendant Corporation, dealt seriatim with the provisions in the agreement, and said that there was no obligation on the part of the defendants to pay anything except in respect of each lamp lighted; therefore, nothing could turn on the penalty clause. The contract was not to be regarded as having been frustrated by the conditions which had arisen. The defendants treated the contract as being still in force, and under it he submitted that they were liable only for the lamps lighted, and

that they were legally in a position to deduct for those lamps which had been unlighted.

MR. JUSTICE BAILHACHE, in giving judgment, said the case would have been interesting but for the fact that a somewhat similar case had been before the Court of Appeal—he referred to the action brought against the Leiston Urban District Council by the Leiston Gas Co. There was not much to distinguish between the two cases. Reading the Wycombe "penalty clause" in connection with Clause 7 and the end of Clause 3, he was satisfied that the words "from any cause whatever" were, in fact, limited to causes over which the electric lighting company had control; limited, in fact, to cases of default or neglect on the part of that company. There was no distinction in that respect from the Leiston penalty clause. In the Leiston case the decision of the Court of Appeal was made clear, and it was binding on him. He, therefore, must give judgment for the plaintiffs for the full amount claimed, with costs.

MR. MATTHEWS asked for a stay of execution, on payment of costs into Court.

MR. POLLOCK said that if the defendants would agree to pay interest on the money he would consent to a stay of execution.

MR. JUSTICE BAILHACHE: Very well; then there will be judgment for the plaintiffs for £1,200, with interest from the date of the issue of the writ.

LIGHTING RESTRICTION ORDER.

THE Stalybridge, Hyde, Mossley, and Dukinfield Tramways and Electricity Board were fined 40s. by the Stalybridge Magistrates, on Monday, for failing to shade or reduce the lights at the generating station on June 19th. It was stated that the Board had obtained an exemption under the Lighting Restriction Order on complying with the condition that a responsible person was in constant attendance to answer telephone calls within 15 seconds. On June 19th the defendants failed to respond to a call made for the purpose of receiving a test message issued by the Field-Marshal Commanding-in-Chief Home Forces (Lord French). The defence was that there was something wrong with the relay connected with the telephone system.

WAR ITEMS.

Shipping After the War.—With reference to arrangements that were recently being entered into in certain cases for the charter of British vessels for use after the war, the Ministry of Shipping has announced that it thinks it desirable to warn all concerned that they can have no assurance that national requirements will admit of effect being given to such arrangements when the time comes.

Carbon Imports Prohibited.—A Proclamation dated June 28th prohibits the importation of the following into the United Kingdom, save those imported under Board of Trade licence:—

Carbons for arc lamps; carbons for searchlights; cartridges of all kinds and parts thereof; electric dry cells and carbons therefor.

South African Engineers' Corps.—Mr. Mason, chief mechanical and electrical assistant engineer of the Rand Water Board, who has seen service in German East Africa, has been appointed to the command of a Miscellaneous Trades Corps for Europe. The strength of the corps is 232, and the age limit 52 years. The corps will consist of boiler-makers, fitters, trimmers, pipe-fitters, carpenters, platelayers, and the like.

Excess Profits.—In the House of Commons, Sir Francis Lowe asked the Chancellor of the Exchequer whether in computing the excess profits tax he would recognise the claims of those who had sunk capital in developing industries to have the amount so expended by them added to their other capital expenditure in estimating their pre-war standard of profits.—MR. BONAR LAW replied: In computing capital for the purposes of the excess profits duty account is taken under existing law of proprietors' capital employed in the business. A return on unremunerative capital invested during the standard years is also provided for by section 41 (4) of the Finance (No. 2) Act, 1915.—*Financial Times*.

American Comment on the Rising Cost of Materials.—The *Electric Light*, of New York, comments editorially on the situation in its June issue thus: "Those of us who eat to live know only too well how the cost of foodstuffs is climbing. Even dog biscuit is soaring, and that despite the fact that virtually no demand for it comes from dogs. The old economic axiom of supply and demand seems to play fast and loose when there's a war on. The supplies appear though to come along somehow whenever a dollar is fished out of a pocket that formerly held but 50 cents. If anyone doubts the truth of this statement let him ask the manager of any public utility, say the manager of a power plant or an electric railway. He will tell you how much the cost of labour, coal, oil, cotton waste and repair parts has gone up since Germany started out to sit in the sun. The railway man says it takes about two fares to buy what could be had for one fare in antebellum days. He can get the stuff, but

he must have more fares. Judging from our own experience with dog biscuit and other things, we guess the railway man is right. He wants more revenue from his property to help him pay his mounting bills, so he has asked the public service commission hereabouts to let him tack on a charge of a couple of cents for transfers. If he wins the commission over to his side, the people will stop transferring and take to walking; if he doesn't win, his railway is headed for bankruptcy. In either event, his lot is not an enviable one."

Bad Time-keeping.—The Ministry of Munitions is putting into effect the provision made in the Schedule of Protected Occupations, M.M. 130, for withdrawing protection from recruitment on account of bad time-keeping from men engaged on Admiralty, War Office, or munitions work. The following procedure is being adopted:—

1. Allegations of bad time-keeping will in the first instance be investigated on the spot by the Local Representative of the Admiralty or the Ministry of Munitions. If he considers that the case is a serious one, he will send a report on it to the Admiralty or to the Ministry of Munitions, as the case may be, who, if they consider that further action should be taken, will refer the case to the Local Enlistments Complaints Committee for the Division in which the man is employed in order that they may report upon it. The Committee will be instructed in all cases to hear the man personally before making their report, and, if he wishes it, to hear also the Branch Secretary or other representative of his Trade Union. They will also communicate with the employer if he makes representations to them, or if they consider it desirable. On receiving the report from the Committee, the Admiralty, or Ministry of Munitions, as the case may be, will decide whether the case is sufficiently serious to warrant the withdrawal of protection under the Schedule.

2. Sickness or other reasonable cause will be taken into account in deciding whether the case is one where protection should be withdrawn.

3. In the case of men employed in controlled establishments, the question of the withdrawal of protection for bad time-keeping will not ordinarily be considered unless the man concerned has been previously convicted of bad time-keeping by a Munitions Tribunal and has subsequently failed to improve.

4. The procedure set out above will apply to men in non-controlled as well as controlled firms; but in the case of non-controlled firms, the preliminary of prosecution before a tribunal will not be practicable.

Exemption Applications.—Dover Tribunal has granted four months' exemption to G. F. Howard (34, C1), a fitter in the Corporation tramway department.

At Aldershot, Mr. Vertue, electrical engineer, appealed for W. G. Hubbard (36, C2), mechanic, who, he contended, was doing better service in his present employment than he would be as a soldier. The appeal was dismissed on the understanding that the Military would use the man as a substitute.

At Gillingham (Kent), Mr. A. D. Chalmers, borough electrical engineer, appealed for W. A. Macdonald Paton (19), electrical engineer, and said that he had done all he could to replace him. Exemption pending substitution was granted.

On a Military appeal, exemption to November 1st, allowed by Gloucester Rural Tribunal to the electrical engineer at a local private asylum, has been reduced to July 15th, and made final.

At Gloucester, the Military appealed against conditional exemption granted to two motormen (36 and 34, Class C2) on the Corporation tramways, on the ground that they were engaged in one of the public services included in the list of certified occupations. The general manager (Mr. F. H. Corson) said that they had cut down the services to the lowest consistent with public requirements. The appeals were allowed, and the calling-up notice was fixed for July 31st.

The Central Appeal Court has dismissed an appeal in respect of Mr. L. Marshall, manager of the Taunton Tramway Co., Ltd.

Lepton Tribunal have allowed a Military appeal against exemption held by T. D. Linder (27), fitter and turner with the Hart Accumulator Co.

The Isle of Thanet Tramway & Lighting Co. appealed, at Broadstairs, for four men engaged on the tramways. The manager (Mr. Forde) said that the men concerned were indispensable to the proper working of the undertaking, which was decidedly one of public utility. He had released other men passed for general service, though they had been granted conditional exemption, and he was quite prepared to release these men if satisfactory substitutes could be provided, but it was no good sending him a draper or a tailor. At the beginning of the substitution scheme they sent him a man who, he should think, had never been inside an engineering shop. Conditional exemption was granted in each case.

On a review, Folkestone Tribunal has renewed conditional exemption held by F. J. Robinson (34, Class C1), electrician at the Pavilion Hotel.

At Folkestone, the Electric Light Co. applied for two months' exemption for W. V. Baker, meter reader and account collector, to enable a substitute to be trained. The request was granted.

At Lincoln, exemption was claimed by Mr. Gregory, electrician, for his wireman, placed, after rejection, in Class B2. He said that he had in hand an important contract under licence from the Ministry of Munitions. Three months were contended.

At Maidstone, three months' exemption has been allowed to Mr. W. T. Lambert (39), manager of the Corporation tramways, and H. Hayes and C. Hudson, coal unloaders at the Corporation electricity works.

At Ryde, exemption was claimed by P. G. Churchill (22, Class A), stoker at the works of the Isle of Wight Electric Light Co. It transpired that Churchill had been rejected from both the Army and Navy, and the company engaged him in consequence. Exemption until January 1st was granted.

A Military appeal was made at Ryde (Isle of Wight) against

exemption held by F. A. White (26, Class A), electrical fitter with the Isle of Wight Electric Light Co. It was urged that White was in a reserved occupation, but the Military Representative contended that there was no reservation at all. It transpired that by a new regulation anyone at a generating station was exempt, and the Tribunal decided that White was in a reserved occupation, and confirmed their previous decision.

At Burnley Tribunal, Mr. Mozley, tramways manager, appealed for the senior conductor and checker, aged 39 and married, passed C 2. The Town Clerk stated that such men were not now certified. Mr. Parker (Military Representative) had no objection to a temporary short exemption. Mr. Mozley asked if they could be allowed to retain the man until the busy season was over. He was given to September 30th (open).

At Southwark, Com. T. E. Hewitt, who is a member of the Tribunal, and carries on business as an electrical engineer in the borough, applied for the further exemption of three metal workers, 28, 27, and 23 years old respectively, all passed for general service. He stated that before the war he employed 17 men, but had now only these three men left. They were engaged on making metal parts for the R.A.C.D., whilst the Minister of Munitions had taken over certain premises in South Wales, and had called upon him to light them up at once. He was also engaged on installing the electric light at Red Cross Hospitals. If he could get men to take the places of these employees he should be glad to release them, but they were engaged on work of extreme national importance, and they were behind with their deliveries. They were granted a month's exemption each.

LOW-TEMPERATURE ELECTRO-THERMAL PROCESSES.

A PAPER read by Mr. C. F. Hirshfeld, chief of the Research Department of the Detroit Edison Co., before the American Electro-Chemical Society, was recently reported in *Metallurgical and Chemical Engineering*. The author said that, in a general sense, the electric furnace could not be considered a commercial competitor of furnaces heated by combustion. The use of the electric furnace must make possible the attainment of something unattainable by combustion methods, or else there was no possibility of its being used in place of the older type excepting, possibly, under very unusual conditions as to the relative costs of fuel and electrical energy.

There were certain low-temperature processes which, under certain circumstances, could be conducted to better commercial advantage by means of electric heating than was possible by means of combustion heating. The term "low temperature" might be taken as referring to temperatures below about 290° C. (554° F.). Such temperatures were below practically all commercial metal-melting temperatures, but were common in numerous baking and drying operations, which formed a surprisingly large part of industrial processes.

During the past few years the use of electric heating for such temperatures had been adopted in cases calling for the installation of equipments with capacities ranging from several hundred to several thousand kilowatts.

The best example of the extensive adoption of electric heating for low-temperature work was furnished by the electric japanning equipment installed during the past few years. The word japan was used as a sort of collective title for a number of paint-like materials intended to be baked at various temperatures between 100° C. (212° F.) and 260° C. (500° F.) for decorative or protective coatings on metal objects.

When electric baking of japan was first considered a few years ago, it was found that practically all japanning practice was of an empirical character. Makers of japans practically all agreed upon certain rules and regulations, but there was a large mass of so-called trade secrets which were, partly or wholly, mutually contradictory; operators were hired on the basis of a self-advertised collection of rules of thumb, combined with imaginary charms of various sorts for ensuring excellent results. The executive responsible for factory production were entirely at the mercy of these self-styled experts. It was not surprising that, under such conditions, the japanning room should have been a source of constant worry. In many establishments an average rejection of as much as 10 per cent. of the finished work was regarded as a characteristic of japanning processes, and was taken as a matter of course. The methods in vogue made it so impossible to control the essential variables that little opportunity existed for studying in the field the effects produced by giving them different values.

The application of electric heating to this art served the very useful purpose of making it possible to control accurately some of the variables, and the combination of electric heating with the continuous methods which were introduced with it made this control more extensive and automatic. With the combination of electric heating and continuous types of oven as now built, it was possible to control accurately and automatically all of the variables. Therefore, if one piece of work was satisfactory all must be satisfactory, if they came to the japanning room in the same state of preparation and if they had the same characteristics as to quality of material, contour, distribution of mass, &c.

Much of the credit for the control attainable with electric

heating must be given to the mobility of electric heating units. They could be shifted about with great ease until that particular arrangement which gave the best temperature distribution and best temperature gradient was discovered. After they were once located in such positions, the results attained were independent of all of the variable characteristics of combustion processes. Their performance must be the same not only day after day, but even year after year.

The ease and certainty with which electric heating units could be controlled automatically must also be given its full share of credit. The human factor, with all of its inherent tendency toward forgetfulness and toward variation from time to time, was absolutely eliminated by this method.

Since the introduction of continuous electrical methods it had been possible to make semi-scientific investigations in the industrial field, and several notable pieces of work had been done along these lines. As a result of one such investigation, the japanning in one large plant had been reduced to what was practically an absolute basis. In this case practically everything was controlled automatically, and one individual located in front of an instrument board some distance from the ovens and out of sight of all operations had general supervision of the entire process, and was responsible for results.

At the time when electrification started it was customary to bake japan in direct-fired gas ovens, in most plants. In these ovens gas was burned within the space in which the work was enclosed, and the products of combustion baked the work during the entire process. It was found to be particularly difficult to be sure of obtaining a high gloss, and the weathering qualities of work made under what were supposed to be exactly similar conditions were remarkably diverse.

Photomicrographs showing typical structures resulting from baking japan were given in the paper. It was shown that from baking japan slowly in a direct-fired gas oven the formation of small craters resulted, which seemed to be typical of all baking methods in which the heating was done by means of hot gases bathing the work.

On the other hand, photomicrographs of work done in electric japanning ovens under otherwise identical connections, show that the electrically-baked piece had smaller and more evenly distributed craters, and that the surface was more perfect. The baking of the coats in the gas oven consumed a total of 5½ hours, while the three corresponding coats were baked electrically in 2 hours and 40 minutes. Inspection of pieces baked in direct-fired gas ovens, and similar pieces baked in electrically-heated ovens, always showed that the electrically-baked material had a higher and more perfect gloss or finish.

Practically all heat transferred to the work in a direct-fired gas oven was carried to it by convection. In an electrically-heated oven at least part of the heat was brought to the work in the same way; the rest of the heat was transferred by radiation from the heaters, and it seemed probable that the action of the heat received in this way was different from that received by convection. It was at least probable that radiant energy penetrated the japan coat to a considerable depth before being entirely absorbed and converted into heat, and this caused more rapid setting of the inner portions of that coat.

If the craters were due to the causes assumed above, it should be possible to eliminate them entirely by baking the japan from the inside out. This could be done electrically by heating the metal itself, either by the direct passage of current or by induced eddy currents.

Certain experiments were conducted on a small scale, and inspection showed the sample baked by convection heating to have the poorest surface, while that baked by internal heating very obviously had the highest gloss and most perfect surface. Baking by internal heating was essentially an electrical method, far removed in every way from methods previously in use. With this method a maximum metal temperature of the order of 170° C. (338 F.) and a bake of 15 minutes were perfectly capable of giving better results than could be obtained with external electric heating with 45-minute bake and a maximum temperature of 230° C. (446° F.). It seemed probable that one coat baked in this way would prove the equal of two or three baked by the older methods. The effect of all this upon energy charges for a given weight of metal baked was obvious.

An equally promising field existed in foundry core rooms. The baking of foundry cores was a most haphazard process in the majority of foundries. Preliminary experiments conducted for the purpose of discovering whether the essential properties of cores varied as greatly as their colours gave astounding results.

There were now in operation several electrically-heated core-baking ovens, and their users all appeared highly enthusiastic over the results attained.

There were numerous other low-temperature baking processes, and the majority were in the same undeveloped state as the two cited above. One very important field in which little had been done was the baking of foodstuffs, such as bread and other cereal products. Electric heating had been applied to the baking of such materials in several cases with very gratifying results, improving both the appearance and quality of the product.

The introduction of electrical methods for such purposes as enumerated above should be of particular interest to the chemist, because it made it possible to reproduce on an industrial scale a sequence of operations and conditions which had been worked out on a small scale in the laboratory; it made it possible to control industrial production to the same extent that laboratory investigations were controllable, and thus opened to the chemist in the industrial field a tremendous opportunity for improvement of product and increased production.

Prof. Hirshfeld's paper elicited a long and animated discussion. In his final reply, Prof. Hirshfeld emphasised that the cost of energy was by no means necessarily the vital point. Ten years ago japanning was done by coal and coke firing. The change to gas heating involved an energy differential of 18 to 1, but the higher cost of the gas was considered of minor importance. Why not now change to electric heating, where the differential was so many times smaller than in the former case?

BUSINESS NOTES.

Book Notices.—*Scholey's Magazine*, which was suspended at the outbreak of the war, is now being re-issued. The June number is largely devoted to the question of efficiency, which is being closely studied by industrial and labour leaders. Efficiency in the boiler house, where perhaps the greatest economies can be effected, is the main feature of the issue, which can be obtained from Messrs. Scholey & Co., Ltd., price 2d.

Vol. XII of the *Proceedings* of the Roebury Engineering Society for the session 1914-15 has recently been issued, the delay being due to the war. It contains papers on "Modern Electric Lighting," by H. C. Wheat; "Modern Condensing Plant Systems," by T. R. Houston; and "Deep Well Boring," by — Sahl; as well as a list of members and other domestic information.

We have received a copy of No. 7 of *Russia*, an illustrated magazine of Anglo-Russian trade, published by Messrs. R. Martens and Co., Ltd. (Development Department), 149, Leadenhall Street, E.C. 3.

The *Central* for June contains articles on "A New Form of X-ray Localiser," by F. F. Renwick; "The Human Element in Industry," by "Works Manager"; "With a Field Company in Picardy," by R.O.B.; and "Arthur's Pass Tunnel, N.Z.," by E. L. Gosset; as well as numerous "Old Student Notes" and additions to the Roll of Honour.

The second issue of the *M. and C. Apprentices' Magazine* has come to hand, rejoicing in the success of its predecessor. It contains many interesting articles and humorous, technical, and personal items.

Trade Announcements.—MESSRS. VERITYS, LTD., have taken new offices in Birmingham at Phoenix Chambers, Colmore Row. Telephone number unaltered: "Central 12."

MR. H. G. CRUSE announces that he is continuing the business of his late father, Mr. Cruse, electrician, of 37, New Road, Lewes (Sussex).

Swedish Trade in Canada.—According to a report from the Imperial Trade Correspondent at Toronto, quoted in the *Board of Trade Journal*, a Swedish Association of Canada (Svenska Forbundet i Canada) has been established, with offices in Montreal, for the purpose of bringing Swedish nationals in Canada into closer communication with each other for mutual benefit, and for furthering intercourse between Canada and Sweden. It is anticipated that for the present the activities of the Association will be largely confined to preparations for closer relations after the war.

Catalogues and Lists.—MESSRS. E. BENNIS & Co., LTD., 28, Victoria Street, London, S.W. 1.—New catalogue (28 pp.) admirably illustrated with half-tones and line drawings, dealing with their boiler-house elevators. A general description of their gravity bucket elevators is followed by some notes on the economy of small elevators, and on their self-starting and self-stopping device. Brief accounts are then given of plants installed by them for a number of well-known mills. Copies of the catalogue will be forwarded on application.

MR. G. WYTHRICH, of Oswaldestre House, Norfolk Street, London, W.C. 2, sends us a 64-page booklet containing illustrations of a number of the principal specialties of the Oerlikon Co., also interior and exterior views of the company's works in Switzerland.

BRITISH INSULATED AND HELSBY CABLES, LTD., Prescott.—Twelve-page illustrated catalogue of the "Prescott" wiring system. The system and its component parts are described, and prices are tabulated for twin house wire, joint-boxes, bases, and distribution boxes.

Makers of all classes of electrical material are requested to send their catalogues to THE B.E. Co. (of London and Birmingham), LTD., 119, Mansion House Chambers, E.C. 1, for transmission to the firm's agent in Paris.

Change of Name.—MR. W. A. SCOTT (Messrs. W. A. Schultz & Co., chartered accountants) announces that he has by Deed Poll abandoned the name of Schultz, and adopted that of Scott. The style of the firm will be W. A. Scott & Co.

LIGHTING AND POWER NOTES.

Australia.—The Sydney Municipal Council Electric Lighting Committee has decided to dispose of a number of obsolete arc lamps, valued at £16,000, owing to carbons being unobtainable and to a more efficient lamp having been placed on the market.

Barrow.—The L.G.B. has suggested to the Health Committee the advisability of submitting its proposals for electrifying the sewage pumping plant as soon as practicable, in order to facilitate the granting of a loan for the work when the present restrictions are withdrawn.

Belfast.—PRICE INCREASE.—The Tramways and Electricity Committee has recommended that the present rate for electricity be increased by 4d. per unit from July 1st.

Bexhill-on-Sea.—Owing to the increase in the cost of service cables, the T.C. has decided that consumers shall in future pay for such part of the cable and laying as is beyond 40 ft. from the centre of the roadway.

Brighton.—YEAR'S WORKING.—The report of Mr. Christie, the manager of the electricity undertaking, to which we referred last week, points out that, owing to lighting restrictions, &c., nearly 2½ million units output had been lost as compared with normal times, but this had been largely compensated by power supply, for while lighting and power sales were about equal in pre-war times, they now had a ratio of 3 : 7. Coal cost 40s. 9½d. per ton, against 17s. 3d. in 1913-14, representing an increase in cost of £19,742; the average fuel costs for 1914 and 1917 were 37d. and 84d. per unit respectively. The consumers numbered 6,739, and 1,015 H.P. of motors were connected, 1,256 H.P. being hired. The maximum load was 4,312 kW., and the load factor 25.9 per cent.

Burnley.—PROPOSED LOAN.—An additional feeder cable being required for the Calder Vale district owing to the increasing demands for power purposes, the Electricity Committee has decided to ask the L.G.B. for powers to borrow £1,600, the estimated cost of laying the cable.

At its monthly meeting the Chamber of Commerce agreed to support the proposal for the better organisation of electrical supply for the benefit of industries.

Chester.—WATER POWER PROPOSALS.—The T.C. has decided to apply for a grant of £200 under the Development Fund Act, with a view to investigating the potentialities of the River Dee for hydro-electric development, with the object of supplying electricity to the agricultural and other rural industries of the county. The proposal has been favourably considered by the Board of Agriculture, and is referred to in a leaderette in this issue.

Continental.—FRANCE.—Prof. Glangcaud, of the Faculté des Sciences, at Clermont-Ferrand, has drawn attention to the natural wealth in the shape of water power, hydro-carbons, and carbonic acid of the Mont-Dore district in the centre of France. On the Dore River two electrical installations are working, with an aggregate capacity of 50,000 H.P., and two others are planned; but these are far below the capabilities of the river. Abundant petrol resources also, he says, abound in the volcanic ground of this district; while in the plain of Limagne, 300,000 kg. of natural carbonic acid exudes from the earth daily, and is unutilised. A closer co-operation of the Departmental technical engineers, scientists, and manufacturers is, the Professor thinks, needed in the interests of the country and of the electrical industries. Similarly with regard to lignite, France possesses extensive deposits, but only those of Aulépín, in Haute-Loire, are utilised, by means of German prisoners' labour, to provide local fuel, whereas at Giovanni d'Arno, in Italy, 200 tons per day are extracted for the production of electrical energy.

ITALY.—Conditions produced by the war have led to a discussion on the ability of Italy to find within herself sources of power for present and future industries. It appears that the only source of power which can be used to free the country from her dependence upon imports of foreign coal is the streams and torrents, which can be utilised for generating and transmitting electricity to a great part of the country; some of this work has already been done. Of the 800,000 hydro-H.P. in use on June 30th, 1914, it is estimated that 235,000 was in Piedmont, 225,000 in Lombardy, 10,500 in Liguria, 57,000 in Veneto, 5,500 in Emilia, 22,600 in Tuscany, 24,800 in Marche, 110,200 in Umbria, 32,000 in Lazio, 75,000 in Abruzzi e Molise, 7 in Sardinia, and the remainder in the Departments of Puglia, Basilicata, and Calabria. During the past year concessions that are expected to develop 200,000 H.P. have been granted. French and Italian engineers have estimated that from 4,000,000 to 5,000,000 water H.P. could be developed. If the mean of these estimates, 4,500,000 H.P. is taken as correct, and the 800,000 H.P. already developed is deducted, there remains 3,700,000 yet to be developed. To replace the energy obtained from imported coal used in railways and industries about 1,150,000 H.P. must be further deducted, leaving a surplus over all present uses of 2,550,000 H.P., or sufficient 16 more than double the power now in use in the country.—*United States of America Commerce Report*.

In a decree just issued the Ministry of War anticipates the expenditure of £1,000,000 on the utilisation of water power for the production of electrical energy and the working of the necessary plants. The expenditure embraces the acquisition of material as well as the cost of the additional labour.

SPAIN.—A concession has recently been granted for the establishment of a plant to utilise the water power of the River Guadalquivir, in the Province of Jaen, in the generation of electrical energy for lighting and power purposes.

Croydon.—The T.C. has decided to extend the mains to certain local works, at an estimated cost of £4,761. A garage for charging electric vehicles is to be provided at the electricity station, at an estimated cost of £550.

Dundalk.—The estimate of the Council's electrical engineer for the year ending in March, 1918, shows a deficit of £1,050, after meeting all working expenses and interest and sinking fund charges. This is due mainly to the high cost of fuel oil. In the circumstances it was decided by the Committee, and approved by the Council, to increase the price of energy for lighting purposes.

Finchley.—In commenting on the working of the electricity department during the past 12 months, the chairman of the Committee stated that coal cost over 26s. per ton, or 8 per cent. more than in the preceding year, and fuel oil cost £8 12s. per ton, or 140 per cent. more. Increased charges brought in £1,630 added revenue, but the fuel bill increased by £4,192. They used 4,071 tons of coal and 509 tons of oil, generating 1,345,000 units by coal at a cost of 1d. per unit, and 1,155,000 units by oil at a cost of 723d. per unit. The gross profit amounted to £10,630, equal to 12½ per cent. on the outstanding capital. It has been decided to further increase the charges for electricity for lighting and power.

Iford.—PROPOSED LOAN.—The U.D.C. has decided to apply to the L.G.B. for a loan of £5,800 for generating plant for the utilisation of steam at the refuse destructor works.

London.—KENSINGTON.—The Works Committee of the B.C. has agreed to a proposal by the Notting Hill Electric Lighting Co., Ltd., to increase the charge for electricity supplied for street lighting from 1d. to 1½d. per unit. The change is to come in at the end of the current quarter.

Maidenhead.—PRICE INCREASE.—The T.C. has advanced the price of current to ordinary consumers by 1d. per unit, and to power consumers by 10 per cent.

Manchester.—YEAR'S WORKING.—The annual statement of the Corporation electricity department for the year ended March 31st last shows a total income of £742,073, compared with £620,000 in the previous year; the net surplus was £62,889, as compared with £54,897. Of the surplus, £30,000 has been transferred to the rate account, £31,804 in payment of income-tax, and £1,085 for capital expenditure. The report states that one of the problems has been the maintenance of an adequate coal supply to the three generating stations. Arrangements have been made to still further increase the amount of coal carried in stock by the acquisition of further land for storage and the installation of mechanical appliances for handling coal. The average price paid for coal, taking the stations as a whole, rose 38d. per ton during the year, whilst the average weight of coal consumed fell 104 lb. per unit sold. A 5,000-kw. turbo-alternator has been completed at the Stuart Street station, also a high-pressure turbine for coupling up to a 4,500-kw. alternator. It is anticipated that a new 15,000-kw. turbo-alternator will be in commission by September, whilst a contract has recently been placed for a 20,000-kw. turbo-alternator. New or additional supplies have been, or shortly will be, furnished to 27 important consumers, principally through sub-stations installed on their own premises.—*Manchester Dispatch*.

Middleton.—YEAR'S WORKING.—There was a net loss of £1,605 on the working of the electricity undertaking for the past year.

Newcastle (Co. Down).—The U.D.C. has agreed to pay the Irish Towns Lighting Co. £230 per annum for nine months' public electric lighting for a period of three years.

Northampton.—PRICE INCREASE.—The Electric Light and Power Co. has, owing to the continued increase in the cost of production, temporarily advanced the price of current for all purposes by 10 per cent. as from the midsummer meter readings.

Perth.—WAGES.—The staff of the Corporation electricity station have received an additional 2s. on their weekly wages, in order to put them on a level with other Corporation departments.

Scunthorpe.—PROV. ORDER.—The U.D.C. has decided to apply at the earliest available opportunity to the B. of T. for a prov. order for electric supply. A prov. order obtained in 1903 was revoked five years later.

Shipley.—WAGES.—The Council has approved the Finance Committee's recommendation granting a further advance of 5s. per week on pre-war rates—making 12s. in all—on the pay of Council workmen, particularly in the electricity, gas, and highways departments. The advances are retrospective as from May 1st.

South Africa.—The Cape Town T.C. has decided to call for tenders for a motor-driven circulating pump, at an estimated cost of about £750.

Owing to the non-delivery of the additional boiler plant, and the inability of the electric light department to obtain suitable boiler tubes for the existing boilers, very drastic restrictions have had to be imposed on would-be consumers. All new connections, except for private houses, are prohibited, and no extensions either to lights, motors, or cooking are now allowed.

Uckfield.—PROV. ORDER.—The B. of T. has granted an extension for a further period of 12 months of the electricity order obtained by the Crowborough Gas Co.

TRAMWAY and RAILWAY NOTES.

Belfast.—At the monthly meeting of the Corporation on Monday last, Alderman Tyrell said that the tramway receipts continued to be satisfactory. The net revenue from the electricity undertaking was £5,697. The effect of the Daylight Savings Act was a saving of 1,300 units per day last winter. By the recent awards some 126 men employed at the Corporation tramway depot are to receive an increase of from 1s. 3d. to 1s. 6d. per day, according to age, in lieu of war bonuses. In the case of the employees who struck at the electricity station, an increase of 8s. to 11s. per week has been made, in lieu of war bonuses, according to age, the higher rate being for all over 18 and the lower rate for those under it.

Blackburn.—RAIL RENEWALS.—As a result of the intervention of the Ministry of Munitions, the Birmingham Corporation is supplying the Corporation with sufficient rails for the relaying of a worn-out portion of the track in Preston Old Road. It had been proposed to take rails from the Cherry Tree route, and discontinue that service, but the residents objected and sought Government help.

Burnley.—On Saturday morning the members of the Tramway Workers' Union decided to strike against overcrowding and working overtime. The strike was in progress until Saturday night, and was resumed on Sunday evening until the cars returned to the depot. It was not, however, resumed on Monday, when publicity was given to the following resolutions, adopted in Manchester on Sunday:—"That hostilities cease for the present, with a view to endeavouring to arrange a meeting with the Managers' Federation, as advised by Sir D. Shackleton"; "that no one be taught the duties of driver or conductor unless he or she was learning before the dispute commenced, or was at the time a member of our Association."

Canada.—An electric car on the Niagara Gorge route ran off the track at a washout, and fell into the river, 27 persons being reported killed and 40 injured.

Darwen.—The Tramways Committee, last week, declined to grant free passes on the cars to local Guardians attending board meetings at Blackburn. A request by the local special constables for free car passes was also refused.

Halifax.—With the consent of the Council, the Tramways Committee has authorised an option to purchase from it, on or before August 4th, at the price of £6,283, land and buildings at Highroad Well, originally used as a car shed.

RAIL RENEWALS.—The Tramways Committee proposes to relay North Bridge with new rails, such rails being at present in store. The borough engineer has been instructed to prepare a report as to the lengths of rails laid in streets not now used for the purpose of tramways, together with the cost of taking them up and relaying them where renewals are required.

Iford.—TRAMWAY LEASE.—With regard to the leasing of the Barking tramway track, a conference has been held between representatives of the two councils, and a provisional agreement has been arrived at to the effect that the existing lease be renewed for three years from June 1st, 1917, upon the same terms, with the exception that the annual rental be £1,250, and that the price for the purchase of current from the Barking Council be 1½d.

Keighley.—Arbitration proceedings were held, last week, in connection with the local tramway employees' demands which caused the recent strike. The employees asked for an advance of wages to correspond with the Bradford rate of pay for male and female workers, a war bonus of 6s. per week for males and females, and time and a-quarter for work on the seventh day. The proceedings lasted about two and a-half hours; the award will be announced later.

Sheerness.—The U.D.C. has decided not to entertain an offer to purchase the undertaking of the Sheerness and District Electric Power and Traction Co. The company has informed the Council that it intends at an early date to close the service between Sheerness Pier and Cheyney Rock and Sheerness East, and to remove the rails, poles, and overhead equipment.

TELEGRAPH and TELEPHONE NOTES.

Japan.—Although the State telephone system is operated at a large profit, the Department has not been able to keep pace with the demand for connections, of which 134,300 were awaiting attention at the end of 1914; the result has been that persons urgently requiring connection have had to purchase from others their telephone rights at heavy cost. Each telephone in Tokio, on the average, makes 22 calls per day, an average more than double that prevailing even in New York, a flat rate of charge being in force.—*T. and T. Age*.

United States.—The New York Telephone Co. has completed the work of laying a large submarine telephone cable across Raritan Bay, a distance of nearly 5½ miles. It is said to be the

longest maximum size duplex submarine telephone cable at the present time. It contains 74 pairs of wires for regular telephone work and 12 pairs for testing purposes.

Mr. J. J. Carty, chief engineer of the American Telephone and Telegraph Co., has become a Major in the U.S. Signal Corps Reserve. The Bell telephone companies will form 25 signal corps reserve companies, a total of about 100 officers and 2,500 non-commissioned officers and men.—*T. and T. Age.*

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—**SYDNEY.**—August 22nd. N.S.W. Government Railways and Tramways. Thirty-six induction motors (Specification No. 488). September 19th.—One 225-H.P. synchronous motor (Specification No. 489). Particulars from Electrical Engineer's Office, 61, Hunter Street, Sydney.

Dublin.—July 16th. Electricity Supply Committee. Transformers for one year. See "Official Notices" to-day.

Edinburgh.—July 12th. Scottish National Housing Co., Ltd. Metal-filament lamps. See "Official Notices" to-day.

Glasgow.—Electricity Department. Boiler-house plant. E.H.T. switchgear (20,000 volts). See "Official Notices" June 15th.

Hull.—July 19th. T.C. Machinery oils for the electricity works and sub-stations. Mr. J. F. Magoris, Acting Electrical Engineer.

Manchester.—July 10th. Tramways Committee. (a) Cloth (beaver, serge and pilot); (b) block tin. Mr. J. M. McElroy, General Manager.

July 11th. Electricity Committee. Stuart Street station. High and low-pressure steam and feed pipework. Mr. F. E. Hughes, Secretary, Electricity Department.

Spain.—Tenders have recently been invited by the municipal authorities of Deva (Province of Guipuzcoa) for the concession for the electric lighting of the town during 10 years.

West Ham.—July 17th. Corporation. Two motor ambulance vehicles. See "Official Notices" to-day.

CLOSED.

Brighton.—The Lighting Committee recommends the acceptance of the offer of the Underfeed Stoker Co., Ltd., for three travelling grate mechanical stokers, at £3,087.

Manchester.—Electricity Committee. Accepted tenders:

Hydraulic accumulator and ram pump.—Hydraulic Engineering Co., Ltd.
Coal elevator.—W. J. Jenkins & Co., Ltd.
750-kw. converter.—B.T.H. Co., Ltd.
1,000-kw. rotary converter and transformer.—Mather & Platt, Ltd.
150-kw. rotary converter and transformer.—British Westinghouse E. & M. Co., Ltd.
300-kw. motor-converter.—Bruce Peebles & Co., Ltd.
Cables.—Callender's Cable & Construction Co., Ltd.; Liverpool Electric Cable Co., Ltd.; B.I. & Helsby Cables, Ltd.

Stores for 12 months. Accepted tenders:—

Adhesive tape.—L. Andrews & Co.
Dry batteries for flash-lamps.—Ward & Goldstone.
Box compound and Bittite tape.—Callender's Cable & Construction Co., Ltd.
Cast-iron cable troughing.—Coalbrookdale Co.
D.C.C. silk cord and Eureka wire.—London Electric Wire Co. and Smiths, Ltd.
Enamelled wire.—Connolly Bros., Ltd.
Insulators.—Bullers, Ltd.; Donlon & Co.; Gaskell & Grocott.
Lion jointing and packing.—J. Walker & Co., Ltd.
Nickel chrome and strip.—H. Wiggan & Co., Ltd.
Rubber tape.—L. Andrew & Co.; W. T. Henley's Telegraph Works Co., Ltd.; W. T. Glover & Co., Ltd.; C. Macintosh & Co., Ltd.
Service boxes.—J. Stubbs, Ltd.
Tinned steel and armature wire.—W. N. Brunton & Sons.
Auto-transformers and auto-balancers.—Brit. Elec. Transformer Co., Ltd.
Trifurcating boxes.—B.I. & Helsby Cables, Ltd.
Tubing and accessories.—Brotherton Tubes and Conduits, Ltd.
Tubing, &c. (Simplex).—Simplex Conduits, Ltd.

Salford.—Electricity Committee. Accepted tender:—
Cable.—Macintosh Cable Co., Ltd., £5,396.

FORTHCOMING EVENTS.

Salford Technical and Engineering Association.—Saturday, July 7th. Visit to Messrs. Royes, Ltd., Irlam.

Birmingham and District Electric Club.—Saturday, July 14th. Visit, in conjunction with the Association of Mining Electrical Engineers, Warwickshire and Staffordshire Branch, to the Walsall Corporation generating station at Birchills.

OUR HALF-YEARLY INDEX.

THE Index to Vol. 80 of the ELECTRICAL REVIEW has now been printed. As already announced, it will not be distributed with the journal, owing to the need for effecting paper economy. Copies will be supplied for 3d., post free, to those who make special application for it. Readers and others who require copies for binding the half-yearly volume, or for keeping together with their loose copies, should make application at once to the Publisher, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

NOTES.

Volunteer Notes.—COUNTY OF LONDON VOLUNTEER ENGINEERS (FIELD COMPANIES).—Headquarters, Balderton Street, Oxford Street, W.

Orders for the week, by Lieut.-Colonel C. B. Clay, V.D., commanding:—
Monday, July 9th.—Technical instruction for No. 3 Company, Right Half Company, at Regency Street. Drill, No. 3 Company, Left Half Company. Signalling Class. Recruits' Drill, 6.30.

Tuesday, July 10th.—Lecture, 6.30. Physical drill and bayonet fighting, 7.30.

Wednesday, July 11th.—Drill, No. 1 Company, Right Half Company.

Thursday, July 12th.—Drill, No. 2 Company, Right Half Company. Ambulance Class, 6.30. Signalling Class.

Friday, July 13th.—Technical instruction for No. 3 Company, Left Half Company, at Regency Street. Drill, No. 3 Company, Right Half Company. Recruits' Drill, 6.30.

Saturday, July 14th.—C.O.'s Parade, 2.45. Uniform, for Drill in Hyde Park. MACLEOD YEARSLEY, Adjutant.

The Aluminium Resources of the Empire.—As a result of inquiries made as to the position of aluminium production in the Empire, the British Empire Producers' Organisation learns that, notwithstanding the fact that some of the best deposits of bauxite—the ore from which aluminium is extracted—are in foreign territory, namely, in France and the United States, the British Empire has an important place amongst the world's producers of this metal, and is likely to hold it. The best British deposits of bauxite are in Co. Antrim, Ireland, whence the ore is sent to the aluminium works at Foyers and Kinlochleven, in Scotland, where the output of metal is now well over 10,000 tons a year. Canada also manufactures nearly as much at Shawinigan Falls, in Quebec Province, from bauxite imported from the United States. A lease of some of the bauxite deposits recently proved in British Guiana has been granted to the company owning these Canadian works on condition that within seven years it establishes in British territory refining works capable of producing about 4,000 tons of aluminium per annum. Large deposits of bauxite which could be worked by simple quarrying are awaiting development in the Central Provinces of India. This bauxite could hardly be exported from India at a profit, but it might be treated on the spot for the extraction of alumina for export, and possibly aluminium might ultimately be made in India. The British Empire already has a good share in the world's production of this metal, and also has large reserves of the raw material upon which it can draw in due course.

National Insurance (Unemployment) Acts, 1911 to 1916.

Contributions are payable in respect of:—

2,325 X. Workmen engaged wholly or mainly in fitting up cast-iron fuse-boxes, such as are commonly used for ordinary domestic installations.

2,327 X. Workmen employed by firms of tube makers, and engaged wholly or mainly in tagging, skimming or bell-mouthing tubes for the automobile industry.

The Fixation of Nitrogen in Germany.—The production of ammonia by the Haber synthetic process rose from 30,000 tons in 1913 to 60,000 tons in 1914, 150,000 tons in 1915, and 300,000 tons (estimated) in 1916. An output of 500,000 tons of ammonia is anticipated in 1917, containing 100,000 tons of nitrogen; at the same time 700,000 tons of sulphate of ammonia (140,000 tons of nitrogen), and 400,000 tons of calcium nitrate (80,000 tons of nitrogen) are expected to be produced, the total including 320,000 tons of nitrogen, which exceeds by 100,000 tons the entire consumption of nitrogen in Germany in 1913. *La Revue Générale de l'Electricité*, from which we derive these figures, originally published in the *Frankfurter Zeitung*, makes reservations with regard to their accuracy.

Summer Time.—The U.S. Senate has passed a Daylight Saving Bill, with an amendment to make it take effect next year. The measure is now before the House of Representatives.

With a view to economy in fuel, the Provisional Government has decided, beginning on July 14th, to advance the normal time by one hour throughout Russia.

Spain.—La Sociedad Anonima Productora de Fuerzas Motrices has been formed at Bilbao, with a capital of 6,400,000 pesetas, for the acquisition and utilisation of waterfalls, the manufacture and sale of materials for the electrical industries, and the acquisition and working of fuel, metal, and other deposits.

The company is the owner of a fall on the River Hannisell, province of Levida, where the installation is expected to be completed by the end of 1919.

Terms of Apprenticeship.—The need for the better industrial training of young workers and the question of apprenticeship as the most suitable method by which this can be obtained is at present being widely discussed by employers in all trades. The following recommendations on the arranging of apprenticeships have been drawn up by the Apprenticeship and Skilled Employment Association, which has had long experience of the actual apprenticing of boys and girls to employers in skilled trades. In framing these suggestions due regard has been had to the necessity of adjusting the old and too rigid apprenticeship system to answer the altered social and industrial conditions now obtaining:—

Length of Term.—A maximum period of five years. A seven years' apprenticeship, though upheld by many Trade Unions, is needlessly long, having regard to the present standard of education now reached by candidates for apprenticeship and the later age of attendance at school, and it undoubtedly operates as a deterrent in many cases.

Age at Commencement.—15 or 16 where it is possible for the boy to remain at school. For those leaving the Elementary Schools at 14 years of age, it is best that they should enter the works where they are to be apprenticed immediately on leaving school.

The Period of Trial.—before the indentures are signed—should be at least one month in length; a longer period is sometimes desirable. This period should be included in the term of apprenticeship. During this time the boy should be put on work which he will do when apprenticed, in order that his ability and liking for it may be tested. A wage should be paid during this period not greater than the wage during the first year of apprenticeship.

Wages must vary according to trade and locality, but should not compare so unfavourably with the wages paid to boys in unskilled trades as to deter poor parents from apprenticing their sons on purely financial grounds. Much talent which would have been of the greatest use to the nation has been lost through apprenticeship wages being so low that lads from poor homes, but with marked industrial gifts, have been unable to enter skilled trades.

Premiums should not be required; they have the same effect in keeping out poor boys as have low wages. If charged, the wages should be proportionately high.

A Bonus—payable at intervals for good time-keeping, behaviour, and work—is an incentive to the apprentice to do his best.

General and Technical Education at continuation classes should be arranged for and insisted on, especially in the case of apprentices who are bound at 14. Where possible this should be during working hours, in order that the apprentice may come fresh to the classes and get the utmost profit from them. Where this is not possible, some relaxation of hours should be allowed either on the afternoon of the day on which the class is to be held, or on the following morning. During the first two years of the apprenticeship the classes attended should be on subjects of general rather than technical education.

The Indentures must contain an undertaking by the employer to teach the trade, and by the apprentice to learn it, and must be signed by the parent, boy, and employer in the presence of a witness. Clauses should be included relating to all the above points, and to the hours of work, overtime, holidays, and payment during sickness. If an outside and impartial agency is interested in the apprentice it is an advantage that this agency should appoint a member to sign the indentures as a fourth party, and that the power of arbitration, and in the last resort cancellation, should be given him. This avoids recourse to a court of law in the event of any dispute between the employer and apprentice. An indenture must be stamped with a revenue stamp. A specimen form of indenture can be sent if desired, price 1½d post free.

Photoelectric Sensibility.—In the *Physical Review*, Mr. T. W. Case describes a systematic search for substances which show a change of resistance when exposed to light. The results of the author's research are given in a long table. Two specimens which show remarkable action are acicular crystals of bismuth sulphide (bismuthinite) and a granular lead antimony sulphide. The resistance of a piece of the latter 1 mm. × 10 mm. "reduces about 5,000 per cent." (*sic*) from the value in the dark in dull sunlight at an applied potential of 110 volts. If the substance be actually heated up, either by exposure to heat or passing a current which slowly heats the substance, then the resistance is gradually lowered, but this is a slow process. All of the photo-active sulphides show the quick light reaction in the red part of the spectrum. Both the bismuthinite and the lead antimony sulphide give fine results when used as a transmitter in a photophone system, using a manometric flame for transforming the voice variations into light variations. The voice reproduction is very clear and loud.—*Electrical World*.

Danger of Compressed Oxygen.—According to Mr. George S. Rice, Chief Mining Engineer of the Bureau of Mines, U.S.A., there has been a large number of explosions in various parts of the country of tanks containing oxygen made by the electrolytic process, due to the presence of hydrogen mixed with oxygen, and the Bureau has been making an investigation of this subject.

In general the findings of the Bureau are these:—That, strictly speaking, there is no spontaneous combustion, but in all cases where sufficient data have been obtained the oxygen has been used in conjunction with a torch for welding or cutting, and the flame has flashed back through the mixture. It is possible that ignition may occur by a jet of oxygen playing on carbonaceous material under certain special conditions; nevertheless, these conditions are

most unusual, as in many experimental tests made by the Bureau the jet could not be so arranged as to cause ignition, although there was a rise of temperature at a certain point and cooling due to expansion at a point beyond.

In all cases, however, the real danger is in the hydrogen getting into the oxygen, and it has been found that this is due to improper design in the manufacturing apparatus—that is, the cells and electrical connections; to insufficient safeguards connected with the electric apparatus, the polarity suddenly and unexpectedly shifting; to the manufacture of oxygen without frequent analyses; and to incompetent or ignorant attendants.

Unfortunately, certain makers of oxygen-manufacturing apparatus have advertised that any labourer can take care of their apparatus. It is believed that the manufacture of electrolytic oxygen can be carried on in a manner to make it entirely safe. In fact, there has to be over 9 per cent. of hydrogen with the oxygen to make an explosive mixture. Nevertheless, certain tanks from one batch caused three widely separated explosions in California, killing seven men in all, and an analysis of gas from a tank filled at the same time showed that it contained over 50 per cent. of hydrogen.—*American Machinist*.

Economy in Coal Consumption, and Inter-connection of Electricity Works.—The Controller of Coal Mines has been advised that an economy in the use of coal can be effected and much inconvenience avoided during the next and succeeding winters by giving effect as far as possible to the following suggestions:—

Power Users.—That the various factory owners throughout the country who at present generate their own power by means of coal should make arrangements for taking their power requirements from an outside source in districts where the power supplies have a margin available. The Coal Controller will assist as far as possible in obtaining priority for plant, machinery, and motors required, provided a substantial coal saving can be demonstrated.

Use of Coke.—The use of locally-produced coke or coke breeze in place of coal as much as possible in domestic grates, factory furnaces (where such cannot take an outside supply), public utility plants at light loads, also in baths and wash-houses, provided coke is available in sufficient quantities.

Public Services.—The curtailment of those public services which entail coal consumption, such as early and late tramway running—after consultation with the Ministry of Munitions, where munition workers are likely to be affected—and the prevention of unnecessary use of water.

Stocks.—The accumulation of stocks in the summer months, as far as deliveries will permit, of the coal required during the winter months, the cost of such storage being considered as a form of insurance against the probable coal shortage.

Cooking and Heating.—The installation of gas or electric cooking and heating appliances in public and private buildings, with a view to saving coal generally, and lessening the serious inconvenience to the public next winter should the local distribution of coal become irregular or insufficient.

Emergency Disconnection.—The application to the Board of Trade by the electric supply authority for sanction under Regulation B 1 to disconnect classes of non-essential consumers in cases of urgent necessity, in order to enable the supply to be continued to munition and other essential users. This power should be obtained, although it need not be put into execution until the necessity arises.

Interconnection.—Making arrangements as suggested in the letter of the Board of Trade dated May 25th, 1916, with the neighbouring towns to interconnect electric distribution systems or generating plants by means of underground cables, or in suitable cases of temporary overhead wires over the intervening country, so as to enable one or two of the most economical power stations in each district to supply several towns at light loads, instead of each town having to run its own power station uneconomically at such times. This would also enable the various power plants to shut down in turn during week-ends and holidays to effect plant repairs, and would provide some amount of power at call as a stand-by in case of coal supplies giving out locally.

In order to carry out the last suggestion, the Controller is advised that additional powers will have, in some cases, to be obtained as regards passing over private property, trading between public utility companies and local authorities, and possibly relief from some of the existing power supply regulations; and if cases are brought to his notice, they will receive his assistance where the saving in coal would warrant the provision of the necessary plant, mains, &c.

Regulation of Coal Prices.—The Controller of Coal Mines has issued a code of directions as to the sale of coal, with a view to dealing with fluctuations in colliery prices which have recently occurred in certain districts owing to abnormal market conditions, and preserving the regularity in the distribution of coal which is so necessary at the present time. The directions mainly affect prices of coal for export and bunker purposes, for which a definite schedule of prices has been drawn up, but they also provide that the prices of coal for home consumption shall remain at the maxima prescribed by the Price of Coal (Limitation) Act.

The Board of Trade Committee on Electricity Supply.—

We are informed by the Board of Trade that Sir A. Chibald Williamson, Bart., M.P., has consented to act as chairman of the Committee on Electric Power, in place of the Right Hon. F. Huth Jackson, who has resigned on medical grounds, and that the following representatives of local authorities owning electric supply undertakings have been added to the Committee, viz.:—Mr. W. B. Smith, Mr. Harold Dickinson, and Mr. E. F. Vesey Knox, K.C.

The Fixation of Nitrogen.—Plant is about to be erected at Manchester for the manufacture of nitrogenous products by means of an electrical process of British origin, the rights for which are owned by the International Nitrogen and Power Co. The installation is expected to be at work within six months.

Fatality.—At Bolton Electricity Works, on Sunday, a switchboard attendant named Hoarler was killed through coming into contact with a H.T. wire.

Institution and Lecture Notes.—Royal Society of Arts.—The annual general meeting was held on June 27th, Dr. Dugald Clerk, F.R.S., in the chair. H.R.H. the Duke of Connaught, K.G., was re-elected President of the Society, and amongst the new vice-presidents elected was Field-Marshal Sir Douglas Haig, who is a Fellow of the Society of over 20 years' standing. Sir Henry Trueman Wood was re-elected secretary, but it was announced that he had tendered his resignation to the Society, to date from September next. He has held the secretaryship since 1879.

Société Internationale des Electriciens.—In order to comply with legal requirements regarding societies recognised to be of public utility, the Société Internationale des Electriciens has revised its statutes, and has taken the opportunity to change its title to Société Française des Electriciens.

American Institute of Electrical Engineers.—The annual convention, which was to have been held in June, was cancelled on account of the national situation. Instead, a special meeting was to be held in New York on June 27th and 28th, at which the convention papers were to be presented and discussed.

Institute of Metals.—The Council announces that an extra election of members will take place on July 18th. Those desirous of applying for membership of the Institute are invited to write to the Secretary, 36, Victoria Street, S.W. 1, for a copy of the new membership booklet, which includes an up-to-date list of the Institute's 760 members. The membership of the Institute has recently shown a very considerable increase, more additions to the roll having been made during the past six months than in the previous three years. A new financial year of the Institute commences this month. The annual autumn meeting of the Institute of Metals will be held on Wednesday, September 19th, in the rooms of the Chemical Society, Burlington House, London, W. 1, when many interesting papers will be submitted for discussion.

Institution of Electrical Engineers.—The Committee of the Students' Section of the Institution of Electrical Engineers invites offers of papers from students of the Institution to be read during the coming session, between September, 1917, and May, 1918. Offers should be sent at once, with as much information as possible, to the Hon. Secretary of the Students' Section, Mr. A. W. Grace, "Evandale," Granville Road, Sidcup.

More than 3,000 Uses of Electricity.—The Society for Electrical Development (New York) has issued a booklet listing more than 3,000 applications of electricity, which has been sent free to its members. It is intended as a guide or reminder for sales managers, contractors and electric suppliers, and is one of a series to be issued in connection with the Society's "Keep Business Going" campaign.

Late Legal.—ELECTRIC TRAMWAY CO. SUED.—In the King's Bench Division, on Tuesday and Wednesday last, before Mr. Justice Avory and a Special Jury, an action was heard in which Mrs. E. M. Lloyd and Mr. G. W. Lloyd, of West Hendon, sued the Metropolitan Electric Tramways Co., Ltd., Mr. G. Simpson, of the Army Service Corps, Hounslow, and Mr. T. Owen, of Cricklewood, in respect of personal injuries sustained on June 27th, 1916, in Cricklewood Broadway, to the female plaintiff by reason of the alleged negligence of the various defendants. The male plaintiff sued in respect of the loss that had resulted to him by the occurrence. The case arose out of a collision between one of the Metropolitan Electric Tramway Co.'s cars and a motor lorry driven by Simpson, who, it was said, was being instructed in driving by the defendant Owen. Owen denied negligence, and Simpson said that the accident was the fault of the driver of the car. The Tramway Co. denied liability. A large body of evidence was called, and in the result the jury found for the plaintiff against Simpson and the Tramway Co. They found in favour of Owen. Judgment was given for the plaintiff for the agreed sum of £25 against Simpson and the Tramway Co. Judgment was given in favour of Owen, with costs.

CENTRIFUGAL FANS. PATENT REVOKED.—A petition for the revocation of a patent for a centrifugal fan was heard by Mr. Justice Sargant in the Chancery Division, on Tuesday. The petitioners were James Keith & Blackman Co., Ltd., the registered owners of patented inventions in connection with centrifugal fans for delivery of air and other gases under pressure. The patent attacked was Ralph Hancock's patent 21,353 of 1913. Mr. Moritz appeared for the petitioners, and there was no appearance for Mr. Hancock, who, it was stated, was in America.

Evidence having been given on behalf of the petitioners by Mr. Jas. Swinburne and Mr. Chas. Tuson, his Lordship said that there was not sufficient subject-matter to justify the grant of the English patent. Further, tests had been made by Mr. Swinburne and Mr. Tuson of a fan designed in accordance with the English specification of Hancock, as against the ordinary design by Keith, and it had been shown that the Hancock fan was less efficient than the Keith fan; and accordingly there was a presumption arising from that that there was no utility in the design. On the whole, his Lordship thought that he must grant this petition for revocation.

Electrolytic Smelting of Tin Ores.—H.M. Consul at Antofagasta, Chile, reports that experiments on a small scale in the electrolytic smelting of tin ore have been made in Bolivia. The tin extracted is stated to have been of high quality, but, owing to the prohibitive cost of production, the experiments did not indicate the possibility of commercial operation.

Fleet Street Memorial Service.—The Bishop of London will take the service at St. Bride's Church, Fleet Street, E.C., on Saturday, July 28th, which has been arranged by the committee of the Press Club in memory of the members, sons of members of the Press Club, and other Fleet Street journalists who have fallen in the war. Particulars will be announced later, and members and others who desire names to be included are asked to communicate with the Hon. Secretary, the Press Club, St. Bride's Passage, Salisbury Square, Fleet Street, E.C. 4.

Japanese Copper.—Japan ranks second only to the United States in the production of copper, and the Swedish Ambassador at Tokio and Pekin calls the attention of the Swedish College of Commerce to this fact, and to the need of knitting first-hand relations with Japanese producers and exporters, so as to escape the commissions exacted by middlemen in London, Hamburg, and Antwerp.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station and Tramway Officials.—Mr. E. S. RAYNER, the manager of the Doncaster electricity and tramway undertakings, a proposed increase of whose salary from £450 to £500 was recently rejected, after a heated debate, by a narrow margin of votes in the Council, is to leave Doncaster, by request of the Deputy-Controller of the Admiralty for an appointment under that department. Mr. Roberts, the deputy-engineer, is to take charge pending the Council's decision as to re-arrangement of work. Mr. Rayner's departure, owing to Admiralty demands, being practically immediate.

We regret to learn that Mr. PICKVANCE, electrical engineer to the Wrexham T.C., who had a motor accident some time ago, is ill, and will have to rest for a few weeks.

The Manchester Corporation Electricity Committee recommends that Mr. J. G. THOMSON be appointed boiler-house engineer at the Stuart Street station at a salary of £275, rising to £300, and that Mr. H. W. BRISTOW be appointed assistant boiler-house engineer at Stuart Street station at a salary of £200, rising to £225.

According to the *Daily Telegraph*, Mr. R. O. BALDWIN, traffic superintendent of the Bournemouth tramways, has been appointed general manager of the Exeter tramways.

Mr. J. T. FAYLE, traffic assistant to Leyton U.D.C., has been appointed traffic manager to the Southend Corporation tramways.

The following increases of salary have been given by the Bolton Town Council:—Mr. B. S. HORNBY, chief assistant electrical engineer, £250 to £280; Mr. H. E. ANNETT, generating station engineer, £250 to £280; Mr. E. JONES, chief clerk, electricity department, £150 to £170; Mr. E. R. JAMESON, assistant engineer, £140 to £150.

The L.C.C. Highways Committee recommends that as from July 15th next, Mr. E. W. DICKINSON, superintendent of the Greenwich generating station, be the power-station engineer, at a salary of £500, rising to £700 a year; that Mr. E. L. POPE, resident electrical superintendent (southern section), be the distribution engineer (southern section), and Mr. T. L. HORN, resident electrical superintendent (northern section), be the distribution engineer (northern section), both Mr. Pope and Mr. Horn at a commencing salary of £500, rising to £600 a year.

Inspector W. THOMAS, of the Walthamstow tramway staff, who is leaving for South Africa for the benefit of his health, has been presented by his colleagues with £80.

General.—The following appear in the new list of Civil List Pension awards:—

£100 to Mrs. Charlton Bastian, in consideration of the services to science of her late husband, Dr. Charlton Bastian, and of her straitened circumstances.

£75 to Mrs. Minchin, in consideration of the scientific work of her late husband, Prof. E. A. Minchin, and of her straitened circumstances.

Sir A. R. BINNIE, late chief engineer of the London County Council, who died on May 18th, aged 78, left property of the value of £10,335.

Mr. LAWFORD GRANT, who has been appointed managing director and treasurer of the Eugene F. Phillips Electrical Works, Ltd., Montreal, went to Canada in 1907 as president and managing director of the Canadian British Insulated Co., Ltd. In 1913 he accepted a position as assistant manager of the Phillips Co., and now succeeds Geo. H. Olney, who was the head of that firm for 18 years, Mr. Olney having recently retired owing to ill-health. Mr. Grant is a civil and

electrical engineer, and was formerly engineer for the British Insulated & Helsby Cables, Ltd., of England. Among the many large undertakings, which he carried out for the latter company was the electrification of the Government dockyard and naval base at Malta.

Sre. G. MARCONI, who is in the United States, was presented with the honorary degree of Doctor of Science by Columbia University on June 6th.

Roll of Honour.—Second-Lieutenant W. P. CALDER, K.R.R., was killed by a shell on June 14th whilst leading his platoon in attack. He was with Messrs. Siemens Bros. & Co., Ltd., for 19 years, and left the cable department of that company to join the Army. His captain speaks of him as a brave, energetic, and faithful officer who did excellent work.

The death of Major CYRIL R. M. YOUNG is reported, he having succumbed to wounds received in action on June 7th. The deceased officer was the eldest son of Dr. and Mrs. Moffatt Young, of West Hartlepool, and, prior to the war, was in partnership with Mr. Hodgkin, of Darlington, as a consulting electrical engineer.

The son of Mr. George Parkinson, of Waterhouses, County Durham, Sapper T. PARKINSON, R.E., has been wounded. Formerly he was an electrician at a local colliery.

Corporal D. MENDAY, R.F.A., telegraphist at Portsmouth Post Office, has been awarded the D.C.M. He volunteered to remain at a battery position to keep up telephone communication when the battery was ordered under cover.

Corporal E. JACKSON, West Riding Regiment, who has just been awarded the D.C.M., was an electrician at the works of Messrs. R. F. Winder, Leeds.

Lance-Corporal M. HOGAN, who was on the Colchester Corporation tramway staff, has died of wounds. He had gained the Military Medal.

Lieutenant C. STREET, R.F.C., killed, was trained as an electrical engineer at Broadheath, and gained a commission in the Cheshire Regiment.

Private CECIL GIBBONS, Lancashire Fusiliers, killed, was employed at the Peel-Conner Telephone Works, Ltd., Adelphi, Salford.

Mr. G. G. EWER, sales engineer to the Stepney Borough Council electricity supply department, who was a Captain in the 7th Batt. Essex Regiment (T.F.), and was promoted Major in 1915, has just been promoted to Lieutenant-Colonel of the 1/6th Essex Regiment, and has, in addition, been awarded the D.S.O. Lieut.-Col. Ewer saw service in Gallipoli and in Egypt in the early days of the war, and is now serving with the Egyptian Expeditionary Force.

The Stepney electricity undertaking has now over 60 employees serving with the Colours.

Private JOHN CHARNOCK, Loyal North Lancashire Regiment, killed in action on June 7th, aged 32, was employed by Messrs. Dick, Kerr & Co., Ltd., Preston.

Councillor JOHN BANNISTER, a member of the Electricity Committee of Burnley Town Council, has died from typhus in Egypt, aged 39 years. He held the rank of sergeant.

Lance-Corporal T. ANDERSON, aged 33, attached to the Intelligence Department, has been killed in action in France. He served his apprenticeship as an electrician with Messrs. Thompson, Blackburn.

Sapper W. E. B. GRATION, R.E., killed in action, was employed at the Bradford Corporation electricity works, Bolton Road.

Lance-Corporal A. WEATHERHEAD, West Yorks. Regiment, reported wounded and missing, was an electrician in the employ of Mr. Thos. Wray, electrician, Harrogate.

Private JAMES A. CALLAGHAN, Loyal North Lancashire Regiment, who has been killed in action, was employed by Messrs. Frankenburg, of Manchester.

Sergeant F. PRATT, Royal Scots, killed in action in France, served his time as an articled pupil with Messrs. Bruce Peebles & Co., with whom he was a designer when he enlisted.

Lieutenant L. S. MADORELL, Australian Infantry Brigade, awarded the Military Cross, was an electrical student at the works of the Manx Electric Railway Co., Douglas (Isle of Man), prior to going to Melbourne, Australia.

Bombardier A. R. TANSLEY, R.F.A., who was an electrician with the G.E. Ry. Co., has been awarded the Military Medal.

Mechanical Staff-Sergeant A. H. MARSHALL, A.S.C., drowned at sea, served his apprenticeship with Mr. A. House, electrical engineer, of York, and was with Messrs. Elphick, of Newcastle-on-Tyne.

Sergeant E. WALLIS, who has gained the Military Medal for conspicuous bravery, was engaged with Messrs. Fraser and Chalmers, of Erith.

Corporal L. A. GLOVER, Queen's West Surrey Regiment, killed in action at the age of 43 years, was for some years with Messrs. Baxter & Caunter, London.

The *Times* states that Second-Lieutenant S. H. L. DOUGLAS-CROMPTON, Royal Fusiliers, who was killed on June 7th, aged 21, was intending to become an electrical engineer, and was at a technical college when the war broke out. "He tied a blue handkerchief on to the end of his stick, and told his men to follow it. He . . . seemed to forget there was any danger. . . . While rallying his men he was shot by a sniper."

Obituary.—PROF. K. BIRKELAND.—Prof. K. Birkeland, of Christiania, died in Tokio on June 18th. His name is well

known as that of the joint inventor of the Birkeland-Eyde electrical process for the fixation of atmospheric nitrogen, which now employs approximately half a million n.r. of electrical plant. Prof. Birkeland was an eminent physicist, especially interested in terrestrial and solar magnetic and electrical phenomena.

REVIEWS.

Alternating Currents. By C. E. MAGNUSSEN. London: Hill Publishing Co. Price 17s. net.

So many text-books on electrical engineering have been issued recently by American writers that it becomes more than a little difficult to distinguish between them, and to assign to each its special suitability for different classes of engineering students.

It may be well, therefore, to begin the present notice by attempting to outline the special characteristics of the work to which it applies.

Like several others that have been noticed recently in our columns, the present work is the result of notes of lecture courses prepared for undergraduate students—in this case at the University of Washington. The discussion as a whole is confined to main principles, and little descriptive or constructional matter is included.

The first chapters deal mainly with the conditions existing in simple alternating circuits, and contain a very full introduction to the vector algebra of such circuits, worked out with numerous and clear diagrams.

Following this general introductory matter, which occupies the first 11 chapters, we have one chapter devoted to each of the following types of machines:—Transformers, induction motors, alternators, synchronous motors, rotary converters, single-phase commutator motors, and asynchronous generators. The principles of the behaviour of each of these machines are treated mainly by means of vector diagrams and vector algebra.

The next two chapters deal with the "dielectric circuit," and give a very interesting elementary introduction to the general theory of insulation. The remaining seven chapters deal with transmission lines, protective devices, and wave forms. In this last section, again, vector diagrams and vector algebra are employed, except in the chapter on protective appliances, which is mainly descriptive in character, and contains a number of illustrations of actual pieces of apparatus.

It will be gathered from what has been said that the book is essentially a student's text-book, rather than a book for general reference, also that it makes no attempt to deal with questions of design or construction, but deals (chiefly by means of vector analysis) with underlying principles. It is, further, only in the last section, dealing with transmission lines, that a fairly advanced treatment involving considerably higher mathematical knowledge is included.

We may next proceed to discuss in rather greater detail the treatment of the various parts of the subject. In the first section, which deals with the general alternating circuit, we are led through series and parallel circuits containing resistance, inductance, and capacity, and with the aid of a very clear series of diagrams, the methods of treating each case algebraically and symbolically are well explained. The author has adopted the simple device of distinguishing between the vectors of current and voltage by giving a different shape to the barb of the arrows used in the diagrams. The symbolic notation follows in the main that of Steinmetz, though some variations have been introduced without any apparent reason.

The treatment of the behaviour of the various types of machines is mainly vectorial, and accordingly such subjects as the wave form of alternator voltages, currents, and reactions are not dealt with in great detail, nor are irregularities due to the slots of induction motors dealt with. A special chapter towards the end of the book is, however, devoted to the subject of commercial wave forms and harmonics, and many typical examples are illustrated and discussed in detail.

To the more advanced reader, the second portion of the book, especially the chapters dealing with the "Dielectric Circuit," and with transmission lines, will prove the most interesting, and it is in these chapters that the author has departed from the beaten track followed by the ordinary student's text-book. The treatment of the problems of insulation and electric high-tension discharge as special cases in the general dielectric circuit is quite admirable. The vectorial treatment of transmission lines, although perhaps less original, is also excellent, and brings the subject within the range of the average advanced student. The very full chapter on wave forms has already been referred to.

In conclusion, we may congratulate the author on the production of an excellent text-book which should prove useful to many undergraduate students of electrical engineering. Perhaps its leading characteristic is its great clearness and its consistent application of vectorial methods as adapted to a very large variety of problems.

A Laboratory Course in Practical Electricity for Vocational Schools and Shop Classes. By M. J. ARCHBOLD. New York: The Macmillan Co. Price 5s. net.

The author of this manual is the instructor in vocational electricity at the Wendell Phillips High School, Chicago, and the general trend of trade school teaching in the States is fairly indicated by the type of experiment and the method of treatment given in this book. It is claimed that any textbook can be used in conjunction with this course of experiments, and the loose-leaf arrangement permits alteration of the order of work at the discretion of the teacher.

The course is divided into four terms, or semesters, of about 25 experiments each, and a course of practical shop work is suggested to correlate with this manual. The first section commences with simple experiments on magnets and magnetic fields, and leads up to voltaic cells, galvanometers, Ohm's law, and the commercial measurement of resistances. The method of treatment can be best explained by illustrating in a few typical cases. The loose sheets serve as the record of the experiments done, and, as the instructions are all printed in the past tense, it only remains for the student to make his own diagrams and fill in a few words here and there to complete the sheets.

For example, in the experiment on "Making a Compass Needle" we find an oblong space about 2 in. by 3 in., headed "Sketch of spring being rubbed with magnet. Resulting poles marked," and alongside, these sentences awaiting completion:—

"The watch-spring compass was brought near the North Pole of the bar magnet and it attracted the — end of the compass.

"The end last touched by the bar magnet was found to be a — pole, and attracted by the — pole of the bar magnet.

"It was found that like poles always — each other, and unlike poles always — each other."

The same insistence on a stereotyped method of recording results and deductions continues throughout the book. The later and more difficult experiments, however, bear less resemblance to missing-word competitions than the earlier ones.

The second semester's work deals further with resistance measurement, heating effects, and energy costs. Meter reading is taught with some pains, and some introductory work on electromagnetics is begun. The third section deals fully with motors and dynamos—motors first because dynamos are driven by motors in most schools; the fourth section begins with the elementary principles of alternating currents, and then proceeds to A.C. generators, motors, transformers, and meters.

In an appendix sketches are given of all experiments and connections, together with tables of sines, cosines, tangents, and B. and S. wires.

The strong points of the book are (1) its insistence on the systematic recording of experimental results, and (2) its habit of putting questions at the end of each experiment to discover whether the principles have been fully understood. Its weak points are (1) the stereotyping of experimental records, and (2) the spoon-feeding adopted in the missing-word method in the earlier chapters. In spite of these defects, it is certainly desirable that such books should be seen in this country. English trade-school teaching methods are still far from perfect, and while American methods cannot be adopted *en bloc*, they indicate important progress in a department of education which we cannot afford to ignore.

The pale khaki cover and the white linen backing do not appear to us to be suitable for the hard wear generally accorded to a laboratory book, but in other respects the arrangement and production of the book are pleasing and satisfactory.—P. H. S. K.

Electrical Laboratory Course for Junior Students. By MAGNUS MACLEAN, M.A., D.Sc. London: Blackie & Son. Price 2s. net.

This little book is intended to cover an elementary first year's course in electrical engineering. It has been prepared by the head and staff of the electrical department of the Royal Technical College, Glasgow, from MS. instruction sheets used in the laboratory, and comprises descriptions of 70 experiments with detailed instructions, theoretical notes, and diagrams of connections.

Some idea of the scope of the book can be obtained from the following typical experiments: Maps of magnetic fields, determination of "H," constant of a tangent galvanometer, measurements of resistance by meter bridge and P.O. box, measurement of high and low resistances, E.C.E. of copper, Joule's equivalent, photometry of glow and arc lamps, B.H. curves, cable faults, Kelvin balance, characteristics of dynamos. A page of "Instructions to Students" is given at the beginning of the book, and there is also an appendix of useful data.

All the instructions and hints bear the hall-mark of practical experience and common-sense, and the book is likely to serve a useful purpose in connection with similar practical electrical courses in other technical institutes and colleges.—P. H. S. K.

NEW COMPANIES REGISTERED.

Macfarlane Winch Co., Ltd. (147,812).—Private company. Registered June 25th. Capital, £12,000 in 100 shares of 1s. each and 12,000 shares of £1 each. To take over from G. T. Macfarlane patent 1,089 of 1917, in connection with ships' winches, on the terms of an agreement between the said G. T. Macfarlane, of the one part, and the Power Plant Co., Ltd. (for this company), of the other part, and to carry on the business of mechanical, electrical, hydraulic, marine, and general engineers, &c. The subscribers (each with one share) are: E. Trevor L. Williams, J.P., Clock House, Byfleet, Surrey; G. T. Macfarlane, Innanincka, Cannons Lane, Pinner, Middlesex, mariner. The first directors are: E. Trevor L. Williams, J.P., and G. T. Macfarlane. Solicitors: Messrs. Slaughter & May, 18, Austin Friars, E.C.

Hooton & Ellesmere Port District Electric Supply Co., Ltd. (147,800).—Private company. Registered June 25th. Capital, £3,000 in 1,500 "A" shares and 1,500 "B" shares of £1 each. Objects, as title. Agreement between the Rt. Hon. Lady Rossmore and Mary Straker of the first part, Johnson & Phillips, Ltd., of the second part, and S. S. Dawson (for the company) of the third part. The subscribers (each with one share) are: S. S. Dawson, 51, North John Street, Liverpool, chartered accountant; T. R. Cholmondeley, Pont-y-Ochlin, Gresford, North Wales, estate agent. The first directors are: S. S. Dawson, T. R. Cholmondeley, J. Macgregor, and C. Stewart. Registered office: 136, Albany Buildings, Old Hall Street, Liverpool.

Blackwall Engineer & Welding Works, Ltd. (147,833).—Private company. Registered June 28th. Capital, £3,000 in £1 shares. Electricians, mechanical, and electrical engineers, welders, makers of motor vehicles and parts thereof, &c. The subscribers (each with one share) are: H. Andrews, 61, Welbeck Road, East Ham, E., accountant; G. Steel, 5, Disraeli Road, Forest Gate, E., electrical engineer. The first directors to be appointed by the subscribers. Solicitor: W. Cook, 59, Gracechurch Street, E.C.

British Glass Wool Co., Ltd. (147,843).—Private company. Registered June 29th. Capital, £1,500 in £1 shares. Manufacturers of glass wool and glass fibre, importers and manufacturers of electrical appliances applicable thereto, and any other electrical and mechanical appliances, &c. The subscribers (each with one share) are: A. R. Holmes, 38, Highbury Hill, N., engineer; Alice M. Stevens, 41, Loraine Road, Holloway, N., clerk. The first directors are: A. R. Holmes (permanent) and Alice M. Stevens. Solicitor: D. W. Marpole, 1, Kenfrew Road, S.E.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Carrickmacross Lighting Co., Ltd. (4,276).—Particulars of £2,500 debentures created November 14th, 1916, and April 20th, 1917, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital, and certain premises, &c., in Chapel Lane, Carrickmacross. Trustees: W. Pierce, Carrickmacross, and F. A. Orr, Castleblaney.

Electrical Contracts & Maintenance Co., Ltd.—Memorandum of satisfaction in full on March 5th, 1914, of debentures dated May 11th, 1909, and August 4th, 1910, securing £300 and £100 respectively. Notice filed June 26th, 1917.

Metropolitan Electric Supply Co., Ltd.—Particulars of £250,000 debentures created May 15th, 1917, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: (1) Freehold land and generating station at Acton (subject to a prior charge); (2) so much of a piece of freehold land at Willesden on which generating station stands as is not comprised in the security for the 3½ per cent. second mortgage debenture stock; (3) the undertakings constituted under the Hanwell Electric Lighting Order, 1904, the Acton Electric Lighting Order, 1891 (subject to prior charge), and the Southall-Norwood Electric Lighting Order, 1905; (4) the undertaking relating to the Urban District of Greenford constituted under the Uxbridge & District Electricity Supply Extension Order, 1903; (5) 6,000 preferred paid shares in the Broomfield Electric Supply Co., Ltd.; and (6) the company's undertaking and general assets, subject to charges under trust deed of July 20th, 1894, and July 4th, 1899. Trustees: Trustees, Executors & Securities Insurance Corporation, Ltd. Commission, allowance or discount: 10 per cent.

Contraflo Condenser & Kinetic Air Pump Co., Ltd. (110,264).—Capital, £80,000 in £1 shares. Return dated May 18th, 1917. All shares taken up. 7s. per share called up on 27,000; £9,450 paid. Mortgages and charges: Nil.

Cutting Bros., Ltd. (81,178).—Capital, £25,000 in 1,500 ord. and 1,000 pref. shares of £10 each. Return dated December 29th, 1916 (filed February 28th, 1917). 500 ord. shares taken up; £1,000 paid on 100; £3,200 (£8 per share) credited as paid on 400.

Chislehurst Electric Supply Co., Ltd. (50,980).—Capital, £15,000 in £5 shares. Return dated April 16th, 1917. All shares taken up. £15,000 paid. Mortgages and charges: £9,000.

W. G. Cannon & Sons, Ltd. (87,796).—Capital, £3,000 in £1 shares. Return dated June 7th, 1917. All shares taken up. £9 paid; £2,991 considered as paid. Mortgages and charges: Nil.

CITY NOTES.

United Electric Tramways of Monte Video, Ltd.

SIR G. A. TORCHIE, M.P., said that the difficulties of the year had been rather worse than in 1915. Nearly three-quarters of the increase in operating expenses arose from the high price of coal. To-day it was about 150s., with no improvement in sight. Freights which used to be 12s. to 14s. per ton were now 100s. to 120s. The Eight Hours Law of Monte Video also meant both increase of wages and increase of staff. Heavy renewals would occur in the near future, especially in connection with re-paving. But these were abnormal times, and they ought not

to defer dividends, especially preference dividends, unless it became absolutely necessary. The chairman referred at some length to the fact that the municipality was proceeding with its vast paving programme, notwithstanding the times. Their interests were being, and would continue to be, very seriously affected thereby. The whole cost of paving the streets was defrayed by the owners of property on either side in equal parts. Where tramway lines existed the company had to pay for the equivalent of the space occupied by the lines, and 50 centimetres on either side of the rails. Anything that tended to strangle tramway enterprise was inimical to the public convenience. Proceedings had been commenced in Monte Video with a view to obtaining a definite decision as to the company's legal position. The next six months were the lean months, when there were no exceptionally heavy traffics to help toward meeting the fixed charges, now abnormally high. They must be patient and await events.

Aluminium Corporation, Ltd.

MR. KENNETH CLARK, presiding at the annual meeting on June 27th, said that they had hoped to clear off another year's preference dividend at that meeting, but the taxation upon industries of their description was of a heavy character, and the settlement of the various items in the accounts was a matter of very great difficulty. It was, therefore, impossible to estimate at present what amount would be available for distribution, so they were carrying the balance forward. He hoped that the authorities would bear in mind that theirs was one of the key industries of the country, and that their opponents in other countries had been reaping a large benefit from the enormous prices that they had obtained for their metal, and their profits had been practically untouched by special war taxes, so that they had been able to build up large reserves which would put them in a strong position in respect of international competition. The difficulties in regard to supplies of raw materials, labour, freight, &c., had increased during the year. Their increase of output had been a matter of much concern, and they had carried out during the year, and under difficulties, a large amount of work with that end in view. The negotiations for the purchase of the additional water rights had been prosecuted vigorously, and a great many difficult purchases carried through. The plant for the erection of the dams had been purchased, and the means of transit from the North-Western Rly. Co. to the site of the dams, 1,200 ft. above sea level, provided. The bridge across the Conway River had been constructed, and they were now able to take the L. & N.-W.R. Co.'s trucks right into the works yard. The new turbo-generator had been delivered, and would undergo its trial run in their works within the next few days. This meant an increase of 20 per cent. to the capacity of their electrical plant, and should put them in a position during the coming winter, for the first time in their history, to make full use of their pipe line; but they would not be able to make full use of the entire electrical capacity until they had completed their erection of the new dams, so as to store the necessary water to provide power during the summer months. During the year they erected a heavy rolling mill plant, with three trains of rolls, and these had been in satisfactory use for some time past. This addition should be of great assistance to the company, for it would enable it to market its output in the form of sheets. Last year's output was the largest in the company's existence; in fact, it showed an increase of more than 30 per cent. in their production, mainly due to the Duly tunnel, which had far more than justified its formation. They had under consideration a funding scheme, which they hoped to submit at a later date, with a view to dealing with the arrears on preference dividend. The war had shown new uses for aluminium, and, in his opinion, the production of light alloys would be an important feature of the aluminium industry in the years to come. He looked, therefore, for a largely increased demand after the war. They now had a sound business, which had proved itself to be a national asset, but it was absolutely necessary that they should continue their policy of extension, and this meant a continuance of capital expenditure, for which large sums of money would be necessary. He trusted the time was not far distant when they could begin to put aside sums of money as reserves for the many contingencies that had to be met by all trade concerns. In replying to discussion, the chairman said that the company was in a very sound position. It was doing extraordinarily well; costs had come down very much, and if they were successful in getting the water which they had in view they would not only be able further to increase their production, but probably to double it.

British Columbia Electric Railway Co., Ltd.

The directors announce that, owing to the serious increase in the cost of living, the tramway employees asked for an increase in wages, which it was absolutely impossible for the company to pay, in face of jitney motor-car competition, and having regard to the present fares charged. The men stopped work on June 19th. Public pressure, arising from the cessation of the services, compelled the authorities to take action and approach the company, with the result that the company agreed to reinstate the services, making the best possible terms with the employees on the understanding embodied in resolutions

of the City Council that an impartial investigator be appointed by the Provincial Government to examine and report on the transportation problem in the city and surrounding district, with particular reference to the jitney motor-car competition. The city and the company have agreed to abide by the Commissioner's recommendations. The company has agreed to resume the railway services until the Commissioner's recommendations are received. These services were resumed on June 21st, and the company is paying the increases asked for by the men.

Consolidated Electrical Co., Ltd.—Mr. H. ALLEN presided at the annual meeting, and said that there was a trifling decrease in the net income, due entirely to the reduced dividend received on their telephone shares, which he believed would be only temporary. The net result of their operations was that they paid the same dividend as for the previous year, carrying forward £3,006, against £3,159. They were practically free from liabilities; investments had suffered no material depreciation during the year.

Telegraph Construction & Maintenance Co., Ltd.—Interim dividend of 5 per cent. (12s. per share), free of tax.

Browett, Lindley & Co., Ltd.—For 1916 the net profit, after providing for interest charges and writing £6,134 off for depreciation, was £9,450, out of which the full year's dividend of 6 per cent. has been paid on the preference shares, together with an extra distribution of 3 per cent. on account of arrears, and a dividend of 4 per cent. on the ordinary shares, leaving £3,540 undivided, subject to excess profits duty.—*Financial Times*.

West Coast of America Telegraph Co., Ltd.—After providing for interest charges, transferring £14,000 to general reserve, and providing £1,000 for investment fluctuations, £9,286 is carried forward.

STOCKS AND SHARES.

TUESDAY EVENING.

THE Stock Exchange "enjoyed" a long week-end holiday, which few wanted, the pretext being an ancient rule providing that the House shall be closed on all Bank Holidays. This served to cut into what little business there is at this season of the year, and, in consequence, markets have been very quiet. Questions are in the air as to what may be the prospect for another War Loan, but well-informed quarters look for nothing in the way of a popular loan for some time to come.

At the commencement of the half-year just ended, the 5 per cent. War Loan was imminent, and its official terms were published early in January. These terms proved sufficiently tempting to save the fall in other investment stocks that had been freely predicted. Markets resisted the triumphant newcomer with a strength surprising to those who remembered the financial disturbance created by the 4½ per cent. War Loan of June, 1915.

We may with advantage set out the net rises and falls in markets connected with electrical companies' shares, for the six months have been big with war happenings, naval, military, and political, with their effect upon the stocks and shares of the world. How lightly they have touched so purely an investment market as that for electricity supply issues this comparative table shows:—

Share.	Jan. 2.	Now.	Rise or	Share.	Jan. 2.	Now.	Rise or
			fall.				fall.
Brompton ..	6½	6½	—½	London Electric	1½	1	—½
Charing Cross ..	3½	3½	+½	Metropolitan ..	2½	2½	+½
Chelsea ..	3	2½	—½	St. James's ..	6	6½	+½
City of London ..	11½	12	+½	South London ..	2½	2½	—
County of London	10½	10½	+½	South Met. Pref.	21.6	21½	—6d.
Kensington ..	5½	5½	—½	Westminster ..	5½	5½	+½

Of these 12 companies, the March reports for the year 1916 showed an overhead increase in gross revenue amounting to 9 per cent. above that of 1915, but the expenses were 11 per cent. higher, the latter figure working out to no less than 67 per cent. of revenue, as compared with 51 per cent. for 1913, the year before war started. Four of the companies reduced their dividends, the Brompton, Chelsea, Kensington, and the London. The last-named passed its dividend altogether, as compared with a payment of 3 per cent. in 1915, this being caused by an accident to the generating station. No increases were made, but the South Metropolitan repeated the distribution of 4 per cent. which it made for 1915, the first since 2½ per cent. was paid for 1908. The introduction last year of "summer time" played havoc with prices. At the Brompton and Kensington meeting, three months ago, the chairman, referred to summer time as being an undoubted benefit to the community at large, but an "unmitigated evil to the purveyor of artificial illumination." It was a prominent factor in lowering the long-established dividend

rate, in the case of his own company, from 10 per cent. to 9 per cent.

Railway stocks, as regards the Tubes, have given way, the present price of $s2\frac{1}{2}$ for Underground Electric Incomes being 10 points below that with which the year began. This was the natural sequence to the dividend being lowered (for the last half-year) to 2 per cent., as against the 3 per cent. to which the bonds are entitled. Districts have shed $\frac{1}{2}$, and Metropolitan at $23\frac{1}{4}$ are $1\frac{1}{4}$ lower on the six months.

Telegraphs and telephones are mostly higher, the upward movement being continued with steadiness throughout the period. Marconis at $35\frac{1}{16}$ are $8s. 9d.$ to the good on balance, though Americans are almost unchanged at 16s.; Canadians at 11s. are $1s. 6d.$ up. British Columbia Electrics have fallen heavily, on fears of municipal competition. Mexicans are higher; Brazil Tractions 4 points down, due to the board's decision to pay no more dividends this year on the common shares.

The Manufacturing group shows noticeable firmness in most instances. To tabulate interesting examples:—

Share.	Jan. 2.	Now.	Rise or fall.	Share.	Jan. 2.	Now.	Rise or fall.
Brit. Aluminium	28/6	28/9	+3d.	Edison p.p.	..	13/1	+2
Brit. Insulated	11/1	12/1	+1/1	Electric Con.	..	13/1	+1
B. Westinghouse	..	22	..	Gen. Electric	..	13/1	+1
Callender's	13	13/1	..	Henley	..	16	15/1
Castner Kellner	3/1	3/1	..	India-Rubber	..	12/1	12/1

Appreciable rises have taken place in armament, coal, iron, and steel shares. The rubber share market has been extremely active, and although the top prices of March/April are not maintained, the half year has left most rubber quotations higher than they stood six months ago.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.						
	Dividend	Price				
	1915.	1916.	July 3, 1917.	Rise or fall this week.	Yield p.c.	
Brompton Ordinary	..	10	9	6/1	..	26 18 8
Charing Cross Ordinary	..	5	5	8/1	..	7 2 10
do. do. do. 4/1 Pref.	..	4/1	4/1	8/1	..	6 18 6
Chelsea	..	4	3	2/1	..	6 4 4
City of London	..	8	8	12	..	6 13 4
do. do. 6 per cent. Pref.	..	6	6	10	..	6 0 0
County of London	..	7	7	10/1	..	6 11 9
do. do. 6 per cent. Pref.	..	6	6	10	..	6 0 0
Kensington Ordinary	..	7	10	5/1	..	5 11 7
London Electric	..	8	8	1	..	Nil
do. do. 6 per cent. Pref.	..	6	4	13/1	..	6 6 8
Metropolitan	..	8	8	2/1	..	8 0 0
do. do. 4/1 per cent. Pref.	..	4/1	4/1	3/1	..	7 10 0
St. James' and Pall Mall	..	8	8	6/1	..	6 3 1
South London	..	6	6	2/1	..	7 5 6
South Metropolitan Pref.	..	7	7	21/1	..	8 13 4
Westminster Ordinary	..	7	7	6/1	..	8 1 9

TELEGRAPHS AND TELEPHONES.						
	Dividend	Price				
	1915.	1916.	July 3, 1917.	Rise or fall this week.	Yield p.c.	
Anglo-Am. Tel. Pref.	..	8	8	98	..	6 2 0
do. do. Def.	..	83/6	1/1	22/1	..	6 16 4
Chile Telephone	..	8	8	7	..	5 14 4
Cuba Sub. Ord.	..	6	5	8/1	..	6 17 8
Eastern Extension	..	8	8	18/1	..	5 16 6
Eastern Tel. Ord.	..	8	8	189/1	..	5 14 9
Globe Tel. and T. Ord.	..	7	7	12/1	..	5 17 1
do. do. Pref.	..	8	6	10/1	..	5 17 1
Great Northern Tel.	..	22	22	86	..	6 2 3
Indo-European	..	13	13	51	..	8 7 5
Marconi	..	10	10	3/1	..	8 0 6
New York Tel. 4/1	..	4/1	4/1	99	..	4 11 0
Oriental Telephone Ord.	..	10	10	25	..	3 16 0
United R. Plate Tel.	..	8	8	6/1	..	5 18 6
West India and Pan.	..	6d.	6d.	13xd	..	1 16 4
Western Telegraph	..	8	8	14xd	..	5 14 4

HOME RAILS.						
	Dividend	Price				
	1915.	1916.	July 3, 1917.	Rise or fall this week.	Yield p.c.	
Central London, Ord. Assented	..	4	4	60/1	..	6 8 0
Metropolitan	..	1	1	23/1	..	4 8 0
do. District	..	Nil	Nil	16	..	Nil
Underground Electric Ordinary	..	Nil	Nil	13	..	Nil
do. do. "A"	..	Nil	Nil	6/3	..	Nil
do. do. Locome	..	6	5	82/1	..	5 6 0

FOREIGN TRAMS, &c.						
	Dividend	Price				
	1915.	1916.	July 3, 1917.	Rise or fall this week.	Yield p.c.	
Adelaide Sup. 6 per cent. Pref.	..	8	6	5	..	8 0 0
Anglo-Arg. Trams, First Pref.	..	5/1	5/1	21xd	..	7 16 6
do. do. 2nd Pref.	..	5/1	5	2/1	..	7 6 0
do. do. 5 Deb.	..	6	6	68/1	..	6 0 0
Brazil Tractions	..	4	4	48/1	..	8 13 10
Bombay Electric Pref.	..	6	6	10	..	Nil
British Columbia Elec. Rly. Pico	..	5	5	57/1	..	7 8 6
do. do. Preferred Nil	..	Nil	Nil	92/1	..	Nil
do. do. Deferred Nil	..	Nil	Nil	27/1	..	Nil
do. do. Deb.	..	4/1	4/1	57/1	..	Nil
Mexico Trams 5 per cent. Bonds	..	Nil	Nil	37	..	Nil
do. do. 6 per cent. Bonds	..	Nil	Nil	30	..	Nil
Mexican Light Common	..	Nil	Nil	14/1	..	Nil
do. do. Pref.	..	Nil	Nil	22/1	..	Nil
do. do. 1st Bonds	..	Nil	Nil	39/1	..	Nil

MANUFACTURING COMPANIES.						
	Dividend	Price				
	1915.	1916.	July 3, 1917.	Rise or fall this week.	Yield p.c.	
Babcock & Wilcox	..	15	16	3	..	5 0 0
British Aluminium Ord.	..	7	10	28/9	..	8 19 2
British Insulated Ord.	..	17/1	20	12/1	..	7 15 0
British Westinghouse Pref.	..	7/1	7/1	2/1	..	8 6 4
Callenders	..	20	20	18/1	..	7 11 0
do. 5 Pref.	..	6	5	42xd	..	5 17 8
Castner-Kellner	..	22	22	8/1	..	6 10 2
Edison Swan, £3 paid	16/3	..	Nil
do. do. fully paid	..	4	4	14	..	Nil
do. do. 4 per cent. Deb.	..	7/1	7/1	70xd	..	5 18 6
Electric Construct.	..	6	6	12/1	..	8 0 0
Gen. Elec. Pref.	..	10	10	45/1	..	6 3 1
do. do. Ord.	..	25	25	15/1	..	6 9 0
Henley	..	4/1	4/1	4	..	8 1 8
do. 4/1 Pref.	..	10	10	12/1	..	5 12 6
India-Rubber	..	20	20	87/1	..	5 6 0
Telegraph Co.	..	30	30	87/1	..	8 8 2

* Dividends paid free of income-tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, July 4th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	..	per lb.	1/6
a Ammoniac Sal	..	per ton	275
a Ammonia, Murate (large crystal)	..	"	254
a Bisulphide of Carbon	..	"	223
a Borax	..	"	238
a Copper Sulphate	..	per lb.	261 10
a Potash, Chlorate	..	"	2/6
a " " Perchlorate	..	"	2/1
a Shellac	..	per cwt.	215/-
a Sulphate of Magnesia	..	per ton	216
a Sulphur, Sublimed Flowers	..	"	235
a " " Lump	..	"	22
a Soda, Chlorate	..	per lb.	10ad.
a " " Crystals	..	per ton	120/-
a Sodium Bichromate, casks	..	per lb.	..
METALS, &c.			
c Brass (rolled metal 2" to 12" basis)	per lb.	..	..
c " Tubes (solid drawn)	"	..	..
c " Wire, basis	"	..	..
c Copper Tubes (solid drawn)	"	1/8 to 1/8	1d. dec.
g " Bars (best selected)	per ton	2165	..
g " Sheet	"	2165	..
g " Rod	"	2166	..
d " (Electrolytic) Bars	"	2142	..
d " " Sheets	"	2167	..
d " " Wire Reds	"	2150	..
d " " H.C. Wire	per lb.	1/5	..
f Ebonite Rod	"	3/-	..
f " Sheet	"	2/6	..
n German Silver Wire	"	2/3	..
h Gutta-percha, fine	"	6/10	..
h India-rubber, Para fine	"	3/-	1d. dec.
i Iron Pig (Cleveland warrants)	per ton	Nom.	..
l " Wire, galv. No. 8, P.O. qual.	"	2/2	..
g Lead, English Pig	"	..	..
g Mercury	"	per bet.	Nom.
e Mica (in original cases) small	per lb.	6d. to 3/-	..
e " " " medium	"	6/6 to 6/-	..
e " " " large	"	7/6 to 14/- & up.	..
d Silicon Bronze Wire	per lb.	1/9	..
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	"	..	..
n " Wire, Nos. 1 to 16	per lb.	8/6	..

Quotations supplied by—

a G. Boer & Co.	g James & Shakespearo.
c Thos. Bolton & Sons, Ltd.	h Edward Till & Co.
d Frederick Smith & Co.	i Belling & Lowe.
e F. Wiggins & Sons.	l Richard Johnson & Nephew, Ltd.
f India-Rubber, Gutta-Percha and	n P. Ormiston & Sons.
Telegraph Works Co., Ltd.	r W. F. Dennis & Co.

Death by Induction.—The *Journal Télégraphique* quotes from *Annales des P.T.T.* particulars of a remarkable fatality due to a shock received by induction. In the valley of the Romanche, France, there are numerous generating stations and power transmission lines working at pressures from 25,000 to 55,000 volts, three-phase: a State telephone line, carrying interurban circuits and several telephone lines belonging to the power companies, parallels the power lines over a considerable distance. On April 28th, 1916, a lineman connected with one of the companies was speaking with a portable telephone set on one of the private lines when he received a fatal electric shock. An inquiry followed, which revealed the following circumstances:—At the time of the accident no contact could have taken place between the telephone circuit and the high-pressure lines. The cut-outs on the State lines carried on the same pole as the private circuit operated, and shocks were felt by State employés in the telephone service. At the moment when the accident took place, a sudden interruption occurred on a power line working at 15,000 volts, which paralleled the State line over a length of 20 km. (12½ miles). The abnormal pressure rise which caused the accident was not due to any contact between the lines; it was produced by induction between the power line and the telephone line. At the moment when the interruption of current took place, one of the three-phase cables remained for a brief interval at a high pressure, after the other cables had returned to zero voltage. Under the electrostatic influence of this cable the telephone line was raised to a pressure which occasioned the fatality.

Electrical Wages Award.—The Chief Industrial Commissioner's Department of the Board of Trade, in connection with the application of the electrical wiremen of Bradford and Shipley for an advance in wages from 1½d. to 1s. per hour, has raised the standard to 1½d. per hour, to cover and include all previous advances. Overtime is to be paid for at time and a-quarter for the first two hours, time and half afterwards to midnight, and double time subsequently until starting time next morning, double time also being awarded for Sundays and Christmas Day, and time and a-half for Bank Holidays. The working hours are reduced from 5½ to 4½ per week, and there are concessions in relation to night work, "dirty money," travelling and country expenses, &c. Engagements may be determined on either side by one hour's notice. Disputes are to be settled by a Council of employers and employés.

ELECTRO-CULTURE.

SOME NOTES ON H.T. DISCHARGE APPARATUS.

THOUGH only just beginning to attract public attention, electro-culture is by no means a new idea. The earliest attempts on record are to the credit of a Scotchman named Mowbray, who tried some experiments in the year 1750, though the first real advance was due to Lemstrom, who tried some experiments in Finland in 1885, and a few years later in England, France, and Germany.

The difficulties of such a research are very great, owing to the absence of exact data in all agricultural and horticultural work. The fertilising value of every manure differs from every other, and even different samples of the same kind do not give equal results, but will behave quite differently in different soils. Clay, loam, and sand all require different dressings, and the value of a manure on the one is no guide to its value on another. The very rain differs in its action on plant life under different climatic conditions and places. Plants are greatly influenced by the air. Some need wind—to others it is fatal. The contour of the land, whether at the top or bottom of a slope, the shelter afforded by trees and

the open market. The price which a public, ignorant of the experiments, and anxious only to get the best value, will give is a good guide and even an accurate measure of their relative worths. It needs, however, large plots of ground and considerable expenditure to conduct experiments on this scale, and even then great skill and judgment are wanted in choosing the plots and in preparing them for planting in such a way that the results may be truly comparable. Those who are used to making practical comparative tests will from these considerations realise the almost insuperable difficulties under which Lemstrom worked.

He himself alludes to the investigation "as by no means inviting." Nevertheless, despite all the inexactitude of the agricultural side, the utter lack of knowledge on the botanical, and the absence of suitable apparatus on the electrical, he tackled the subject with a very large measure of success, and laid the foundation of a new industry which we slow and conservative people are just beginning to develop 30 years later under the beneficent stimulus of German malevolence.

These early experiments were made with influence machines of various types, one terminal being connected to earth and the other to a network of wires over the plants, which at the first were grown in pots, but later in the open ground. Constant trouble

occurred with the generators, which would reverse polarity frequently and sometimes fail to excite, while at other times the damp atmosphere would form practically a short circuit path for the extremely small quantity of electricity which these machines can deliver. Thus his experiments, while leaving no doubt as to the general value of the electrical discharge in plant growth, and enabling him to make several important generalisations, are confused and unconvincing in detail.

The advent of X-rays and wireless telegraphy produced an imperative demand for a practical high potential generator, and the supply which quickly followed made it possible to try Lemstrom's experiments on a larger scale, and with more intense discharges. Our knowledge of atmospheric electricity and of the discharge of electricity through gases, has increased enormously since 1885, so that we are now able to take measurements of the quantities of electricity involved, and even to form some very rough idea of how it is carried from the overhead wires to the plant.

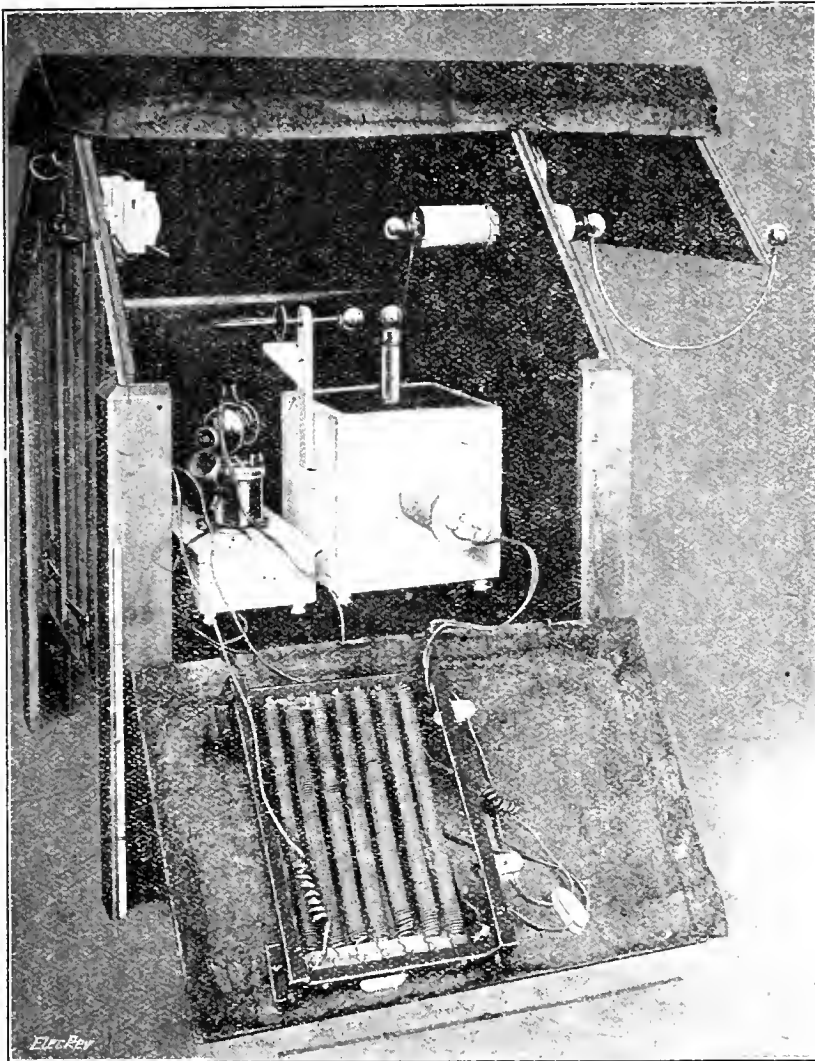
For the last 12 years experiments have been carried out in England on an extensive scale in several different places on different soils and under different climatic conditions, the leaders in the work being Sir Oliver Lodge and Prof. J. H. Priestley, the latter with the help of the Board of Agriculture. The results obtained have been the subject of reports in the *Journal of the Board of Agriculture* (April, 1910; October, 1913; January, 1915; October, 1916; April, 1917); from these reports all the figures that are given here have been taken, and they may thus be regarded as cautious and well considered data not likely to err on the side of over-estimation.

The Apparatus Used.—Ever since Lemstrom's experiments the method of distributing the charge to the crops has been much the same, a network of wire, or strands of barbed wire or plain wires are stretched over the field at a convenient height by means of H.T. insulators, and kept charged to a potential of about 80,000 to 100,000 volts.

A net is too inconvenient and costly for large areas, while barbed wire involves the use of very heavy poles and large insulators, account of the great strain needed to keep it reasonably taut—thus the choice usually falls on a plain wire.

The density of an electric charge at any point on a body is proportional to the curvature at that point; that is, the potential relatively to earth will be greater the greater the curvature, and thus it comes about that the wires used should have as small a diameter as practicable, so as to keep as low as possible the potential necessary to produce a discharge. With wires of from 24 to 30 s.w.g. 90,000 volts maximum appears a good medium. It will be noticed that this is just about the pressure at which it is possible to transmit power without corona troubles being serious, i.e., at this potential it is possible to send currents without loss along large wires, but discharge takes place from fine ones. All leads to the network can, therefore, be of bare wire of 10 or 12 s.w.g.

The fine wires if of silicon bronze or galvanised steel may be used without fear with a span of 150 ft. and a sag of not more than 8-12 in. They should be kept as low down as possible, as this increases the intensity of the discharge, but in order to avoid localising it on the highest plants, the distance between wire and ground should not be less than twice the height of the full grown plant. Generally it has to be greater still to allow for working underneath: 7 to 9 ft. seems to be a good range, as a man with a hoe can work underneath without disturbing the wires.



DISMANTLED HUT SHOWING ELECTRO-CULTURE SET EXHIBITED BY MESSRS. W. H. COX & CO., AT THE RECENT MUNICIPAL ELECTRICAL CONFERENCE.

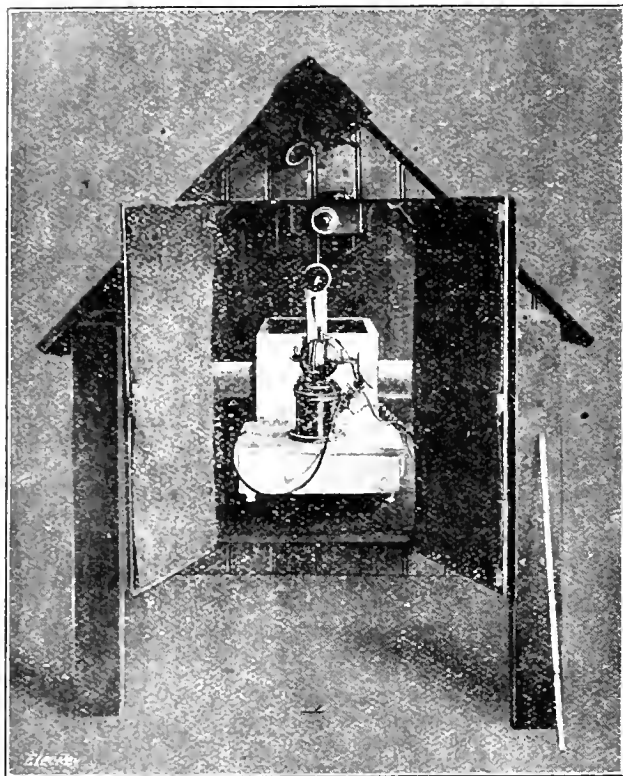
hedges from sun, wind, and rain—all these things, and many others, help to determine the rate of growth. For no single one of all these things can any exact unit be determined. Generalisations and roughly true empirical laws can be laid down, but there has never been written any equation connecting together all or some of these variables, and the result of their mutual interaction can only be estimated, the degree of accuracy depending on the soundness of some person's judgment and the breadth of his experience.

The usual experimental procedure is to plant several plots with whatever is to be the subject of experiment, taking care to keep the conditions as nearly as possible identical in all. One plot is treated in the special way under investigation, and the rest in the normal manner: then any difference between the growth under special treatment and the average growth of the others may be taken to be due to that treatment, and, where measurements can be made, a ratio obtained.

Quantitative results are, however, always difficult. One may be able to say definitely, that one flower is better than another, but by how much? One potato or tomato may be heavier than another, but is the quality the same in both, and how can that quality be measured? Where the thing is done on a large enough scale, a solution of this dilemma is found by selling the goods in

but each individual case must be decided on its merits. The space between wire and wire should be about two-thirds of their distance from the ground, in order to obtain a fairly high intensity of discharge.

One of the best methods of suspension is to place stout poles set in concrete at the corners of the field: old telegraph poles cut in half do well, and can generally be bought at a moderate rate from the local telegraph engineers' depot. Extra-high-tension insulators



VIEW SHOWING COIL, SPARK GAP AND INTERRUPTER.

are fixed to these, and from them span wires of galvanised iron are taken along the length of the field. Should this length be greater than about 150-200 ft., intermediate poles are used: these may be lighter than the main ones.

The fine discharge wires are strung across from span wire to span wire. Light brass hooks form as good a connection as anything, and allow the discharge wires to be shifted or taken down. The H.T. current is fed to the thick span wires, which conduct it with but little loss to the fine wires, from whence it discharges on to the crops.

The H.T. current may be produced in several different ways, each of which has its own peculiarities, its advantages, and disadvantages. The usual generators are:—

1. *Static Machines.*—The current from these is ideal for the purpose, being at a constant potential, but even with the largest machines there is difficulty in getting sufficient quantity. There is apt to be difficulty in damp weather, owing to the machines failing to excite or losing excitation if the resistance of the external circuit drops. Many types have a nasty habit of reversing polarity for no obvious reason. The machines have to be kept absolutely free from damp, and are expensive.

2. *Step-up Transformers.*—As a source of high potential, these are the simplest, cheapest, and most efficient, but the current from them needs either rectification or the suppression of one half wave, so as to impart a unidirectional charge to the wires.

The former is attained by the use of a revolving shaft driven by a synchronous motor, and carrying conducting arms, which alternately make and reverse connection between the H.T. ends of the transformer and the main contacts.

This is the best machine by far for large areas—say, of 50 acres and upwards—is simple and reliable, but the cost, which may be anything between £200 and £400, makes the outlay rather high for small areas.

The suppression of one half wave is done by the use of a "valve tube." This instrument, the best-known type of which is the "Lodge," consists of a glass globe evacuated to one or two millimetres of mercury and containing two electrodes, one of large area and with a good space round about it, the other of small area, as closely confined as possible, and often surrounded by an electrostatic shield. The former conditions are favourable to the formation of the "negative dark space" which always accompanies a discharge *in vacuo*; the latter unfavourable. Thus there is considerably less opposition to the current passing one way than the other. A different and more efficient type of valve is the "Kenotron," in which the negative electrode consists of a red-hot spiral in a vacuum which, giving off ions, will allow current to flow from it but provides no path for a discharge in the opposite direction.

This method of charging up the network is not so ideal as it appears on paper, for several of the ordinary valve tubes are required in series in order to deal with 100,000 volts. They

gradually increase their vacuum owing to the absorption of gas by the glass walls, which causes a gradual increase of resistance in the right direction for the current without much compensating gain in the opposite; means are provided for rectifying this, but they are not very satisfactory, and after some time the valves become erratic in behaviour.

A "Kenotron" valve can be made to suppress 100,000 volts, but requires a battery or small transformer to heat the cathode, which must, of course, be charged to the same potential as the cathode itself, and thus has to be insulated for the full potential both from earth and the mains. Moreover, it is an expensive article, costing £50 or more to install.

Both types of valves are very fragile, being of thin glass and highly exhausted, they are also liable to "perforation"—i.e., puncturing of the wall by a high-tension spark from any conductor that may by accident be brought too close.

3. Some form of high-frequency apparatus has often been used, but the current from these cannot readily be rectified, and the effects produced are not so good, probably for this reason. Also, it is impossible to carry such currents along any conductor possessing appreciable self-induction, and thus it is very hard to charge a network evenly by this means. The generator always involves a spark gap, which burns and wears, and so needs fairly frequent attention.

4. *Induction Coil and Interrupter.*—This is probably the most efficient and satisfactory method of dealing with any plot not large enough to warrant the use of a H.T. transformer and revolving rectifier. The outstanding peculiarity of these instruments is the extremely asymmetrical wave they produce.

In principle, an induction coil consists of an open-core transformer of large ratio, the primary of which is fed with an interrupted direct current. Owing to the self-induction of the primary, which is kept as large as possible, the current grows but slowly, when the interrupter closes the circuit, and may take as much as 1-50th second or more to reach its full value. The induced potential in the secondary is, of course, proportional to this rate of growth, and will, in consequence, be comparatively small.

The interrupter is designed to break the circuit as quickly as possible, and to quench the resulting arc with the utmost rapidity and the least possible loss of energy in heat. The consequence is that the rate of decrease of the current is very much greater than was the rate of growth, and the potential across the secondary will be correspondingly greater. With a closed iron circuit the magnetisation of the iron will not fall to zero with the current, but lags greatly behind it, hence the need for the open core.

The general form of interrupter involves a mechanical break between a contact and mercury under some dielectric which will prevent oxidation. Either the mercury or the contact, or both, may be in motion.

The container is kept full of a liquid or gaseous hydrocarbon with good arc-quenching properties, and this, together with the rapidity of motion and the good cooling from the surrounding masses of metal, interrupts the circuit with great rapidity.



WEATHERPROOF HUT, SHOWING OUTGOING H.T. CONNECTION.

The current thus produced may have a peak value of 50,000 volts in one direction and only a few thousand in the other, and if such is supplied to a network of fine wires, a strong discharge will take place at each occurrence of the high-value peak, while on the other half of the wave the potential never becomes high enough to produce any effect.

The large ratio between make-and-break potentials necessitates good design both of coil and interrupter; the older apparatus of this type gives a far greater inverse potential than that mentioned, and so requires a valve tube to prevent the wires being raised to too high a negative potential.

Wireless and X-ray work have produced so great a demand for coils and interrupters that these have now become thoroughly

reliable machines, well made, and capable of standing up to their work without much attention, and seldom breaking down. The ordinary commercial types are, however, designed for much too high a secondary voltage for electro-culture work, and were not intended for such long continuous running. The heat conduction from the secondary is very bad, owing to the great insulation needed, and thus the C²R losses may cause dangerous heating, while the large number of turns set an upper limit to the discharge current, which entails the use of a much larger coil than should be necessary. A specially-designed coil is therefore required, giving great quantity at a less potential than usual, and with a very low-resistance secondary: it should also be designed with a view to being absolutely waterproof, as paraffin wax is slightly hygroscopic, as, indeed, are all that class of insulating compounds.

It will be seen that the current from this kind of set is in the form of intermittent impulses, so that the charge on the wire produced by one impulse can discharge back through the coil during the next interval. This can be avoided by putting a valve tube in circuit to check the back flow, but they are delicate, unstable pieces of apparatus, which give a good deal of trouble in use, and it is probably better to do without them and to use a coil capable of giving a sufficient discharge such that enough electricity may be given off at each impulse to bring up the mean current density in the air to the required standard without resort to such contrivances.

In all these instruments, some method of measuring the potential is needed, and the simplest seems to be a measurement of the sparking length. Below is a table connecting spark length with voltage, maximum values, which determine the sparking length, being given. In each case one pole is assumed to be earthed; this makes some difference in the high figures.

Max. volts. K.V.	Spark gap length in inches.		
	Points.	2½ balls.	5" balls.
10	35	—	—
20	65	—	—
30	100	—	—
40	15	5	5
50	20	65	65
60	27	8	8
70	35	10	95
80	—	12	11
90	—	15	125
100	—	18	14
110	—	23	16

It is very necessary to provide a thoroughly waterproof place for the apparatus, and provision should be made for warming, so as to drive off any condensation. The apparatus can be made to deal with either direct or alternating current, and any supply voltage between 25 and 250 volts.

Effects on Crops.—Some data and illustrations have already been published in the ELECTRICAL REVIEW for May 11th, 1917, where one of Prof. Priestley's reports is reprinted in full with two interesting illustrations, showing the improvement effected on wheat and second-year clover, and it is not necessary to add much here.

Young strawberry plants have increased in yield by 80 per cent., older ones by 36 per cent. and 25 per cent.

Potatoes are good subjects, and invariably show increases, usually between 20 per cent. and 50 per cent., the increase being in the size of the tubers, and not the number, from which it would seem that there was here a means of bringing new potatoes on to the market earlier. Carrots, beet, tomatoes and mangolds all show increases of from 20 per cent. to 50 per cent.

Wheat has been the subject of the most extensive and prolonged experiment, and the average increases shown up to 1914 were from 20 per cent. to 40 per cent. A crop grown in 1915 under a very much more intense discharge, showed an increase of about 50 per cent. in grain and nearly 90 per cent. in straw, besides being ready for harvesting earlier. The grain was also of a superior quality.

The effects of the discharge on germination appear to have been neglected of late, but there is abundant evidence to show that the young plants show earlier when the seed plots are treated: but in this country at least, caution must be used in forcing crops out of the ground in early spring on account of frost.

In greenhouse work, where there is no danger from frost, and all the elements are under control, there seems to be a wide field, and the application is not at all difficult, one wire, or at most two, being run parallel to the length of the house, attached to an 18-in. length of ebonite rod as insulator at one end, and passing through an E.H.T. porcelain leading-out tube at the other, the coil and interrupter being fixed outside the house. Special arrangements can be made to run several houses near each other from the same apparatus.

General Remarks.—The discharge appears to act, roughly speaking, as artificial sunshine, and as it is quite as possible to over-stimulate plants as human beings, judgment is necessary in determining how long to keep the discharge going per day. In damp, cloudy weather four to five hours per day seems about the time usually given in the most successful cases, and this should be diminished in proportion as the day is sunny, while in hot scorching sunshine and in times of drought the discharge should never be put on. Morning and evening are the best times for treatment, especially the former.

The crops under treatment draw more from the soil, both moisture and food, and therefore plenty of water and manure must be given. On soil that is too poor, or lacks moisture, no benefit will, and harm may, result.

In windy weather the electrified air is blown about, benefiting

neighbouring crops but diminishing the quantity received by those under treatment, and this should be allowed for in such weather, which is often the time when the treatment is most needed.

There seems to be a possible exception to the general rule in the behaviour of leguminous plants—a family characterised by the presence in their roots of small nodules containing colonies of bacteria, whose function appears to be the extraction of nitrogen from the plant, giving it to the soil. Such plants thus enrich the ground instead of impoverishing it, an outstanding exception to the general rule, which may have great significance in considering their behaviour under the discharge. Clover, however, which is one of this family, though it did badly when electrified one year, gave a superabundant crop the second year when it was not electrified, so that the treatment seems to have had an important after effect.

Another most useful effect is that blight and insects generally are destroyed by the discharge, which will quickly clean such things as beans and carnations when attacked.

There seems but little doubt that in the high-tension discharge we have a means of counteracting the lack of sunshine, which is the one drawback from the agricultural point of view to our very fertile land, and if properly exploited by men of energy, patriotism, and foresight it may yet solve the problem of making farming an easier and more lucrative profession.

The illustrations in the above article are of the electro-culture set made by Messrs. Harry W. Cox & Co., Ltd., which was shown to visitors at the recent annual meeting of the Municipal Electrical Association, in London.

This set is suitable for areas of from 10 to 15 acres, and consists of an induction coil, interrupter, switchboard, and resistance for controlling the discharge, and a time-switch for automatically switching on and off the discharge at the required times: this equipment is enclosed in a weather-proof hut, which can be electrically warmed to ensure dryness. A length of 25 yards of 7/20 twin cable is supplied, together with a plug fitting, for connecting the hut to the source of supply, also the necessary insulators for same and an earthing plate for connecting the negative pole to earth. This constitutes the apparatus required for generating and controlling the H.T. supply to the discharge network, which consists of thin copper discharge wires supported from galvanised steel span wires, which are carried on suitable insulators attached to poles. Messrs. Cox supply and erect the complete equipment, and provide the necessary supervision to ensure its successful working.

IMPORTS OF HOLLAND.

THE following figures, showing the imports of electrical and similar goods, for consumption, into Holland during the year 1915, are taken from the recently-issued official trade statistics; the figures for 1914 are added for purposes of comparison, and notes of any increases or decreases are given:—

	1914. Gulden.	1915. Gulden.	Inc. or dec. Gulden.
<i>Machinery, steam, industrial and agricultural.</i> —			
From Belgium	2,513,000	1,380,000	— 1,133,000
„ Great Britain	6,481,000	6,070,000	— 411,000
„ Hamburg	191,000	40,000	— 151,000
„ Germany	23,867,000	16,816,000	— 7,051,000
„ United States	2,678,000	1,570,000	— 1,108,000
„ Sweden	338,000	481,000	+ 143,000
„ Other countries	177,000	443,000	+ 266,000
Total	36,245,000	26,800,000	— 9,445,000
<i>Gutta-percha, raw.</i> —			
From France	31,000	—	— 31,000
„ Great Britain	549,000	29,000	— 520,000
„ Dutch Guiana	744,000	85,000	— 659,000
„ Java, &c.	709,000	—	— 709,000
„ Other countries	113,000	2,000	— 111,000
Total	2,146,000	116,000	— 2,030,000
<i>Gutta-percha manufactures.</i> —			
From Belgium	503,000	2,000	— 501,000
„ Great Britain	176,000	241,000	+ 65,000
„ Germany	221,000	8,000	— 213,000
„ Other countries	1,000	31,000	+ 30,000
Total	901,000	282,000	— 619,000
<i>Iron wire.</i> —			
From Belgium	4,143,000	110,000	— 4,033,000
„ Great Britain	32,000	1,000	— 31,000
„ Germany	18,577,000	6,651,000	— 11,926,000
„ Sweden	347,000	2,000	— 345,000
„ Other countries	42,000	53,000	+ 11,000
Total	23,141,000	6,847,000	— 16,294,000

	1914. Gulden.	1915. Gulden.	Inc. or dec. Gulden.
<i>Instruments, physical, chemical, &c.—</i>			
From Belgium ...	384,000	17,000	— 367,000
.. Great Britain ...	538,000	1,456,000	+ 918,000
.. Hamburg ...	439,000	—	— 439,000
.. Germany ...	6,246,000	3,205,000	— 3,041,000
.. Other countries ...	271,000	969,000	+ 698,000
Total ...	7,878,000	5,647,000	— 2,231,000

Copper wire.—

From Belgium ...	90,000	—	— 90,000
.. Great Britain ...	392,000	1,160,000	+ 768,000
.. Hamburg ...	306,000	—	— 306,000
.. Germany ...	2,643,000	13,000	— 2,630,000
.. Other countries ...	78,000	1,599,000*	+ 1,521,000
Total ...	3,509,000	2,772,000	— 737,000

* Mainly from the United States.

India-rubber manufactures.—

From Belgium ...	2,417,000	1,000	— 2,416,000
.. Great Britain ...	2,271,000	3,010,000	+ 739,000
.. Java ...	8,520,000	—	— 8,520,000
.. Germany ...	106,000	160,000	+ 54,000
.. United States ...	12,000	28,000	+ 16,000
.. Other countries ...	912,000	724,000	— 188,000
Total ...	14,238,000	3,923,000	— 10,315,000

Steel wire.—

From Belgium ...	581,000	2,000	— 579,000
.. Great Britain ...	571,000	97,000	— 474,000
.. Germany ...	2,124,000	938,000	— 1,186,000
.. Other countries ...	70,000	12,000	— 58,000
Total ...	3,346,000	1,049,000	— 2,297,000

Glass manufactures.—

From Belgium ...	195,000	37,000	— 158,000
.. Great Britain ...	114,000	116,000	+ 2,000
.. Germany ...	2,206,000	2,331,000	+ 125,000
.. Other countries ...	13,000	49,000*	+ 36,000
Total ...	2,528,000	2,533,000	+ 5,000

* Sweden 21,000 Gulden.

Porcelain.—

From Belgium ...	129,000	8,000	— 121,000
.. Great Britain ...	44,000	42,000	— 2,000
.. Germany ...	1,490,000	1,914,000	+ 514,000
.. Other countries ...	107,000	34,000	— 73,000
Total ...	1,680,000	1,998,000	+ 318,000

NOTE.—Gulden = 1s. 8d.

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED).

applied expressly for this journal by Messrs. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

- 8,714. "Locking or securing devices for electric fittings." ST. HELENS ROPE & RUBBER CO. and J. C. WHITE. June 18th.
- 8,721. "Electric welding machine, &c., switches." BRITISH INSULATED AND HEATSEALING CO., LTD., P. BECHER & T. ROBINSON. June 18th.
- 8,722. "Removable electrical fuse carriers or connecting devices." R. W. DODGES AND BRITISH INSULATED & HEATSEALING CO., LTD. June 18th.
- 8,724. "Electric motors." L. R. McDONALD. June 18th. (U.S.A., June 19th, 1916.)
- 8,726. "Device applicable to spring-controlled switches of telephone receivers." A. S. JONES. June 18th.
- 8,718. "X-ray apparatus." F. J. HARLOW. June 18th.
- 8,740. "Electrically-heated cooking stoves." C. W. WINTERBOTHAM. June 18th.
- 8,748. "Electric contact breakers." ROUS-ROUVE, LTD., & F. H. ROYCE. June 18th.
- 8,759. "X-ray tube stand and table." F. E. GRAYBILL. June 18th.
- 8,791. "Automatic voltage regulation." J. C. TOMLIN. June 19th.
- 8,792. "Ignition devices for explosion motors." M. A. VORCEL. June 19th. France, June 23rd, 1916.
- 8,814. "Means for adjusting electric and gas lamps." G. E. FRISGAR. June 19th.
- 8,826. "Portable electric drier for local drying of drawings, &c." T. VASIOR & I. R. PANSER. June 20th.
- 8,896. "Electric welding machines." W. H. ROBINSON. June 20th.
- 8,852. "Vaporizing and ignition means for internal-combustion engines operating liquid fuel." J. ROBINSON. June 20th.
- 8,854. "Electric locomotive." BRITISH THOMPSON-HOUSTON CO. (General Electric Co., U.S.A.). June 20th.
- 8,894. "Wireless telegraph, &c." H. VON KRAMER. June 21st.
- 8,908. "Electric regulating machines." F. R. THORNTON. June 21st.
- 8,926. "Electrical treatment of gases." L. BEADLEY. June 21st. U.S.A., June 21st, 1916.
- 8,943, 8,931. "Dynamo-electric machines." BRITISH THOMPSON-HOUSTON & A. A. PILLER. June 21st.

- 8,937. "Electrically-driven road vehicles." F. LA ROCHE. June 21st.
- 8,940. "Indicating electrical instruments." G. A. CHEETHAM. June 21st.
- 8,945. "Rotary transformers or converters." CRYPTO ELECTRICAL CO., H. G. SHARP, C. R. SHAW & J. G. SHAW. June 21st.
- 8,964. "Electric cables or conductors." T. S. SEYMOUR. June 22nd.
- 8,992. "Rubber-insulated electric cables or conductors." E. A. BAYLES. June 22nd.
- 8,995. "Device for testing electric ignition of internal-combustion engines." F. W. MURRAY. June 22nd.
- 9,014. "Electric transformers for electric furnaces, &c." J. BIBBY. June 22nd.
- 9,017. "Sparkign plugs for ignition." K. E. L. GUINNESS. June 22nd.
- 9,024. "Interrupters of magneto-electric machines." M. S. CONNER AND C. C. PUCKETT. June 23rd.
- 9,025. "Electromagnetic submarine mine with switchboard control." J. W. PATTISON & W. PATTISON. June 23rd.
- 9,039. "Non-carbonising ignition plug for internal-combustion engines." E. W. WHISTON. June 23rd.
- 9,047. "Electrical temperature regulator." R. W. M. THOMSON. June 23rd.
- 9,061. "Braking systems for electrically-driven vehicles." BRITISH THOMPSON-HOUSTON CO. (General Electric Co., U.S.A.). June 23rd.

PUBLISHED SPECIFICATIONS.

1913.

- 27,657. ELECTRIC INCANDESCENT LAMPS. Progress Motoren und Apparatenbau Ges. October 14th, 1913.

1916.

- The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.
- 2,728. POWER-DEVELOPING APPARATUS. Westinghouse Machine Co. September 22nd, 1915. (101,530.)
- 3,067. ELECTRIC FURNACES. T. H. Watson & Co., H. A. Greaves and H. Etchells. March 1st, 1916. (106,626.)
- 4,067. MAGNETOS. C. C. W. Simpson & R. G. le Noir. March 18th, 1916. (106,628.)
- 5,466. WIRELESS TELEGRAPHY AND TELEPHONY. Soc. Française Radio-Electrique. March 1st, 1915. (Addition to 5,458/16.) (100,282.)
- 7,649. ELECTRIC BRAKES, CHIEFLY FOR LOOMS. J. F. Crowley. May 30th, 1916. (106,663.)
- 7,672. APPARATUS FOR FORMING ENLARGEMENTS ON THE STEMS OF METALLIC FILAMENT ELECTRIC LAMPS. Morris & Whitham, and J. A. Allison. May 30th, 1916. (106,664.)
- 7,708. ROTARY ELECTRIC TRANSFORMERS. Crompton & Co. and N. Pensabene. May 31st, 1916. (106,667.)
- 7,732. STARTING INTERNAL-COMBUSTION ENGINES. Bosch Magneto Co. June 12th, 1915. (100,683.)
- 8,458. ELECTRICAL MAKE-AND-BREAK DEVICES. A. E. Bennett. June 15th, 1916. (106,693.)
- 8,749. PROTECTIVE DEVICES FOR DYNAMO-ELECTRIC MOTORS. G. Ellison and J. Anderson. June 21st, 1916. (106,697.)
- 9,066. ELECTRIC CLOCKS. I. H. Parsons & A. E. J. Ball. June 30th, 1916. (106,702.)
- 9,655. ELECTRICAL SIGNALING SYSTEMS. Sterling Telephone & Electric Co., F. G. Bell & W. C. Davey. July 8th, 1916. (106,706.)
- 10,622. DEVICES OR APPARATUS FOR REGISTERING THE COASTING AND STOPPAGE TIME OF ELECTRICALLY-DRIVEN VEHICLES. W. O. Wade & C. C. Chappelle. August 26th, 1915. (101,290.)
- 11,175. MERCURY INTERRUPTER AND INDUCTION COIL. L. B. Miller. August 8th, 1916. (106,724.)
- 13,173. DYNAMO-ELECTRIC IGNITION APPARATUS. G. F. Cooke. September 16th, 1916. (106,745.)
- 13,805. AUTOMOBILE ELECTRICAL APPARATUS FOR WELDING, SEARCHLIGHT, AND LIKE PURPOSES. Tilling-Stevens, Ltd., & P. F. Smith. September 28th, 1916. (106,752.)
- 13,874. MEANS IN VEHICLES HAVING AN ELECTRIC TRANSMISSION FOR VENTILATING AND COOLING ELECTRIC GENERATORS AND MOTORS. Tilling-Stevens, Ltd., and P. F. Smith. September 24th, 1916. (106,754.)
- 14,466. ELECTRIC FURNACES. J. W. Moffat. October 11th, 1916. (106,760.)
- 14,739. USE OF REACTANCES IN ALTERNATING-CURRENT ELECTRIC CIRCUITS. L. E. ASKE. October 17th, 1916. (106,762.)
- 18,046. AUTOMATIC TELEPHONE SYSTEMS. Automatic Telephone Manufacturing Co. February 14th, 1916. (104,164.)
- 18,340. AUTOMATIC TELEPHONE SYSTEMS. Automatic Telephone Manufacturing Co. December 31st, 1915. (103,116.)

Artificially Loading Hydro-Electric Generators on Test.

In the *General Electric Review* for April, Mr. R. Treat describes a convenient method of loading a turbine-driven generator for testing purposes without the use of water resistances, which has been used frequently by Messrs. R. A. Ross & Co., consulting engineers, of Montreal, since 1907. It consists in connecting another generator to the machine under test, with one phase reversed, so that it runs in the opposite direction of rotation as a synchronous motor. When both machines are up to speed, and are excited to full voltage, the gates of the wheel which is motoring are gradually opened until the required load is obtained, the wheel acting as a water brake. The generator and motor fields may then be varied to produce any power factor and voltage that may be desired.

It is found best to make the connections and close the main switches, and excite both machines, before admitting water to the generator wheel. When both machines are turning over, the reversed rotation of the motor should be verified. The voltage and speed of the generator are then raised to normal, and water is admitted slowly to the motor water-wheel to produce the desired load. The readings of the generator instruments indicate its output; those of the motor need not be taken into consideration. The governor mechanism should be disconnected from the motor, but an attendant must stand by to shut off the water in the event of the circuit-breaker opening. Only a small gate opening on the motor water-wheel is needed to produce full load on the generator.

THE ELECTRICAL REVIEW.

VOL. LXXXI.

JULY 13, 1917.

No. 2,068.

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE 1-4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: "AGEEKAT, LONDON." Code, A B C.

Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 8d.; Canada, £1 3s. 10d. (\$5.80). To all other countries, £1 10s.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co.,
Gresham Street.

AUCKLAND, N.Z.: Gordon & Gotch,
Albert Street; The Mining and
Engineering Review, 31a, Strand
Arcade, Queen Street.

BRISBANE: Gordon & Gotch, Queen St.

CHRISTCHURCH, N.Z.: Gordon and
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Princes Street.

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BETH, &c.: Central News Agency,
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LANCASTER: Gordon & Gotch,
Cimitiere Street.

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neering Review, 90, William Street;
Gordon & Gotch, Queen Street.

MILAN: Fratelli Treves.
NEW YORK: D. Van Nostrand, 25, Park
Place.

PARIS: Boyveau & Chevillet, 22, Rue
de la Banque.

PERTH, W.A.: Gordon & Gotch,
William Street.

ROME: Loescher & Co., Corso
Umberto I° 307.

SYDNEY: The Mining & Engineering
Review, 273, George Street; Gordon
and Gotch, Pitt Street.

TORONTO, ONT.: Wm. Dawson & Sons,
Ltd., Manning Chambers; Gordon
and Gotch, 132, Bay Street.

WELLINGTON, N.Z.: Gordon & Gotch,
Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

THE "ELECTRICAL REVIEW'S"

ELECTRICAL & ALLIED TRADES DIRECTORY (THE RED BOOK),

1917 EDITION

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FUEL ECONOMY AND CONTROL.

ONE of the most pressing questions of our time is the economical utilisation of our national fuel resources, which, though it has been a matter for discussion and speculation for a good many years, has only attracted public attention under the stimulus of war conditions. It is, however, now generally recognised that the industrial and commercial prosperity of this country primarily depends on its fuel resources, and the method of disposal of the latter is attracting widespread attention in scientific and industrial circles.

The paper recently read by Mr. J. A. Robertson before the Municipal Electrical Association dealt with one phase of this question, *i.e.*, the possible saving in fuel by its conversion to, and use in the form of, electrical energy; but this is only one of the many aspects of the problem of fuel economy, the treatment of which depends so largely on the point of view of the individual.

It appears to us, however, that there is only one broad view of the whole matter, on which our future policy must depend—that we should aim at the *conservation of fuel values* in the national interest, rather than in the interest of the individual. The latter is unlikely voluntarily to adopt any scheme with the above object in view which involves sacrifice on his part, and it seems fairly evident that no satisfactory solution of the problem of utilising our fuel resources to the best advantage will be arrived at without some measure of public control.

We may, for instance, consider Mr. Robertson's proposals in conjunction with the coal transport reorganisation scheme put forward by the Coal Controller, and referred to elsewhere in this issue. Both proposals are practically bound up with the transport question, for while Mr. Robertson would save the use, and therefore transport, of 30 million tons of coal for domestic and factory use, by "doing it electrically," in the future, the coal transport reorganisation scheme aims at the saving of some 700 million ton-miles during the next year in coal transport by re-arranging the producers and consumers of 40 million tons of fuel. Seeing that both schemes are broadly conceived, it is probable that a *pro rata* saving in transport, *i.e.*, over 500 million ton-miles annually, may result when Mr. Robertson's proposals materialise.

In passing, we may refer to the recommendations of the Controller of Coal Mines, published in our last issue, in which factory and domestic users are urged to supersede raw fuel by electricity, and assistance is promised in attaining the object in view, particularly by the interconnection of supply undertakings, where the saving of coal would warrant the necessary expenditure on plant.

It seems necessary to distinguish clearly between what can be accomplished now and what may be accomplished in the future; what we do now may or may not materially influence our course of conduct later on, when, as we may reasonably assume will be the case, the fuel utilisation problem of the country is identified with a definite national policy. Mr. Robertson, though claiming an open mind on the subject of coal carbonisation and by-product re-

covery in connection with electricity production, decides on present knowledge that the moment is inopportune for realising such schemes, mainly because it might result in a fractional increase in the cost of electricity; yet we note that he would have coal mining methods reorganised under Government control, so that the national wealth will not be wasted underground in the interests of mine shareholders and profit-making middlemen.

Even if the carbonisation of coal used in electricity works increased the amount of fuel required in the proportion of, roughly, 3: 2, as shown by Mr. Robertson, this would inappreciably increase our total home consumption of fuel, while it would, on the other hand, release valuable products which have in the past been largely imported from abroad. The modern power station combines two extremes—the turbine room, where scientific control has been reduced to a fine art, and the boiler-house, where such control is to a large extent abortive owing to the type of fuel employed, a difficulty which could be got over by gas-firing.

It is unthinkable that by-product processes will stand still, and even more unthinkable that we shall part with our diminishing store of raw fuel in the future, as in the past, while at the same time purchasing from abroad the manufactured products derived from it. We have in the past been prodigal in the expenditure of our fuel wealth; the nearness of our coal areas to the seaboard apparently supplied the incentive for our coal export business, on which, no doubt, both colliery and shipping interests have done exceedingly well, and unfortunately there are many people who regard fuel economy at home merely as a means of increasing our exports of raw fuel—of hurrying up the process of parting with additional tons of “our national capital,” as Mr. Robertson puts it.

The German Wire Lamp Trade.

As was recently mentioned in this journal, the principal glow-lamp makers in Germany have reached an understanding and decided to raise prices in general. It is probable that until this decision was taken the glow-lamp branch had occupied an exceptional position, as quotations had not previously been advanced in the German home market, it is said, since the outbreak of the war. This circumstance is all the more surprising in view of the great increase which has occurred in the cost of raw materials as compared with the prices ruling for these in the pre-war period. If an agreement has now been concluded, it is considered in Germany that the increase in prices possesses an importance which surpasses the limits of a simple price arrangement, as it gives expression to a readiness to come to a definite understanding. The most essential point of the new departure is the accession to the price arrangement of the Julius Pintsch Co., against which the competition of the A.E.G. group had previously been mainly directed, this group comprising, in addition to the A.E.G., the Siemens-Schuckert Works, the Bergmann Co., and the Auer Co. (German Incandescent Gas Light Co.). It is contended that advantage from the new arrangement will also be derived by the third group in the glow-lamp branch, which is formed of the factories of moderate and small size, and which produces lamps according to the drawn-wire process, the rights for which are claimed by the A.E.G. on the basis of patent rights obtained from the United States. An action on this matter is now pending before the Imperial Court. If a decision should be given in favour of the A.E.G., the firms concerned would be confronted with claims which would, it is thought, at least place them in a state of great dependence in relation to the former. If such a decision had already been given, a kind of monopoly under the leadership

of the A.E.G. would have been formed, with the Pintsch Co. as the sole opponent. The latter makes metallic-filament lamps on the squirting process, which is declared to have been considerably improved in recent times, and it is assumed that this fact also has contributed towards the understanding.

It may be remembered that at one time the A.E.G. claimed the right to the designation of glow lamps as wire lamps exclusively for metallic-filament lamps produced by the drawing process, and the company succeeded in this contention in an action brought against the Pintsch Co. a few years ago. The former group argued that the term wire lamp was evidence of quality, whereas the latter submitted that the use of the name by the Pintsch Co. was justified through its having come into common use amongst consumers, especially as the company maintained that its squirting system had advantages over other methods. At any rate, the A.E.G. group gained the day.

It was, however, in another direction that this group possessed the greatest strength from an economic standpoint—in fighting outside makers, namely, from the combination of most of the installation and electricity supply branches in the hands of the great electrical undertakings. As a result of this practice, the group was able to provide a market for its products which was not endangered by competition, as the group was able to make it a condition of the supply of current that lamps and other installation materials should also be obtained from the same source, the consequence being that the market possibilities of the remaining firms were proportionately restricted as the strength of the joint undertakings increased.

The French Electrical Industry.

A FAVOURABLE opinion, respecting the prospects of the electrical engineering industry in France is entertained by M. Laurent, president of the Compagnie Française pour l'Exploitation des Procédés Thomson-Houston. It appears that large extensions of the company's works have been carried out during the past year, the volume of business has been greater, and the profits realised have permitted of the payment of a dividend equal to that which was paid in the last few years preceding the war. Not unnaturally the question arises as to whether this development will come to a standstill or, at all events, slacken, after the cessation of hostilities. The view of M. Laurent, which was put forward at the annual meeting held recently, is that everything points to the development being maintained. The difficulties which have arisen owing to the inadequate coal resources in France have clearly shown in recent months the necessity for substituting water power for coal as much as possible now, and also in the period after the war, when many urgent requirements will arise. In this connection, the president of the company in question considers that an almost unlimited field for the manufactures of the electrical engineering industry will be opened up by the establishment of new hydro-electric works, the conversion of a part of the railways to electric traction, and the numerous applications, which are tentative to-day, but will be assured to-morrow, of electric power to the chemical and metallurgical industries. At the same time, the invasion by German products will be at an end in the French home market, and in those of the Allies. It may also be necessary to extend and modernise the telephone system, which is deemed to be quite inadequate for its purpose, whilst the telephone and telegraph installations in the departments invaded will have to be re-established. It is, therefore, concluded that the future will be a time of great activity, for which preparations must be made at the present time.

STAFF ORGANISATION IN ELECTRICITY SUPPLY UNDERTAKINGS.

[COMMUNICATED.]

MUCH has been written on the subject of organisation in electricity undertakings, but no attempt has, so far, been made towards the standardisation of designations in connection with staff positions in these undertakings. The reason for this is probably that local conditions vary so much, and what is regarded as an important position in one municipality may be of little consequence in another. Very often when an electricity official makes inquiries in another city or town regarding the status of the gentleman holding a similar position to his own, he finds that there is no position there exactly the same as his own. The appointment nearly comparable with his is held by an official who possibly has greater or less responsibility than the inquirer.

In our issue of May 4th, 1917, was published an article under the heading of "Promotion in Electricity Supply Undertakings," in which the duties and responsibilities of electricity officials were set forth. The remarks contained therein were based on the supposition that the following system of staff organisation was adopted. This system should be found very suitable for undertakings having a plant capacity of between 10,000 and 50,000 KW.:—

CHIEF ENGINEER AND MANAGER.

CHIEF ASSISTANT.

STATION ENGINEER.

BOILER-HOUSE SUPERINTENDENT.

Technical Assistant.

Charge Engineers

{ Shift Engineers.
Switchboard Attendants.
Drivers.
Firemen.
Trimmers.

Fitters.

ELECTRICAL SUPERINTENDENT.

Sub-station Superintendent.

Sub-station Attendants.

Electrical Fitters.

MAINS ENGINEER.

ASSISTANT MAINS ENGINEER.

Records Draughtsman.

Records Clerk.

Jointers.

Foremen.

CHIEF DRAUGHTSMAN.

Draughtsmen.

SECRETARY.

CHIEF CLERK.

Book-keepers.

Typists.

CONSUMERS' ENGINEER.

METER SUPERINTENDENT.

Meter Testers and Repairers.

Meter Readers.

INSTALLATION SUPERINTENDENT.

Foreman

Electrician.

{ Wiremen.
Installation Inspectors.
Motor, &c., Inspectors.

Showroom

Assistant.

{ Canvassers.
Salesmen.
Clerks and Typists.

Public Lighting

Foreman.

{ Linesmen.
Trimmers.

For small undertakings below 10,000-KW. capacity many of the positions could be combined, while for large systems of over 50,000 KW., although the general scheme as outlined would be appropriate, new subordinate appointments would be necessary.

The question of salaries pertaining to the more important appointments is a matter which should receive more attention than is given in a large number of undertakings. Great divergencies in this respect are shown by a study of the emoluments in various undertakings throughout the country.

In one municipality the salaries of the electricity staff may be arranged on a reasonably graduated scale from the chief engineer downwards, while in another the chief engineer possibly receives a handsome salary, out of proportion to the small salaries of his several departmental assistants next in authority under him.

The rapid growth in the size and importance of electricity undertakings within recent years warrants a careful survey of the remuneration given to the officials responsible for the efficient and economical generation and distribution of electrical energy, which has proved such an important

TABLE OF AVERAGE SALARIES.

Designation.	2,000 KW. capacity.	5,000 KW. capacity.	20,000 KW. capacity.	50,000 KW. capacity.
Chief engineer and manager	£100	£500	£1,000	£1,500
Chief assistant	250	300	500	700
Station engineer	200	230	400	600
Boiler-house superintendent	—	—	250	300
Electrical superintendent	—	—	250	300
Mains engineer	180	200	350	500
Assistant mains engineer	—	—	250	350
Chief draughtsman	150	180	300	350
Secretary	130	160	280	300
Chief clerk	—	—	200	220
Consumers' engineer	200	220	350	550
Meter superintendent	—	—	220	300
Installation superintendent	—	—	220	300

factor in the manufacture of munitions of war. The accompanying table of average salaries has been compiled with the view of determining the relative values of the services of those electricity officials who have had, through force of circumstances, to keep to their jobs during the present war.

TARIFFS IN THE ABSTRACT.

AT the present time, when our American friends are discussing the simplification of their tariffs for electric supply—a matter which, judging from the samples quoted in their papers, should present little difficulty—we can the more readily congratulate our own supply authorities on having in so many instances been able to institute simple tariffs, understandable by the average consumer, and yet so drawn up as to safeguard those technical essentials which are necessarily factors in a commercially successful tariff.

Any tariff scale, however simple, is in effect an attempt to average out the value of the service rendered to a particular class of consumer: the simpler the tariff—assuming always that it has been determined on technical and commercial considerations—the greater the number of determining factors which have been averaged out, while a complex American tariff, such as the following, which is supposedly intended to cultivate electric cooking on the low rate, is an attempt to meet each individual phase of the consumer's demand or service with an equivalent rate value:—

American rate based on active rooms; has a primary step of 10 cents per KW.-hour for 4 KW.-hours for each of the first four active or counted rooms, and for 25 KW.-hours for all additional counted rooms; a secondary step of 5 cents per KW.-hour for all energy over that paid for at the primary step up to a total of 7 KW.-hours per counted room, and a third step of 2 cents for energy consumed per month over 7 KW.-hours per counted room.

This tariff is designed for the same purpose as our own "Domestic" tariff of, say, "12½ per cent. of the rateable value of the house plus ½d. per unit," which has been obtained by broadly averaging the determining factors affecting value of service and applying them in a form which is simple and can be understood by the consumer—i.e., in a commercial form.

In comparison, the American tariff is unwieldy and uncommercial, and though we grant that it may be more scientifically correct, its equity, nevertheless, depends on the accuracy with which the average service value of each step, for the particular class of consumers concerned, has been determined.

When we consider that the cost of a KW.-hour supplied to a particular consumer depends on the distance and method of delivery, the time at which, and during which it is delivered (i.e., the effect on the generating plant of the incidence of its delivery as regards the supply of energy to other consumers), as well as on the degree of efficiency of the generating plant, and sundry other lesser technical and

operating considerations which, though pregnant with significance to the engineer, are as Greek to the consumer, and that the tariff has to perform the dual function of embodying the complex desires of the former in the simplest possible form which will appeal to the non-technical imagination of the latter, it will be obvious that it must in every case, irrespective of its simplicity or complexity, be an abstract assessment of value of service, based on a complex average.

The engineer, recognising the practical impossibility of framing any single tariff which will meet the conditions of all consumers, proceeds to classify the latter into grades, nominally according to the average cost of service for each grade, but frequently according to the average commercial value attaching to the service, which may be greater or less than the cost, and depends on the commercial policy adopted by the supply authority.

In any case, the exact cost of supplying an individual consumer is indeterminate, unless he is the only consumer, or each individual consumer has a fixed load characteristic relative to the others, and it is conceivable that, under certain conditions, a group of a dozen consumers, with a great diversity of load characteristic, might be supplied at even less actual cost than one consumer having the desirable all-day load.

Tariff classification has its drawbacks, for the wider the average of a class is drawn, the greater the variation in actual cost as between good-paying and bad-paying—possibly unprofitable—consumers; true, the latter may, by reason of the assistance rendered by the former, more readily develop their demand into a paying load, but meanwhile the development of the former as a sub-class is held up.

To the engineer, tariff classification is an expedient based on imaginary zones of service value: the actual cost of generating electricity is, on the other hand, a very real thing, though varying from hour to hour according to the effect on the plant of the incidence of the individual consumers' loads. The consumers' loads may be likened to the parts of a jig-saw puzzle, which, when fitted together, will give a connected and uniform result: the greater the degree of perfection attained in the fitting together, the less the cost to the generating station, irrespective of the size of individual loads.

This does not mean that a small consumer can be supplied at the same rate as a large one, because obviously distribution and connection charges affect the result, but it does mean that it may be no more costly to supply a number of short-hour consumers having a considerable load diversity, than one long-hour consumer, provided the former utilise the generating plant to the same extent, and do not incur excess connection charges, and that discrimination against the short-hour consumer, just because he is a short-hour consumer, is not justified.

Clearly, it does not concern the generating engineer where the output goes which gives him his 40 per cent. load factor, provided he can keep to that condition of affairs: similarly, it matters not a jot to the supply authority that an individual consumer is of the short-hour type, provided that his load with the others, short or long, assists in producing a long-hour demand.

Most supply engineers, from technical considerations, regard the peak load as the bone of their existence, and if anathema could hinder what is, after all, a normal development of supply, there would be no peak-load consumers. The general supply has always had a peak load, and probably always will have one of a kind, at some time during the 24 hours, and it is absurd to condemn the consumer—often enough it is the beloved long-hour man—for doing just what you have asked him to do, viz., make as much use as possible of the supply.

The consumer can legally command a supply of electricity at any time, and the engineer must, perforce, provide plant to meet such requirements; that this plant is unused for many hours in the day is surely the fault—if fault it can be considered—of users at other times of the day who are not sufficiently enterprising to make use of that which is necessarily provided.

The tariff scale, as a rule, is such as to encourage the long-hour consumer, or class of consumer giving equivalent

conditions, a premium being placed on "duration of use," with or without restriction of demand.

To restrict the demands of individual consumers during the day is to accentuate the evening peak, and it would be more logical to encourage peaks during the day to counter-balance that during the evening. This object is, of course, more or less achieved by the domestic tariffs of the "point five" type, as also by rates which place a premium on "time of use" off the peak.

In this connection domestic tariffs which have no demand restriction, and offer a low uniform secondary charge, appear to offer great possibilities, as although the consumer is unhindered as to the use of energy at any time, it is evident that a practical limit exists to his lighting requirements, while the limit of his requirements for other purposes, largely during the day, for which such a tariff directly caters, has not yet been ascertained.

On the other hand, it is probable that the ordinary separate lighting tariff is an indirect cause of the peak load, because the ordinary lighting consumer has the impression that each unit costs, say, 4½d., and that he must economise, which he does by restricting his use to peak-load hours: if he should realise that a lower heating rate is available, the disproportionate initial cost of taking advantage of it must be a serious deterrent.

The prospect of developing the heating and cooking load looms so very largely in the future, that one is tempted to speculate as to the ways and means of hastening it.

It seems probable, for instance, that if 75 per cent. of the householders in a street containing, say 100 houses, were to combine and co-operatively purchase energy in bulk for resale at cost price to themselves from the supply authority, at the same time guaranteeing a certain average wattage of heating or cooking apparatus installed, this group of consumers would progress electrically at a much greater rate than the average consumer throughout the area. The street would offer a favourable load, and any improvement brought about by this progressive group of consumers would be reflected in a reduction of charges to them, thus tending to still further development. The supply authority would obtain its most favourable conditions—viz., long-hour use and concentrated load—the street being equivalent to an American apartment house. If these same consumers were to purchase or hire their apparatus co-operatively, they would at the same time reduce the initial cost of their venture.

Any street or residential area of suitable character, in which a sufficient number of householders agreed to the conditions, could be dealt with on similar terms, a co-operative domestic rate being instituted for the purpose. In effect, such a scheme would sort out the good consumers from the bad and indifferent, rewarding them as a class according to their merits, and intensify and hasten on the domestic use of electricity and electrical appliances amongst those sections of the community most suited for the purpose.

Some towns possess areas suited to intensive development, and some do not; and whereas it is impracticable to apply intensive development on a scale suited to a whole city, it is reasonable to assume that such development is possible in the case of a selected section of the community, and that it might result in a type of super-domestic consumer, whose example and experience would be of great value as an incentive to less enterprising consumers, who would all along benefit indirectly from the general improvement in conditions of supply of energy and apparatus.

A New Power?—According to *Indian Engineering*, Mr. J. A. Hamilton, during the course of a speech at the annual meeting of the Central Engine Works, Singapore, observed that a new discovery had recently been made which, it was said, would completely revolutionise all the known systems of power transmission. "The possibilities of this new system have been readily recognised by the War Office and the Admiralty, and the commercial world has therefore been ignored entirely; in fact, the whole output is taken up for war purposes, and the Germans on the Western Front know to-day that some new power has been discovered, and have been speculating as to what it is. After the war, this system will be available; it will revolutionise all forms of power transmission, and will be highly beneficial to rubber estates, tin mines, and to all power users."

COAL TRANSPORT REORGANISATION SCHEME.

As is well known to the majority of our readers, one of the pressing questions brought about by the conditions of the moment is that of ensuring the coal supply of the community.

This is largely a transport difficulty, and, in order to overcome the latter, the Controller of Coal Mines has devised a scheme, which is to come into operation on September 10th, whereby it is estimated that no less than 700 million ton-miles will be saved annually in the transport of coal by public railway.

Great Britain has been divided into 20 areas, and the scheme relates solely to that portion of the coal which is being transported from area to area for inland consumption. In other words, it bears chiefly upon coal which is being conveyed for long distances or cross-country journeys, both circumstances being prolific sources of trouble in view of depleted railway staff and rolling-stock of all kinds.

This scheme, being designed to relieve transport, is based on four main issues:—(1) That consumption of coal should take place as near the producing point as possible; (2) that in view of the superior facilities afforded by the main trunk lines, the movement of traffic should follow these routes wherever possible; (3) that the movement of coal should, as far as possible, be in well-defined directions, viz.:—North to South, North to South-east, North to South-west, East to West; (4) that an area producing less coal than suffices for its own needs should not send any portion of its output to other areas; and that an area producing more coal than it requires for consumption within the area itself should only distribute the balance to adjacent or convenient areas.

The only limitation in regard to Clause 4 is the need for providing fuel of a special type for certain purposes, and this need has been determined by getting into touch with consumers direct. In this connection arrangements are being made for the issue of certificates authorising supplies of coal of a special type required by steam raisers for special purposes—e.g., mechanical stokers, gas producers, &c.—and collieries, factors, and merchants will be precluded from supplying special grades to consumers in the absence of a certificate issued to the latter by the Controller of Coal Mines.

In the various areas District Coal and Coke Supplies Committees are acting as the Controller's representatives in all matters relating to coal. These Committees have been empowered by the Controller to conduct the necessary arrangements for putting the new scheme into force. It is considered that a minimum of inconvenience will thus be caused to all concerned, as collieries in each area will thus be placed in direct touch with the factors, merchants, and direct consumers whose supplies they will have to provide in future. There will consequently be no necessity for those whose supplies are affected under the scheme to proceed in search on the one hand of new customers, or, on the other, of new collieries. As a safeguard, however, should any factor, merchant, or direct consumer not hear from a colliery by August 27th, 1917, that it is authorised to send supplies, a communication may then be made to the District Coal and Coke Supplies Committee concerned, stating full particulars, in order that inquiries may be conducted and arrangements made for supply before the scheme comes into operation throughout Great Britain on September 10th, 1917.

The movement of coal within the areas themselves—i.e., coal produced and consumed in the same area—remains undisturbed, and contracts will not require to be cancelled.

In the case of coal affected by the scheme, however, existing contracts will be cancelled at 6 p.m. on Saturday, September 8th, and new contracts, to be arranged between now and that date, will come into operation on Monday, September 10th.

Not only should the new scheme result in reducing congestion on the railways, but it ought to assist the coal trade generally in getting a better turnover for their wagons, and tend to minimise stoppages at collieries due to delays in the working back of empty wagons over long distances, or from awkward points involving cross-country working.

In developing the scheme generally there has been a free interchange of views with the District Coal and Coke Supplies Committees as representing the colliery owners, and meetings have taken place with representative factors and merchants, and the Controller is also in touch with the Railway Executive Committee with a view to ensuring that adequate arrangements are set up to meet changed directions in the flow of traffic.

All concerned are strongly advised to secure the map diagram reproduced herewith, and the pamphlet, as referred to in the official notice, as these documents will be found to be of material assistance.

It is emphasised that this scheme does not affect water-borne coal, either export, coast-wise or bunkers, anthracite or coke of any description.

It is anticipated, from inquiry, that very few industries will experience difficulty.

At a recent meeting at which the scheme was explained, the question of varying the local health regulations, in view of the mixed quality of the coal which may be supplied, was raised; it was also pointed out that there should be some protection for the consumer in regard to price, and that the Price of Coal Limitation Act had not proved very satisfactory in this matter.

Maps have been prepared showing the division of Great Britain for coal distribution purposes, and an explanatory memorandum

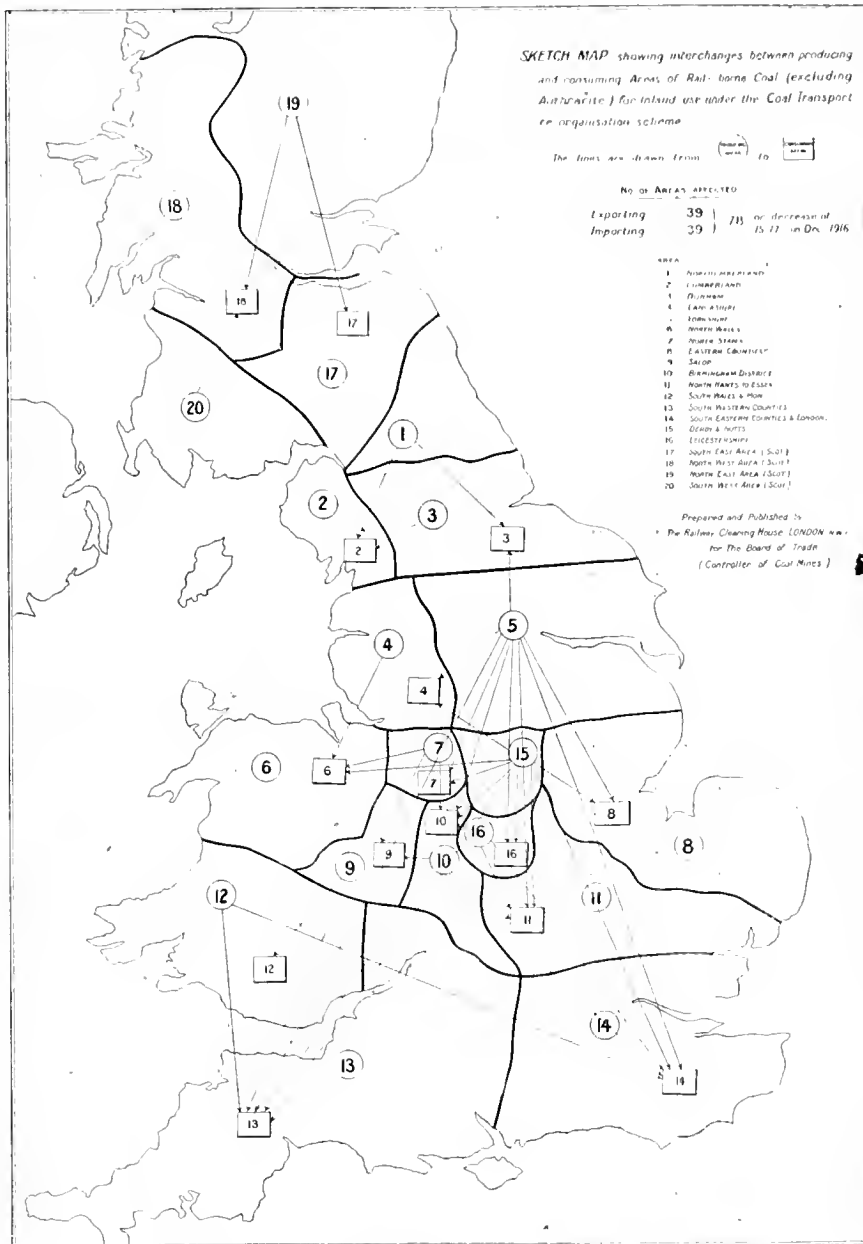


DIAGRAM SHOWING PROPOSED COAL TRANSPORT SCHEME.

contains particulars of the areas to which the forwarding of coal for inland consumption is confined, for (1) steam and manufacturing; (2) gas and coking; (3) domestic use. It also contains a list of District Coal and Coke Supplies Committees responsible for the various areas, and a list of places which are just within the scheduled areas.

40,000 Electrical Employees Subscribe to the War Loan.

—As an indication of the general interest of electrical workers in America in providing the sinews of war, the following information taken from the *New York Times* is illuminating:—40,000 employees of the General Electric Co., of New York, have subscribed for \$3,000,000 worth of "Liberty Loan" bonds, an average of \$75 per individual. The subscriptions were received from the Schenectady, Lynn, Harrison, Fort Wayne, Erie, Pittsfield and other works of the company, as well as from their district offices, and are symptomatic of the attitude of the whole of America.

TAR OIL FUEL AND DIESEL ENGINES.

By GEOFFREY PORTER, A.M.Inst.C.E.

(Abstract of paper read before the DIESEL ENGINE USERS' ASSOCIATION.)

WITH the adoption of an oil fuel other than residual petroleum oils or shale oils has not recommended itself until comparatively recently, owing to the favourable terms on which we have been able to obtain imported residuals. But the force of necessity has compelled us during this period of war to look elsewhere for fuel supplies. Such sources exist in the coal deposits of our own richly endowed land, and they are being brought into utilisation by native talent and skill. It is not impossible that we are on the eve of freeing ourselves from our former dependence upon other countries for supplies of suitable fuel oils.

Mr. Day and Mr. Batho have quoted specifications for tar oil which may be regarded as standard. These specifications I incorporate at this point.

Specification proposed by Mr. C. Day (January 19th, 1916):—

The tar oil must be a product of the distillation of coal tar. No product that has not undergone distillation must be present.

Per cent. insoluble in xylol	...	not more than	2'0
" ash	...	"	0'80
" water	...	"	2'5
" coking residue	...	"	3'0

The oil must be liquid at 60° F. when maintained at that temperature for half an hour. In case of crystals settling in the transport tank, the buyer to be allowed to drain off the liquid portion and to return the solid to the seller.

Mr. Day pointed out that the calorific value of tar oils as determined by numerous tests is not a very variable quantity, and suggested that a definite heat value should not be stated in the specification.

Mr. Batho put forward a specification for tar oils at the Diesel Engine Users' Association meeting of February 23rd, 1916, in the course of remarks he then made, as follows:—

Specific gravity...	...	Between 1'0 and 1'1.
Viscosity	...	Generally 2° Engler (all coal tar oils are very fluid).
Flash point	...	100° F. to 130° F.
Colour	...	Tar oils are, as a rule, dark to almost black. One drop on white paper should show no black residue, as is the case with tar. This black residue means a large percentage of free carbon or other tar ingredients.
Lower calorific value	...	Between 15,800 and 16,500 B.T.H.U. per lb.
Ash	...	Should not exceed 1 per cent. (unburnt residue of tar oil is mostly harmless).
Water	...	Should not exceed 1 per cent.
Sulphur	...	5 per cent. to 1 per cent.
Pitch	...	If the tar oil contains a high percentage of residue which only begins to vaporise at 400° C., one must anticipate a considerable amount of dirt in the engine, and the exhaust valves will require frequent cleaning and grinding in.

The tar oils supplied agree in substance fairly closely with the specifications. It is desirable, at the present moment, not to draw a specification for tar oil too tightly. So far as the demand for these oils in connection with Diesel engines is concerned, it is a new one in this country. Tar oils for our purpose are not yet standardised, and it is too early as yet to draw hard and fast lines. The products we are obtaining are, in general, giving satisfactory results. I have not heard that any difficulties have arisen that are attributed to specific gravity.

I understand that the water content is difficult to determine, chiefly because of the peculiar property of water to collect in pockets in oil. Hence a sample may not be representative of the bulk, and *vice versa*. Further, the oil enters into ebullition at 212° F. Tests of water content must, therefore, be accepted with caution. Owing to the high specific gravity of the tar oil, water is not so troublesome in ordinary engine operation, as it rises to the top of the service tanks. With petroleum residual oil the reverse is the case, and water occasionally will stop an engine if the attendant is not careful.

The coke residue item must be carefully studied. I have seen tests which indicated a coke content as high as 26 per cent. Such an oil would be unsuitable for use in a Diesel engine.

As suggested by Mr. Day, the calorific values agree fairly closely with one another and with the specifications. The lower calorific value is the important one. Below a value of about 15,800 B.T.H.U. per lb. the oil is unsuitable for use in Diesel engines.

The proportion of the constituents insoluble in xylol is an important matter. It is essential to reduce the amount of suspended solids in the oil to an absolute minimum, for they form nuclei for the formation of deposits which carbonise and give rise to difficulties in working an engine. ("Xylol" is described as dimethyl benzol, and has the chemical formula C_8H_{10} ; its boiling point is 133°.)

The M.A.N. specification requires the oil to remain liquid at a temperature of 46'5° F., when it is undisturbed for a period of half an hour, and to be fully liquid at 61° F. Mr. Day's specification concurs. Those of us who have been using tar oils for the first time during a particularly cold winter have learned by experience that this desideratum is not merely a chemist's fad. At a temperature below 45° F. crystallisation is heavy. In one instance I found fully 30 per cent. of the contents of a tank of oil (out of doors), containing 11 tons, to be extremely thick. It could not be pumped at all. Heating a gallon drawn out in a pail dissolved the crystals, but to heat the whole tank was impracticable. Finally the difficulty was overcome by violently agitating the bulk, when the oil became fluid. This method was adopted throughout the winter as occasion required; it cost nothing, and was quite successful. From our experience up to the present one fact emerges, *i.e.*, that tar oil is better stored under cover in a moderately high temperature than in the open.

I have been particularly interested in examining indicator cards of engines burning residual petroleum oil, tar oil alone, and tar oil with the addition of a pilot jet of residual petroleum oil. The use of tar oil produces greater temperatures than does the use of a residual petroleum fuel oil, but the increase is not of high value when allowance has been made for the slower burning property of tar oil by advancing the fuel admission. The starting cards I have been able to obtain appear to be normal; I have not detected any difference of consequence between such cards taken from engines running on the fuels mentioned. In the engine fitted with pilot jet ignition gear under my own charge sudden pressure increases occur occasionally at starting.

Nearly all the cards in my possession, taken at fairly high fractions of full load, are of good shape. I believe that all of us who have used tar oil, with or without pilot jet ignition gear, have found it necessary to advance the fuel admission, the setting for residual petroleum oil being generally too late for the slower burning tar oil. In general, a card taken from an engine using tar oil with pilot jet ignition is not so nicely shaped as a card taken with residual petroleum alone, or with tar oil alone as fuel. The prior ignition of the pilot jet produces a "peaked" admission line in comparison with the regular, slightly drooping curve, which denotes combustion at constant pressure.

My own experience has been with an engine equipped with Messrs. Mirreles, Bickerton & Day's pilot jet ignition gear, and most of my remarks will refer to this engine. The tar oil supply is delivered by the main fuel pump to the cylinders under the control of the governor. The ignition oil is independently supplied, but is not under control of the governor. The quantity of ignition oil is a fixed amount at all engine loads. The ideal quantity is 5 per cent. at full load. The quantity of oil delivered by the ignition pump is set by an arrangement which permits the same adjustment to be given to each pump, each cylinder having its own ignition pump. As the ignition pump is not controlled by the governor, it is advisable to set the governor to keep the engine speed if anything on the low side, as the engine may "run away" when the load is thrown off suddenly. The smaller the quantity of ignition oil used, the less probable is this condition. The provision of some electrically-controlled safeguard in connection with the ignition oil supply would be a desirable feature to adopt. In starting, the engine invariably runs out 20 to 30 revolutions above normal speed. I have run the engine on 4 per cent. of normal full load on the fuel supplied by the ignition pumps alone when set to deliver their maximum quantity.

In fitting these pumps, too much care cannot be taken. Fitted studs and steady pins should be used to preclude the possibility of any movement of the pump body. The adjustments are so fine that even a little shake will affect the oil delivery.

In the ordinary course of running the engine (driving a dynamo direct-coupled) I find the speed control by the governor to be as satisfactory when using tar oil as when burning residual petroleum oil. Impulses are regular; it is seldom that a cylinder "misses"; and one would not be aware that a change of fuel had been made. The engine runs well even on $\frac{1}{10}$ load.

Before commencing the use of tar oil, one or two adjustments must be made. An earlier fuel admission is necessary, owing to the slower burning properties of the oil as compared with residual petroleum oil. I think the amount of the advance depends on the quality of the fuel. In my own experience, I find an advance of about 1° on the crank circle suffices. Similarly, the closing of the needle valve needs a rather earlier adjustment. The only definite method to adopt is that of trial and error. As with residual petroleum oil, the condition of the colour of the exhaust is a guide to correct timing. I have had no difficulty in obtaining colourless exhaust at all loads with injection pressures of the same magnitude for tar oil as for residual petroleum oil. When attempting to use tar oil without ignition gear, I found it necessary to reduce the injection pressure to a large extent in order to obtain satisfactory operation. Those engineers who use tar oil as the sole fuel have also found the reduction of the injection pressure essential for steady operation.

Another important point to consider is the compression pressure in the cylinders at no load. This pressure should not be less than 480 lb. per sq. in. Below this figure, both the ignition of the tar oil and of the residual petroleum oil may be uncertain; and even if regular ignition is obtained, combustion may be incomplete, leading to smoke and high exhaust temperatures. The engine in which I am interested had been at work for a period of 14,000 running hours before being adapted to tar oil fuel. Nevertheless the engine has done consistently good service, using tar oil, for the past nine months, in April last being at work at 65 per cent. of full load (average) for 497 hours, or 16½ hours per diem. Mr. Prentice has also obtained very consistent working with the engine he is

operating with tar oil without a pilot jet. He informs me that the engine has been operated for 2,250 working hours at $\frac{1}{2}$ of full load during nine months, or about 8½ hours a day.

I think it very desirable to fit relief valves to the cylinders when using tar oil. Increases of pressure do occasionally occur at starting, and it is essential, in my opinion, to take all reasonable steps to avoid adding to the already high stresses in the engine parts. The relief valves are set to lift at 750 lb. per sq. in. In the event of a number of "misses" causing an accumulation of fuel on the piston head, and this accumulation suddenly firing, very considerable excess pressures may arise. It is improbable that any relief valve will prevent an explosion, but it will give useful warnings and will take care of all minor pressure troubles.

Pistons become very dirty; the rings become fast in their grooves, and should be examined at three months intervals. The exhaust valves give no trouble. They are cleaned and ground-in at intervals of 250 running hours. I am still using the original exhaust valves supplied with the engines five and a-half years ago. The fuel pumps are rather more troublesome than formerly, owing to the greater amount of sludge found in them. The lower viscosity of the tar oil also renders it more difficult to maintain the plunger glands tight than was the case when using residual petroleum oil.

In the pulverisers we have endless trouble owing to the choking of the cone grooves and rings. Frequently also the passages in the fuel valve casing become choked. The deposit collects rapidly; under the conditions I am familiar with, the deposit must be removed after 50—60 hours' running at about 65 per cent. of full load. If the fraction of full load is greater, the deposit forms more rapidly. This difficulty is very generally found by engineers using tar oil. All tar oils do not show it, and others do so in varying degrees. On some days the deposit is very slight, at other times very heavy; sometimes exceedingly hard, and again very soft. Some engineers have told me that their pulverisers have choked in 12 hours and less. In some instances the deposit is normally so great that it is necessary to reduce the full-load rating of the engine. In my own case the deposit has been less since the warm summer weather set in, and this inclines me to suppose some connection between the crystallisation of the oil in the storage tanks and the deposit in the pulverisers. The cause of the deposit is still obscure. Several engineers have completely got rid of deposits by adopting another pattern of pulveriser. A type which secures the pulverising of a film of oil appears to be satisfactory. In my own case, the choking of pulverisers is merely a nuisance, for other engines are available when the engine burning tar oil is shut down to clean out pulverisers. But for an engineer who cannot ring the changes on his plant, the matter is something far more serious than a mere nuisance.

Another small point from personal observation is the sweeter running obtained by increasing the injection pressure at all loads by about 20 lb. per sq. in. The "cadence" of the engine and the operation of the top gear are then very much more regular. No doubt pulverisation is improved, the impulses are more even, and the governor runs more steadily.

Finally, tar oil is very unpleasant to handle; it is very fluid. The standard of engine and engine room cleanliness, and also of personal cleanliness, is much more difficult to maintain than was the case with residual petroleum oil. I fear that the filthy properties of the oil are inherent, and must be borne with in a philosophical spirit in view of the commercial advantage accruing from its use.

My own engine (fitted with pilot jet ignition gear) has provided the following results from September, 1916, to the end of April, 1917:—

Hours running	...	2,671
Average load	...	58.5 % of full load
Weight of oil fuel per kw.-hr.		
(tar oil and resid. pet. oil)		826 lb.
Pet. oil as per cent. of tar oil		14.9 % by weight
Estimated saving by comparison equiv. cost of pet. oil		494d. per kw.-hour (in cash, £372 7s. 9d.)

On an investment of £160 (the cost of fitting the gear) the return is a handsome one.

The following figures from the daily records relate to fuel consumptions at various fractions of full load, and include both tar oil and the pilot jet oil:—

At 34½ % of full load	...	1.64 lb. per kw.-hour.
" 42 % "	"	1.02 "
" 67½ % "	"	.70 "
" 74 % "	"	.66 "

The next table states the percentage of petroleum oil to tar oil at various loads, in accordance with the adjustments adopted in the ignition oil pumps:—

At 20—29 % of full load	...	17.5 %
" 40—49 % "	"	16.4 %
" 50—59 % "	"	15.0 %
" 60—69 % "	"	13.9 %
" 70—79 % "	"	13.3 %

If these figures are plotted on squared paper a straight line results, as should be the case, and if the line is continued to ascertain the percentage at 100 per cent. of full load one finds 10.3 per cent. as the proportion of petroleum oil at that stage.

I have run the engine many times on lower proportions of petroleum oil, but found that firing was at times uncertain. Ultimately I fixed upon the proportions stated above. I am afraid 5 per cent. is only attainable under ideal conditions.

The figures given in the two tables below relate to a pair of exactly similar engines (under my control), the one burning residual petroleum, the other tar oil with a pilot ignition jet. Higher efficiencies are obtained with the oil of the lower calorific value. I assume the result has its origin in the fact that the residual petroleum oil we are now obtaining has a lower heating value than the oil obtained before the war broke out.

FUEL OIL—RESIDUAL PETROLEUM.

	Running plant load factor.	B.H.P. per kw.-hour.	Overall thermal efficiency.	Cost of fuel, pence per kw.-hour.
1	...	32.1 %	15,650	21.7
2	...	17.1 %	15,480	21.8
3	...	61.2 %	13,370	24.1

FUEL OIL—TAR OIL WITH PILOT JET IGNITION 10.3 % AT FULL LOAD.

1	...	36.3 %	15,005	22.6
2	...	47.2 %	13,229	25.79
3	...	19.5 %	15,205	24.23
4	...	62.4 %	12,615	28.9

These figures are not the results of trials, but are taken from the daily records, and are put forward as an example to indicate approximately the limits within which results may be expected to lie. A few figures giving the reductions in fuel cost in power stations follow:—

1. Engines using pilot jet ignition gear:—

(a) Reduction of fuel cost	...	£12 10s. per week
(b) " " "	...	35d. per kw.-hour
(c) " " "	...	49d. per kw.-hour

2. Engines burning tar oil without pilot jet gear:—

(d) Reduction of fuel cost	...	26d. per kw.-hour
(e) " " "	...	400d. per kw.-hour

Owing to varying rates paid in different localities for tar oil and residual petroleum oil the above figures are not strictly comparative. I have been able to work my three engines without pilot ignition when they are loaded above 70 per cent. of full load. I am not able to guarantee so high a load factor for many hours consecutively, and I found that variations of load gave rise to very unsteady running. I therefore adopted the pilot ignition gear, which enables the engine adapted to operate steadily at all fractions of full load. I also attempted to operate with mixtures of tar oil and petroleum residue oil, obtaining fairly favourable results when using an even mixture of the two fuels. Difficulties arose in the course of time, and I came to the conclusion that the method was a dangerous one.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Electric Furnace for High Temperatures.

An electric furnace in which can be obtained a temperature up to the melting point of platinum is almost an indispensable piece of apparatus in any laboratory. A suitable one is not easily obtained at a price that is not prohibitive.

The furnace shown in fig. 1 is simple in construction, inexpensive, and comparatively long-lived. The heating unit of this furnace is

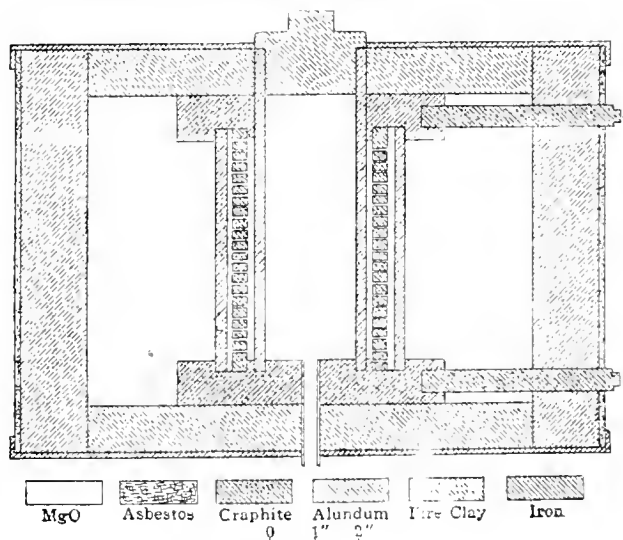


FIG. 1.—SECTION OF ELECTRIC FURNACE.

a helix of Acheson graphite made by sawing around the tube, the material sawed out being replaced with aluminum cement, forming a solid tube which is comparatively strong and can be handled with ease without breaking. The aluminum cement also insulates one

turn from the other and prevents gases from passing through the helix. The one illustrated requires from 25 to 30 amperes at 100 volts for temperatures ranging from 1,100° to 1,500° C. Temperatures up to 2,000° C. are readily obtained.

The graphite resistance coil is confined in a space between aluminum tubes—graphite tubes may be used—to or from which gases cannot readily pass, and in which the gas constitutes an atmosphere in which the resistor element is chemically in equilibrium. The gases present and surrounding the resistor are chiefly carbon monoxide and nitrogen.

The body of the furnace is inexpensive and simple in construction, and if, when put together, the joints are plastered with aluminum cement, it is practically impossible for air to find its way to the graphite resistor, which is readily oxidisable in air above a red heat.

In this furnace, the author has made 36 heats ranging in temperature from 1,100° to 1,600° C., each for a period of five hours, making 180 hours of service. The furnace is apparently in good shape yet. When it gives way a new one is readily put in its place by removing the top iron plate, the fireclay plate, and top electrode immediately below it, also the inner aluminum tube, if necessary. The new unit costs from 75 c. to \$1.—A. W. FAHRENWALD, in *Met. and Chem. Engineering*.

Starting Rotary Converters Connected to A.C. Circuits.

A method of starting rotary converters whereby a machine may be brought up to synchronism without causing any appreciable disturbance in the supply mains is described in patent No. 1,224,729, assigned to the GENERAL ELECTRIC CO., U.S.A., by L. Fleischmann. The method applies to a rotary converter which is mechanically connected with an induction motor having a phase-wound secondary. For starting, the motor is connected to the alternating-current mains as an induction motor. The slip-rings of the converter are also

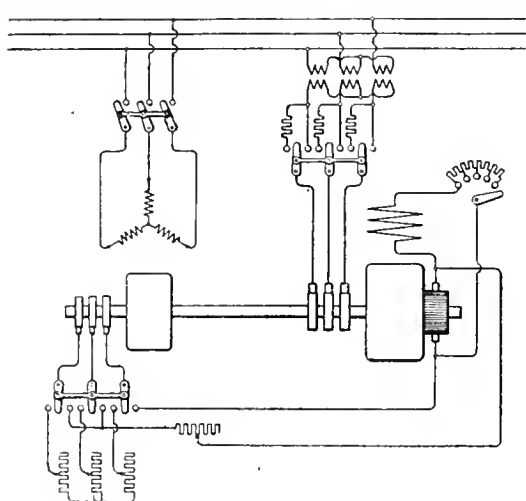


FIG. 2.—CONNECTIONS FOR STARTING ROTARY CONVERTER.

connected to the mains but through resistance, so as to apply only a portion of the normal voltage to the windings. The direct-current end of the converter is then connected to the secondary of the induction motor to supply alternating current of slip frequency. A large torque is thus produced in the motor, which pulls it and the converter into synchronism. The converter may then be connected directly to the alternating-current mains, as it will be in phase, and to the direct-current buses, as it will have the correct polarity.—*Electrical World*.

Electric Submarine Camera.

The *Scientific American* recently described an electric submarine camera for deep-sea photography, which was tested with success on the U.S. steamer *Vestal*, and is the invention of MR. H. HARTMAN, of New York.

The apparatus consists of several cylinders in a rigid steel framework, fitted with a shock absorber at the bottom, and above it a gyroscope to give stability against vibration, which is run from a 12-volt battery in the same cylinder: the three upper cylinders are roughly horizontal, the top one containing a motor and propeller to give direction to the camera. The next one is the camera tank containing, in addition to the camera and its operative mechanism, a distribution board for wiring which is carried up to the deck of the vessel, and enables the camera to be operated from the deck electrically. The third cylinder is a searchlight projector, and both this and the propeller motor are operated through a cable from the ship. The apparatus weighs 1,500 lb. in air, or about 100 lb. submerged, and is suspended from a steel wire rope. About 100 amperes at 120 to 200 volts, according to depth, are required to operate the projector, motors, &c., and the apparatus promises to be of great assistance in securing information in salvage operations where diving is impracticable or difficult.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Electric Radiators.

With reference to the article entitled "Radiators," which appeared in your issue of March 2nd, it might be of interest to you to know that, as a result of three years' close investigation into the relative merits of various designs of heaters, I am in entire agreement with the principles laid down by "Experiment."

It is not usual to associate India with electric radiators and heating apparatus generally, but, as many of your readers know, in the northern parts of this country the winter is often very severe, and fires are required from October until April. In Simla, which is at an elevation of 8,000 ft., the cold is much more intense, and some form of heating apparatus is required practically all the year round.

As the Simla undertaking is hydro-electric, power can be supplied at small cost, and during the past three years we have made every effort to develop the use of electrical radiators and heating apparatus by our consumers.

When first going into this matter, we tried every well-known British-made radiator on the market: and, in addition, we experimented with some of American make. We found, generally speaking, that very few of the radiators gave good results, and this fact, combined with the difficulty we experienced in obtaining spare parts, led us to design and manufacture radiators of our own, for which patents have been taken out. These radiators are designed more or less on the principles laid down by "Experiment," as we have realised for some time that in a radiator it is radiant heat that counts. The results we obtained have convinced us that we get more useful heat per kilowatt out of the radiators made in Simla than it is possible to get out of most of the standard British or American radiators. This is proved by the fact that many of our consumers have returned British manufactured heaters with the request that these should be replaced by those of our own manufacture, and several consumers have informed us that our 1,650-watt heater gives off more heat than 2,000-watt heaters of certain British makes.

Heaters of our make have for some time past been used largely throughout Northern India, and the demand for them is steadily increasing.

In addition to the importance of using an element of suitable design, we have found it equally important to fix behind the elements a reflector of such shape that it will assist in directing the radiant heat in the direction required. Some manufacturers use no reflectors, and others adopt reflectors of a shape that assist but little in radiating effectively the useful heat developed in the elements.

Many manufacturers use the same type of element for different purposes, but I suggest that this is wrong, and an element should be designed to meet the requirements of the particular duty the heater is meant for. If it is to be used as a radiator to give off heat with the maximum efficiency to persons in a room, the type advocated by "Experiment" is the best, but if it is to be used for purposes such as drying clothes, warming plates in a hot cupboard, &c., then an element which gives off an excess of hot air is, if anything, to be preferred.

In conclusion, I would remark that the placing of a red lamp inside a radiator is very effective, for immediately the current is switched on, the whole of the interior is illuminated with a red glow which at once creates an impression of warmth. I have found that this little addition is greatly appreciated by consumers, particularly when radiators are used in the home.

F. L. M.

India, June 5th, 1917.

Electro-Culture.

I trust that Mr. Leslie Miller's inquiry regarding steam static electric machines will be answered. I am afraid the voltage will not be enough, and the cumbersome nature of steam generation is a drawback.

I have made a six-plate Wimshurst which promises a considerable quantity of electricity with a 4-in. spark; the plates are 18 in. glass (cost 3s. each), revolving horizontally on ball bearings. Due to not having a lathe, I have been unable to get it on to the land this year; but I do think that for small experimental plots the Influence machine will be cheaper and safer to use, and the disadvantages mentioned in your splendid article in this week's REVIEW will be easily overcome with our present knowledge.

Can any reader give me the efficiency of a Wimshurst machine? It seems to me to be 100 per cent., except for a slight leakage (neglecting friction, which is practically only the air friction of the plates).

W. A. Turnbull

Electricity Works, Aylesbury.

July 11th, 1917.

Trading with the Enemy.—The *London Gazette* for July 6th contains further lists of persons and bodies in a number of countries with whom trading is prohibited.

REVIEWS.

The Driving of Machine Tools. By T. R. SHAW. London: Scott, Greenwood & Son. Price 4s. net.

This book embodies a series of lectures delivered by the author at the Royal Technical Institute, Salford, and deals with a subject of constantly growing importance; as the author remarks, "control is the essence of machine-tool operation," and in this respect the electric motor plays an ever more prominent part. The days when motors were simply belted or geared to machine tools of standard design are receding into the dim past—nowadays an electrically-driven tool, to rank in the first class, must be designed as a whole, the motor forming an integral part of the machine. The author takes a broad view of his subject, and deals first with the countershaft drive, using cone pulleys and gearing, the principles of correct design being fully explained, together with the characteristics of the work to be handled by the machine, and the methods adopted in practice to vary the speed. Next the all-gear drive, necessitated by modern conditions such as the use of high-speed steel, increased power, and loftier machine shops, is described in its various forms and degrees of complexity. A chapter follows on the applications of the individual motor drive, the well-known advantages of which are clearly stated. The types of motors available, and their respective adaptabilities, are discussed; the author shows that the motor need not be rated for continuous running—a two-hour full-load rating answers for all kinds of machine-tool applications—and that an extremely flexible range of speeds can readily be obtained with the minimum amount of gearing. Starting switches and speed regulators are also described. Other chapters are devoted to planing machine drives, in which the superiority of the electric drive is self-evident, shaping machines, boring mills, &c. The volume, which forms one of the "Broadway" series of engineering handbooks, provides an excellent review of the field outlined, and should prove of great assistance to designers, students, and others concerned with this subject.

The Mechanical Engineers' Pocket-book. By W. KENT, Sc.D., and R. T. KENT. London: Chapman & Hall. Price 21s. net.

Although American hand-books have a relatively limited circulation in this country, there are some which have attained a world-wide vogue; amongst these must be included this well-known work, which is now in its ninth edition, and is in many respects greatly improved. The contents are of necessity encyclopædic in range and variety, for the wants of the mechanical engineer are infinitely diversified; turning over the pages, one is almost bewildered by the mass of tables and concentrated information herein set forth. Such matter does not lend itself to general review, and a mere catalogue of headings would be of no advantage to the reader, while it would occupy an inordinate amount of space. The only true test of a work of this kind is that of use, and having kept it constantly at hand since its receipt, we can testify to its value as a desk companion.

The chapter on electrical engineering has been revised with the assistance of Mr. D. B. Rushmore, and occupies some 80 out of the 1,500 pages composing the volume; severe compression has been necessary to deal with this extensive subject in the space allowed, but some relief has been obtained by giving references to works where particular items are treated at greater length. The matter has been brought closely up to date, and the treatment is remarkably comprehensive under the circumstances.

Taking the book as a whole, it is characterised especially by its adherence to its purpose—to be a "reference-book of rules, tables, data, and formulæ"; unlike some similar works, it avoids extended descriptions of things, which are more appropriate to text-books, and confines itself mainly to working data. In other words, it is not a guide to the novice, but a companion to the practical engineer; as such, it has gained a reputation during its career of 22 years, to which no words of ours can materially add.

The Principles of Apprenticeship Training, with special reference to the Engineering Industry. By A. P. M. FLEMING and J. G. PEARCE. London: Longmans, Green & Co. Price 3s. 6d. net.

The reviewer feels that he owes an apology to the authors for having delayed so long writing his review of their most interesting and informing book. The fact is that he got interested in it, so that instead of reading merely the introduction and contents pages, and basing his review on these, he read it through, and forgot that he was a mere reviewer. The scope of the book is not limited, as might be inferred from the title, to the training which the engineering apprentice receives in the workshop, but deals fully with the practical and general education which a youth should receive during and prior to his workshop apprenticeship.

In his presidential address to the Classical Association, last January, Viscount Bryce, in discussing the chief aims of education, propounded two questions, viz.:—

1. "What sorts of capacities and of attainments go to make a truly educated man, with keen and flexible faculties, ample stores of knowledge, and the power of drawing pleasure from the exercise of his faculties in turning to account the knowledge he has accumulated?"

2. "How should the mental training fitted to produce such capacities begin?"

Now, Viscount Bryce was not discussing the education of the artisan apprentice, but of the boy who will subsequently graduate at one or other of our universities, but the reply he gives to his own questions might be applied with equal appropriateness to the one as to the other. The authors will probably agree that an education which commences on the following lines is calculated to produce as good an engineer as scientist, or diplomat. The mental training to produce the result outlined above should, says Lord Bryce, begin "First of all by teaching him how to observe, and by making him enjoy the habit of observation. The attention of the child should from the earliest years be directed to external nature. His observation should be alert, and it should be exact."

"Along with this he should learn how to use language, to know the precise differences between the meanings of various words apparently similar, to be able to convey accurately what he wishes to say. This goes with the habit of observation, which can be made exact only by the use in description of exact terms. In training the child to observe constantly and accurately, and to use language precisely, two things are being given which are the foundation of mental vigour—curiosity, i.e., the desire to know—and the habit of thinking. . . . What remains is to supply the mind with knowledge, while further developing the desire to acquire more knowledge. And here the question arises: What sort of knowledge?"

The answer to Lord Bryce's last question, so far as the engineering apprentice is concerned, is supplied in Messrs. Fleming and Pearce's book.

We have quoted the above not because the authors do not deal adequately with pre-apprenticeship training, but because the quotation conveys, in better language than the reviewer can command, the impression gathered from a careful perusal of the book as to the initial education which the authors consider desirable. It would be possible to quote many passages from the work under review bearing out agreement between the views of the authors and those quoted above, although the finished product is not the same; but one or two short extracts may suffice. Thus on p. 34:—

"The necessity for careful observation has been repeatedly urged by educational writers, but it is useless to expect boys to look at things which they do not understand, and to 'observe' them. If boys are to observe carefully, they must be first taught to know what they should see. . . . The observation which is valuable is that which involves notice of effects in order to appreciate causes."

In a chapter devoted to existing education in its relation to industry, the authors call attention to the fact that in the early stages "careful study of psychological processes has resulted in the introduction of methods of instruction more in harmony with the child's mind. . . . Interest and curiosity which children have in outside things is utilised to the full, and their co-operation in the process of learning obtained."

But although we appear now, as the authors suggest, to make a good start by adopting a system of primary teaching having a German name—the *kindergarten* system—the characteristic features of the system are not carried into the higher classes, and modern educational methods fail, in the authors' view, owing very largely to the fact that they are too "bookish and pedantic rather than practical." This, they consider, is the main reason for the mutual distrust existing between educationists and business men. The reviewer is not so sure that the term "mutual distrust" is quite the right one; the feeling is rather a one-sided contempt than anything which can be called "mutual." Nor, again, is the contempt directed against the bookish character of the education, but rather against its shocking inefficiency. How many boys, for instance, on leaving school and entering an office, can be trusted to add up correctly a simple money column, to spell ordinary words accurately, to address an envelope intelligently? Any business man will answer that the percentage is very small. This inefficiency of elementary education has a very retarding effect on progress in continuation and technical schools, as the teachers in these schools have to devote considerable time to teaching elementary subjects which form no part of the curricula of these schools. The efficiency of such schools is, therefore, lowered by the initial handicap under which they are placed, rather than by any inherent defect in the teaching methods.

The authors are rather severe on the evening technical school, which they frankly term a failure because, as they allege, the tuition given is of a character utterly unsuited to the character of the students who attend, or should attend, the schools. The other side should, however, not be lost sight of, namely, that the students who attend them are in great measure utterly unsuited to take advantage of the teaching which the evening schools can give them. The reviewer speaks rather feelingly on this subject, having spent many an evening teaching the rudiments of arithmetic to wiring students in order that they might understand elemen-

tary problems in electrical measurement. But what can one expect if boys obtain partial exemption from school between the ages of 12 and 14, and, after having wasted a couple of years in *cul de sac* occupations, begin to think it is time to learn a trade in which they hope to make their living? Soon they feel the need for some technical or trade teaching, and join an evening technical school, having forgotten in the meantime the elementary smattering of education they received at a primary school. It seems hardly fair to blame the evening school for failing, when labouring under so heavy a handicap. No! Let us be fair. Some of the most successful engineers in this country have received the whole of the technical training they ever had at an evening school.

Those who have not made a study of education, and have accepted the statement so often made in the daily Press, that we are miles behind Germany in educational methods, will be surprised to learn for the first time from Messrs. Fleming and Pearce's book that the system of elementary industrial education in Scotland is practically the same as in Germany, and it must be admitted is better than in England. The local education authorities in Scotland, as the authors point out, are compelled to provide suitable continuation schools having reference to the crafts and industries practised in the locality, and have powers to compel attendance; and employers may be compelled by the local education authority to provide facilities for attendance at such schools, and to reckon it as part of an operative's working hours. The above-named powers have been put into force in about 20 localities in Scotland, and are only suspended in others on account of the war. The habit of education in Scotland is so strong that in Edinburgh, although compulsory attendance at continuation schools is not in force, no less than 70 per cent. of the children of school age attend such schools.

From recent statistics it will be seen that throughout Scotland about 20 per cent. of the scholars in elementary schools pass into the continuation schools, whilst in England the number is under 2 per cent. The effect of the higher standard of education in Scotland is no doubt responsible for the high percentage of Scotsmen in responsible positions in English engineering shops, and in the mercantile marine engine rooms. How seldom is an English engineer found in a position of responsibility in Scotland! It is, however, gratifying to learn from the daily Press that Mr. H. A. L. Fisher (Minister of Education) intends shortly to lay before the House of Commons an important scheme of educational reform, embodying the main features of the Scotch system, and the abolition of the half-time system.

But the reviewer finds he is writing an article instead of reviewing the book which he has held up so long. The fact is, it is so interesting and provocative of discussion that it is difficult to keep on the track.

The economic aspect of education, and the relation of education to industry are very broadly and fairly discussed, and the arguments for and against vocational training are fully gone into. Methods of industrial training in England, France, Germany, Switzerland, and the U.S.A. are described in general terms, and specific examples of modern works schools are described in considerable detail, including the schools of the British Westinghouse Co. and Siemens and Halske; and the systems of apprenticeship in vogue at the works of Ludwig Loewe, Siemens & Halske, and the M.A.N. Works are set forth in addition to examples in leading British works. One would have liked to see some reference to the system of engineering training in the British Admiralty, a system which produces first-rate men, and to the collaboration between manufacturers, scientific institutions, and educational establishments, such, for instance, as is in vogue on the North-East Coast. The reviewer throws out the suggestion for the next edition. Sufficient has perhaps been said to indicate that the book is a valuable and timely contribution to the subject of industrial education and engineering apprenticeship training, and deserves the careful study of manufacturers and educationalists—(in parentheses, we don't like the authors' word "educationist").—F.B.

WAR ITEMS.

A Reader's Appreciation.—A Lance-Corporal with the London Electrical Engineers writes, under date July 7th:—

"It occasions me great pleasure to express my thanks for the kindness and promptitude with which you have forwarded the *Electrical Review* during the last 12 months. If it had not been for the matter contained in its pages, and also for its high industrial influence, it is quite probable that I, and many others here, who are almost banned in the whirl of military life, would have lost all touch with the outside electrical world, and might have fallen into such a chaos of disintegration that it would have needed enormous powers of concentration to reawaken our interest. I pass the *Electrical Review* freely amongst my fellows, whose appreciation of its value and merits ranks high, and makes their fingers itch to grasp the good old switches of former days, and to grapple with those problems so necessary to the fulfil-

ment of their art. On behalf of my fellow-men and myself I wish to state that our gratitude and appreciation are sincere, combined as they are with the wish for your future advancement and success."

A Union's Welcome to Disabled Men.—There was a strong protest at Rochdale Town Council against the action of the Electrical Trades' Union in declining to allow their members who are employed at the electricity station to give instruction in switchboard duties to disabled soldiers and sailors. A letter was read from the Union in which it was stated that they were trying to come to some agreement as to wages to be paid, also that no man should be discharged to allow a disabled soldier or sailor to take his place. If an amicable agreement could be come to on these points the Union would issue fresh instructions to its members.—Ald. H. Clark said the letter was one of the most narrow-minded and unpatriotic they had received for a long time. If that was an example of how workers desired to treat one another he hoped employers would show them a better.—Ald. Howarth said the Union did not seem to be helping the Government.—Coun. Shawcross said the placing of disabled men should be a subject of arrangement; it was a quite proper attitude for the Union to take, as they must not say that wounded soldiers were to be placed willy-nilly in a trade, thereby putting regular men out.

Exports from Sweden.—The Swedish Government has prohibited the exportation of accumulators, cells, and batteries, wholly or partly mounted, also electrodes cemented together.

Contraband.—In the "London Gazette" for July 3rd there appears a list of articles to be treated as absolute and conditional contraband.

Copenhagen Difficulties.—As a result of the difficulty in getting the materials for rails, telegraphs, and signals, it is impossible to complete the new underground railway at Copenhagen.—*Times*.

New Industries Established During the War.—Since the outbreak of war many new industries have been established in the United Kingdom, and goods which formerly had to be obtained from abroad are now being manufactured at home. The Department of Commercial Intelligence of the Board of Trade desires to make its record of such new industries as complete as possible, in order to satisfy inquiries for new sources of supplies, which are frequently received. Manufacturers are therefore invited to inform the Department of new industries, or new developments of existing industries, established in this country.—*Board of Trade Journal*.

Exemption Applications.—At Southwark, the Military Representative drew attention to the new list of reserved occupations, pointing out that men previously granted exemption as being in charge of the repair and maintenance of machinery, previously in the list, were now withdrawn from it. The new list only included men exclusively engaged on the repair and upkeep of machinery in munitions works or factories engaged on Government contracts. Ald. Boyd remarked that many Tribunals took no notice whatever of the certified list of occupations.

On the appeal of the manager of the U.D.C. tramways, Ilford Tribunal has given conditional exemption to C. R. Day, ticket inspector.

On a review, the Folkestone Tribunal has confirmed conditional exemption held by E. Marchant (40), clerk at the works of the Electric Light Co.

Oldham Tribunal has granted exemption until October 1st, on business grounds, to an electrical engineer and contractor (29, B 1), and until November 1st to another electrical engineer and contractor (30, Class A), whose partner is in the Navy.

At Douglas (Isle of Man), an appeal was made by L. Dyer (C 2), electrical engineer, engaged, amongst other places, at the Manx brush factory. His work was deemed to be of national importance, and he was conditionally exempted.

Before the Cheshire Appeal Court, the Chester Corporation appealed against final exemption allowed locally to the tramway traffic inspector (30, Class A), and a coach painter in the tramway department (40, Class A), and the Military appealed against three months' exemption allowed to a coach-builder (41, B 1), in the same department. Ald. John Jones, chairman of the Tramways Committee, said they had released every available man. The Tribunal allowed until September 1st to the traffic inspector, dismissed the appeal for the painter, and also that of the Military against the coachbuilder.

At Doncaster, a Military review was made of exemption allowed to a Corporation tramways inspector (29, Class A 2). The chairman of the Tramways Committee said that they could not get proper discipline without capable men as inspectors, and they had got to the lowest limit of men if the service was to remain efficient and the routes were to be kept open. Exemption to September 30th was given, and the Military Representative gave notice of appeal.

At Aldershot, exemption was claimed for F. H. Brown (35), electrician at the Hippodrome, passed in Class B 1 after three rejections. It was stated that it was impossible to get a competent substitute. A final month was granted.

At Carlisle, Messrs. Morton defended a Military appeal against conditional exemption held by A. Munro, electrician, urged by the firm to be indispensable. The appeal was allowed, and the exemption cancelled.

At Canterbury, Mr. C. A. Blaschek, city electrical engineer, applied for exemption for G. E. Locke (38), a coal trimmer, given conditional exemption in 1916. The Clerk stated that the man was discharged from the Navy, but he had been called up again and passed in C1. Mr. Blaschek said that he thought the man was doing work of national importance, and he was exempted until a substitute is found.

Malmesbury Rural Tribunal has given exemption until October 1st to C. A. Harvey (32, Class C3), electrician to the Trustees of the Earl of Suffolk's Estate at Charlton.

On a review, the Maidenhead Tribunal has allowed conditional exemption to remain in the case of G. Lovegrove, electrical engineer. On the recommendation of the Advisory Committee, Rochdale Tribunal has given exemption until September 30th to B. R. Eves (36), tram conductor and motorman, and E. Hornby, motorman, engaged on the Corporation tramways.

LEGAL.

CONTROLLED FIRM SUMMONED BY MANCHESTER CORPORATION.

MESSRS. CONNOLLY BROS., LTD., cable manufacturers, Mill Brow, Blackley (a controlled firm), were summoned at Manchester Police Court, last week-end, for burning trade refuse within 100 yards of a dwelling house, thereby causing a nuisance to householders in the vicinity. The summons was taken out under an Act passed in the eighth year of Queen Victoria's reign, entitled "An Act for the Good Government and Police Regulation of Manchester."

MR. DALE, deputy superintendent of the Corporation's Sanitary Department, said defendants were warned about the nuisance by one of the departmental inspectors on May 23rd, but they repeated the offence on June 12th.

MR. WM. CONNOLLY, the works manager, said the rule was for all shop refuse to be burnt in a destructor, but on each of these occasions it was burnt in a field adjacent to the works, without the knowledge or consent of the firm. He denied that they were burning the insulation off in order to recover the wire, and said the smell was caused by the incineration of used cotton waste.

A fine of 10s. was imposed.

WEST HAM CORPORATION v. BARNETT & WOOD.

IN the Bow County Court, last week, before his Honour Judge Graham, K.C., the West Ham Corporation were the plaintiffs in an action against Ernest Richard Barnett and Wm. Stanley Wood, formerly trading as Messrs. Barnett & Wood, of Albert Works, Chatsworth Road, Stratford, electricians, to recover £18 9s. 2d.

MR. KYFFIN, barrister, appeared for the plaintiffs, and Mr. Vaughan for Mr. Barnett.

COUNSEL said the claim was for electricity supplied and the hire of motors. There was no dispute as to the hiring or the amount, but there was a question as to the form of the judgment. The contracts were signed by Barnett on behalf of the partners, and he asked for judgment in the usual form.

MR. VAUGHAN: If that is done, it involves one being liable for the whole debt, and they dissolved partnership in January. I say that cannot be; it is not fair. If the contract were looked at, it would be seen that "we agree with them to pay for electrical energy." That was a joint agreement, and not a joint and several agreement, which was an entirely different matter. His client was only liable for one half, and the judgment should be in the form of one half each.

JUDGE GRAHAM: If it would do the smallest good to separate the judgments I would do so, but it would not. Judgment for the plaintiffs for the amount claimed against the defendants.

MR. VAUGHAN: Then we shall have to get an indemnity against Wood.

MR. KYFFIN: He says he will pay half.

BLOCH v. STAR MOTOR AND CYCLE CO.

IN the Bow County Court, on Tuesday, before his Honour Judge Graham, K.C., Messrs. H. & S. Bloch, of 31, Great Colmore Street, Birmingham, wholesale small hardware merchants, sued the Star Motor and Cycle Co., of 34, Barking Road, Canning Town, to recover £51 11s. 5d. for electric torch cases supplied. Mr. Emery was counsel for the plaintiffs. It appeared that the plaintiffs' sister called on the defendants, and obtained an order for these electric torch cases, which were supplied. They were distinctly told that the batteries could not be supplied. When payment was pressed for, however, they said they could do nothing with them unless they had the batteries. The cases had not been returned, and no payment had been made. The defendants did not appear, and judgment was entered for the plaintiffs, with costs. An immediate order was asked for and obtained, as counsel said he believed an affidavit sworn by the defendants was to delay, to enable them to make away with assets.

BUSINESS NOTES.

Book Notices.—"Journal of the Institution of Electrical Engineers." Vol. LV. No. 267. June, 1917. This issue contains the following papers:—"High-tension Overhead Transmission Lines," by G. V. Twiss; and "Electric Wave Phenomena in the Dynamo-electric Machine," by F. Creedy.

"Steam Turbines." By J. A. Moyer. London: Chapman & Hall. Price 16s. 6d. net.

"The Journal of the Junior Institution of Engineers" for July contains a paper on "The Electric Lighting of Trains," by G. M. Langley, which gives a comprehensive account of most of the successful systems in use.

"Industrial Research in the United States." By A. P. M. Fleming, M.I.E.E. London: H.M. Stationery Office. Price 1s. net, 1s. 3d. post free.—This is the first of a series of papers which the Advisory Council for Scientific and Industrial Research intends to issue. Its purpose is twofold: Primarily, to record the author's observations during his recent visit to the United States; secondly, to afford material for the consideration of the position of the United Kingdom in respect of research. Amongst the companies which undertake research on an extensive scale are many whose products are well known in this country. For example, the Eastman Kodak Co. spends on research about £30,000, or 0.7 per cent. of the company's profits, per annum; the General Electric Co. from £80,000 to £100,000 per annum. The most striking features of the research work undertaken by such firms are (1) the installation in many cases of full-scale manufacturing facilities, which enable processes to be perfected without hampering the works; (2) the provision of manufacturing facilities in the laboratory in order to develop such products as result from new discoveries to the point at which the scale of manufacture calls for transfer to one of the works departments, or to a new or separate organisation; (3) the growing tendency to devote more and more of the resources of the laboratories to pure science investigations, with a view to making discoveries. Other noteworthy facts are the freedom with which results in pure science are published: the growing appreciation in the factory of the commercial value of scientific men; and the recognition of the value of research laboratories as a means of inspiring confidence in the minds of customers. There are a number of Associations of Manufacturers which undertake research work for the common benefit of their members. The research work of the universities and colleges presents many interesting features, and the national institutions which deal with industrial research are lavishly financed, either by the State or by private benefaction. The commercial research laboratories are on an extensive scale, and are well equipped. The war has disclosed in British industry an enormous latent capacity for adaptability to entirely new lines of manufacture, many of which have depended for their development upon scientific research. The research facilities are, as yet, disproportionate to the need, and there is an urgent call for the establishment of an organisation which shall maintain the creative impulse given by the war. In the light of his study of American developments, Mr. Fleming suggests that the most important alternative schemes for the United Kingdom are:—(a) Research laboratories in industrial works; (b) research laboratories for a group of works in the same industry; (c) the centralisation of research in the universities or colleges; (d) an Imperial centralised laboratory for the whole industry. Mr. Fleming adds that, in considering these policies, it is imperative to bear in mind that industry is the basis of national prosperity, and that every resource should be used to facilitate its progress.

"Proceedings of the American Institute of Electrical Engineers." Vol. XXXVI, No. 6. June, 1917. New York, U.S.A.: From the Institute. Price \$1.—This issue contains a report of the presentation of the Edison Medal to Mr. Nikola Tesla for his "early original work in polyphase and high-frequency electric currents." It is also unique in that a paper on the "Illumination of the Panama-Pacific International Exposition," by Mr. W. D'A. Ryan, is illustrated with 29 plates printed in colours, in addition to other figures, in order to show the wonderful effects produced by what was probably the most elaborate scheme of lighting ever brought into existence. The reproductions, which suggest photography in colours, are excellent, and form a striking innovation in a technical publication. The details of the apparatus specially designed for the scheme, and of the results aimed at and attained, are fully described in the paper.

"Circular of the Bureau of Standards," No. 33: "U.S. Government Specification for Portland Cement." Washington: Government Printing Office.

"Records of Railway Interests in the War." Part IV. From August, 1916, to April, 1917. Illustrated. London: *The Railway News*. Price 1s.

Plant for Sale.—Winchester Corporation Electricity Committee is inviting offers for a Bellis six-cylinder tandem-compound engine, direct coupled to a Parker bipolar shunt-wound generator. Full particulars are given in our advertising pages to-day.

Trade Announcements.—The removal of the Birmingham depot of MESSRS. VERITYS, LTD., has had to be deferred for a time owing to the War Office having taken over part of the new building. Their address is still, therefore, 28, High Street.

MESSRS. BROWN, BOVERI & CO., LTD., have acquired temporary offices at 9, Old Queen Street, Westminster, S.W. 1, as from July 14th, their Caxton House offices having been taken over by the Army Council. Telephone number: Victoria 2538.

Catalogues and Lists.—THE POWER PLANT CO., LTD., West Drayton, Middlesex.—Folder showing their steam turbine gears, double helical mill gears, and double reduction gears.

MESSRS. RHODES, HODGSON & CO., LTD., 118, Tumbling Hill Street, Bradford.—Circular giving particulars of their system of supplying and cleaning sponge cloths for machinery users.

THE ELECTRICAL APPARATUS CO., LTD., Vauxhall Works, South Lambeth Road, S.W. 8.—The July number of the "E.A.C." Quarterly Review contains particulars of a new form of motor-control panel and a high-tension switch pillar of the draw-out pattern.

THE GENERAL ELECTRIC CO., LTD., London, E.C., have issued an advertising novelty concerning "Freezor" fans. It takes the form of a glass showcard struttled for counter and window use, with an attractive prismatic design of the fan. It is calculated to arrest attention of passers-by. The showcards are only supplied to genuine dealers in these fans.

Dissolutions and Liquidations.—PRENTICE WIRELESS TRAIN CONTROL, LTD.—This company is winding up voluntarily, with Mr. F. V. Royce, 5, Broad Street Place, E.C., as liquidator. Meeting of creditors, July 16th.

BRITISH ADDING MACHINE CO., LTD.—This company is winding up voluntarily, with Mr. R. L. Sare, 2, Great Winchester Street, E.C., as liquidator. Meeting of creditors, July 17th.

MARKET HARBOROUGH AND DISTRICT MOTOR TRACTION CO., LTD.—First and final dividend 9s. 10d. in the £, payable by Official Receiver, 1, Berridge Street, Leicester.

UNIVERSAL TELEPHONE AND ELECTRICAL CO., LTD.—This company is winding up voluntarily, with Mr. J. E. Percival, 6, Old Jewry, E.C., as liquidator. Meeting of creditors July 23rd, at 6, Old Jewry, E.C. Particulars of debts, &c., to be sent to the liquidator by October 1st.

BREAR & AYNLEY, electrical engineers, 458, Huddersfield Road, and Albion Electrical Works, Ravensthorpe, Dewsbury.—Messrs. H. Brear & D. Aynley have dissolved partnership as from February 28th, 1916. Mr. Brear attends to debts, &c., and is carrying on the business in his own name at Calder Wharf Mills, Aire Street, Ravensthorpe.

CHARLES L. CUTHBE & CO., india-rubber, asbestos and vulcanite merchants, &c., 37, Great Eastern Street, London, E.C.—Messrs. C. L. Cuthbe and E. D. Burley have dissolved partnership as from October 1st, 1916. Mr. Cuthbe attends to debts.

BOSCH MAGNETO CO., LTD.—Creditors must send particulars of debts or claims to the Controller, Mr. A. E. Woodington, 5, Philpot Lane, E.C., by August 13th.

MORRIS & LISTER (LONDON), LTD.—Particulars of debts, &c., to Mr. H. S. Sugden, 36, King Street, E.C. 2, by August 1st.

ROSE AUTOMATIC TARGET CO., LTD.—Meeting of creditors on August 10th, at 14 and 15, Coleman Street, E.C., to hear an account of the winding up from the liquidator, Mr. W. Cantor.

Bankruptcy Proceedings.—C. B. OGILVIE, Whalley Range, Manchester, electrical engineer.—July 18th is the last day for receipt of proofs for dividend. Trustee, J. G. Gibson, Byrom Street, Manchester.

LIGHTING AND POWER NOTES.

Aberdeen.—The Electricity Committee has approved of an agreement to supply a local firm with a minimum of 250,000 units per annum for five years.

Birkenhead.—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking to March 31st last show a total income of £52,240, an increase of £4,025; expenditure amounting to £33,415, and a gross profit of £18,825; after deducting interest and sinking-fund charges, amounting to £14,977, and income-tax £1,059, there remained a balance of £2,790. Special items, amounting to £919, have been charged against revenue during the year, the net balance carried to renewals fund being £1,871, and this fund now stands at £14,065.

Bradford.—YEAR'S WORKING.—The statement of accounts of the electricity undertaking for the financial year ended March 31st last, shows a net profit of £11,812, as compared with £15,988 in the previous year. The income from the sale of energy amounted to £188,500, as compared with £156,800 in 1916. The output of electricity was more than 46,000,000 units, as against 34,000,000 units in the previous year. The costs of generation were £75,600, an increase of £26,300, but the cost of distribution decreased by £260. Generation and distribution costs combined averaged 13½d. per unit, as against 10½d. in the preceding year. Allowances to dependents of men on military service absorbed £22,841, an increase of £673. Charges for interest and sinking fund amounted to £74,300 per annum. Practically half of the total capital expenditure of £1,100,000 had been paid off, and £36,000 now stood to the credit of the reserve and renewals account. The Committee, in view of the increased cost of working, expressed satisfaction with the result of the year.

The Electricity Committee has received an intimation from the B. of T. that the Electrical Distribution of Yorkshire, Ltd., has decided not to proceed further during the present session of Parliament with its application for a prov. order relative to Clayton and Queensbury.

Burnley.—YEAR'S WORKING.—The report of Mr. Starkie, the borough electrical engineer, for the year 1916-17, shows a total revenue amounting to £34,340, working expenses £17,006, and a gross profit of £17,334, as against £16,380 in the previous year. After meeting interest and loan charges, the net surplus was £3,464, as against £4,472. Charges were increased during the year, and brought in £1,150 additional revenue, more than compensating for the added costs, but extra loan charges more than absorbed any gain under this head. The units sold totalled 5,222,626, a small increase on the previous year, due to improved power and heating business. The maximum load was 2,167 kw., and load factor 27.5 per cent.; the station plant capacity was 5,570 kw. The motor load amounted to 2,064 h.p. in 421 motors, and it is noted that it has become necessary to run the plant for the whole of the 24 hours in order to cope with the night load, hitherto carried by the batteries.

Bury.—YEAR'S WORKING.—The report of Mr. S. J. Watson, the chief engineer, on the electricity undertaking for the year ended March 31st last, shows that 13,971,547 units were sold, or, roughly, 470,000 more than in 1915-16. Of these, 95 per cent. were supplied from the Chamber Hall power station. Some 8,700,000 units were sold for power and heat and 3,000,000 units for bulk supply; the load factor for the combined general and traction supply was 31.7 per cent. A total of 1,029 motors of 8,638 h.p. are connected to the mains. The generation and distribution costs amounted to, roughly, ½d. per unit, and the total cost, including interest and loan charges, to ¾d., while the average revenue per unit was 8d. Both average revenue and costs have risen slightly during the past three years. The output has been maintained on an average of 2.95 lb. of coal per unit, as against 3.06 lb. in the previous year, despite the necessity of using the less economical Rochdale Road plant to a considerable extent, involving the consumption of over 1,000 extra tons of coal as compared with the Chamber Hall plant. The total revenue amounted to £46,596, while the all-in costs were £43,928, leaving a net balance of £2,668, as against £2,003 in the previous year; £1,000 was allocated to rate relief and the balance to reserve.

Continental.—GERMANY.—Under the auspices of the German Continental Gas Co., of Dessau, and the Provincial Authorities of Saxony a new company is being formed, with a capital of £250,000, with the object of operating the new State electricity generating station near Wittenburg. The plant, which is about to be further extended, has already an annual output of about 100 million kw.-hours.

Dartford.—PRICE INCREASE.—In order to meet the extra cost of production, the U.D.C. has increased the price of energy for lighting by 30 per cent. instead of 20 per cent., and for power by 35 per cent. instead of 20.

Donaghadee (Co. Down).—The B. of T. has decided to defer the revocation of the Donaghadee Electric Lighting Order for a period of 12 months as from August 18th next.

Grays.—PRICE INCREASE.—The U.D.C. has decided to advance the price of energy to all consumers, as from July 1st, by 8½ per cent., making a total increase since the war began of 33½ per cent., and to add to new consumers' agreements the minimum charge of 6s. 6d. per quarter.

Heckmondwike.—PRICE INCREASE.—The U.D.C. has adopted the recommendation of a special meeting that the charge for electricity be increased by 33½ per cent., making it 6d. per unit for lighting, and from 2d. to 4d. for power, according to units consumed per h.p., and that the discounts be reduced from 5 to 2½ per cent.

Knottingley.—The B. of T. has extended the period under the E.L. Order by a year.

London.—BERMONDSEY.—YEAR'S WORKING.—The accounts of the B.C.'s electricity undertaking for the past year show a deficit of £7,024. The total income was £12,178. Part of the deficit was due to special charges; the new chain-grate stokers, costing £912, had increased the capacity of the boilers, whilst bulk supply apparatus costing £434, and a boiler feed pump, £297, had been installed out of revenue. War service pay, £337, and war bonus, £249, were other special charges. The units generated, including 189,020 from the bulk supply, were 7,581,914, and of these 256,441 were sold for public lighting and 6,232,255 to private consumers. The total maximum supply demanded was 2,740 kw. The units sold fell short by 207,800 of the quantity estimated, but were 210,000 more than in the previous year.

The Electricity and Street Lighting Committee recommended that the charges for power be further increased by 20 per cent. on the pre-war rate, making 50 per cent. in all, and for lighting a further 10 per cent. on the pre-war rate, making 40 per cent. in all. The Council sanctioned the increased prices, but referred the accounts back for further details.

The Finance Committee reported that with regard to £340 estimated for war service pay during the next year, it was of opinion that this should be a charge on the general rate, as well as the sums under the same heading for the last three years, making a total of £1,133 ss. 10d., and recommended accordingly. The Council adopted the proposal.

ISLINGTON.—In accordance with instructions given to dispense as far as possible with public lighting during the summer months, wherever possible the electric lamps on one side of the road have been extinguished and certain others put into lighting at a distance of about 100 yards apart. The total number of electric lamps in

lighting (exclusive of converted gas lamps, *i.e.*, lanterns on arc-lamp columns) is 412, of which 229 are lighted by arc lamps, the remaining 183 having been converted to one-watt lamps of either large or small candle power. The number of electric lamps put out of lighting in consequence of the reduced lighting is 110.

HACKNEY.—The B.C. has received the Arbitrator's award with regard to the salaries and wages of the staff and employees of the electricity undertaking. The award, which dates back to the first pay day in April, 1917, will increase salaries and wages by a total of £3,526 per year, made up as follows:—Officers, £770; works and running staff, £1,842; sales department, £255; destructor staff, £659.

Nottingham.—The Corporation is proposing to apply for a prov. order for electricity supply in the Kirkby urban district, amongst other places.

Oldham.—**YEAR'S WORKING.**—The report of the joint engineers on the working of the Corporation electricity undertaking during the last year shows a total revenue of £73,555, working expenses amounting to £11,714, and a gross profit of £31,840, as against £26,698 in the previous year. Deducting interest and sinking-fund charges, the net surplus was £9,032, as against £5,107 in the previous year. The units sold were 14½ millions, against 10½ millions (roughly) in 1915-16, the power units having increased from 5,385,000 to 9,338,000 in the 12 months. The additional 4 million units sold only increased the fuel bill by about £1,700, and the works distribution and management costs fell from '852d. in 1915-16 to '69d. per unit in 1916-17. No doubt this result was due in part to the new turbine and boiler plant brought into use, by which the generating plant capacity was increased from 10,140 kW. to 13,140 kW. The maximum load was 6,810 kW., and load factor 21·31 per cent., as against 22·27 per cent. in the previous year. The report contains a series of coloured diagrams which illustrate the progress of the last few years, and it is worth noting that the marked increase in power units sold nearly coincides with the marked economy in coal consumption, which now amounts to about 3½ lb. per unit sold, as against nearly 8 lb. in 1913.

Rotherham.—**LARGE TURBINE PLANT.**—At the meeting of the B.C., last week, the purchase was authorised of a new 25,000-Kw. set at the electricity works, with accessories and boilers, at an estimated cost of £275,000. This brings the total estimate for extensions, within the past year, to £675,000, an expenditure of £400,000 being authorised in March.

Sheffield.—**ADDITIONAL PLANT.**—The Government Department concerned has agreed to allocate 28,000 kW. of generating plant, boilers, &c., to the Corporation, to enable it to meet increasing demands.

Notice is being given to the Rural District Councils of Wortley, Rotherham, Kiveton Park, Norton, Chesterfield, and Clowne, and the Urban Districts of Stocksbridge, Dronfield, and Handsworth, of the intention of the Corporation to apply for a prov. order to supply electricity in their districts or parts of their districts.

St. Annes.—For the first time in its history, there is a deficit of £85 on the electricity undertaking for the year ended March 31st, attributable to the increased cost of labour and coal, and to the reduction of income due to the Summer Time Act.

Stowmarket.—The Electricity Supply Co. has notified the Council that unless certain difficulties are overcome, all its efforts will be concentrated on the Felixstowe undertaking, and the Stowmarket supply will be discontinued. The trouble is apparently due to the withdrawal of men by the military authorities, and it was suggested that the Council should ask the L.G.B. and Ministry of Munitions to take the matter up with the military authorities. It was agreed to discuss the matter in Committee.

Stretford.—The Electricity Committee has approved the continuation of the terms of the agreement until December 31st next with reference to the supply of electricity to the Stretford Gas Co., subject to an increased charge of 15 per cent., and that the clause providing for a minimum consumption shall not apply for the present year.

Swansea.—In his report on the electrical undertaking, the borough electrical engineer recommends that the installation of electric light in the Corporation dwellings at Trewddfa shall be proceeded with. It was stated in discussion that the charge to tenants would be 8d. per week all the year round.

ELECTRO-CULTURE.—A report has been submitted to the Electricity Committee on the advantages of electro-culture in promoting plant growth, and a Committee is to be formed to visit Hereford and study the work carried out there.

Thornton.—The B. of T. has extended the period under the E.L. Order by a year.

Walsall.—The net deficiency on the electricity supply department for the year ending March 31st last is £8,987, as compared with a deficiency of £899 for the previous 12 months. The change-over from 3,300 volts to 6,600 volts on the E.H.T. feeder to Bloxwich has recently been effected.

Councillor Haward, in discussing the balance-sheet, said it had been made very plain on several occasions that a loss was certain to be made during the transition stage from the old works to the new works. They had, however, sustained a loss which was unexpected, due to the commandeering of plant which was intended for the new power station. The consequence was that, instead of the new works being brought into operation early in 1915, it was not

until February 10th this year that any plant was available for use. He considered that they had a strong claim against the Ministry of Munitions for compensation.

The Mayor mentioned that a substantial claim for compensation had already been lodged with the Ministry of Munitions.

Walthamstow.—**LOAN SANCTION.**—The Treasury has agreed to a loan of £16,387 for the purpose of extending the station, at 5½ per cent. interest, repayable both as to principal and interest, in equal half-yearly payments in 15 years. The electrical engineer has been instructed to make arrangements for the erection of an electrical siren on the Town Hall, to give warning of air raids.

Winchester.—**YEAR'S WORKING.**—The report on the working of the electricity department for the year ended March 31st last, shows a total revenue amounting to £11,131, working expenses £8,834, and a gross profit of £2,601, as against £5,826 in 1915-16; after providing for interest and loan charges, &c., the surplus was £132, as against £575 in the previous year. The figures do not vary greatly from those of 1915-16, increased charges having made up for the falling-off due to restricted supply. The output sold amounted to 910,131 units, against 988,366 in 1915-16, of which power accounted for 328,296 and heating for 165,422 units, some 662 kW. of heating and cooking apparatus being included in total connections amounting to 2,712 kW. Heating and cooking units increased by 18 per cent. on the previous year, while in all other sections the sales decreased. The maximum load was 590 kW. and the generating plant capacity 750 kW.; 6·10 lb. of coal, costing '724d., was used per unit sold.

TRAMWAY and RAILWAY NOTES.

Burnley.—**YEAR'S WORKING.**—The annual report of Mr. Mozley, the general manager, on the working of the Corporation tramways, shows that over 17,000,000 passengers were carried and 1,549,000 car-miles worked. The gross income was £87,421; working expenses amounted to £58,601, and, after providing for war allowances, the balance was £25,606, being a few hundreds better than in the previous year. After meeting interest and loan charges, rents of lines, and income-tax, there was a balance of £5,222, which was placed to reserve; the previous year's balance was £6,010. The working expenses increased by £5,032, due to increased wages, cost of materials, and more repairs carried out, and Mr. Mozley includes a striking list of over 40 articles, of which the cost has increased in a number of cases over 100 per cent., while one case of 394 per cent. increase is reported. Tires show 235 per cent., axles 258 per cent., and steel 143 per cent. increase. Mr. Mozley estimates that £5,600—£6,000 per annum should be provided towards depreciation, and he does not regard the net financial result as satisfactory, although, as some £13,000 has been paid in war allowances and increased income-tax in the last three years, he concludes that but for the war the position would have been a satisfactory one.

Heywood.—There has been a loss on the tramway undertaking for the past year of £783.

Irish Electric Tramway Workers' Wages.—At a meeting of the Union of the men employed by the Dublin United (Electric) Tramways Co., it was announced that the directors had granted a further increase of 2s. 6d. per week, making a total of 3s. 6d. during the past 10 months. Cork Electric Tramway and Lighting Co.'s employees have accepted the company's offer of an increase of 2s. 3d. per week, with half an hour's less work per day and one day off in 12, to motormen and conductors, and 1s. 6d. to other branches.

Leeds.—**FEMALE INSPECTORS.**—The Corporation is considering the appointment of women as tramway and ticket inspectors, at a wage of 30s. per week, with the addition of war bonus, rising, subject to satisfactory service, to 32s. 6d. after six months, and to 35s. after 12 months' service.

Manchester.—After a further week of obstructive tactics the employees on the Corporation tramways threatened a strike last week, and Mr. McElroy, the general manager, went to London to lay the position before the Minister of Labour. As anticipated, the Government stepped in, and pointed out that a strike would be illegal. Sir David Shackleton also informed the men's that if work was continued he would arrange for arbitration within seven days and a decision within a fortnight. A ballot of the employees showed a majority of 280 in favour of a strike, but it was considered too small to warrant such a step, and normal conditions have been resumed, much to the general satisfaction.

Newcastle-on-Tyne.—The Tramways Committee has agreed to a scheme for utilising the sand cars during the winter for distributing coal in the city.

South Africa.—The application of electric traction to certain sections of the S.A. railways has been raised on several occasions in recent years. Mr. John Roberts, the borough electrical engineer of Durban, considers that a great field lies before electricity on the Natal main line, and he looks forward to a time at which large power plants will be established in various parts of South Africa from which the railways will draw their supply. According to this authority, the Durban-Johannesburg line must

inevitably be electrified in the near future, and the supply of current will, of course, be a most essential part of the scheme. The Natal line to Johannesburg is 480 miles in length. Assuming current available at Johannesburg and Durban, a third supply about midway would fall, by a fortunate chance, right in the principal Natal coalfield. To ensure continuity in case of breakdown, two more stations would be required, one midway between Johannesburg and Newcastle and the other between Newcastle and Durban. —*British S.A. Export Gazette.*

Walsall.—**YEAR'S WORKING.**—During the year ended March 31st last, the Corporation tramways carried 10,395,050 passengers and operated over 900,000 car-miles. The revenue amounted to £52,373 (roughly 1s. 2d. per car-mile); working expenses were £30,004 (7½d. per car-mile, including 2d. for electricity); and after meeting interest and loan charges, there was a net balance of £11,170. Of this, £5,000 went in rate relief and £3,146 to special reserve, &c. The buses operated in connection with this undertaking earned 14d. per mile; the operating expenses were 10½d. per mile (including 3½d. per mile for petrol); and after meeting financial charges, a balance of 2½d. per bus mile (£3,146) was carried to the appropriation account.

TELEGRAPH and TELEPHONE NOTES.

Russia.—Owing to the opening of the Russian offensive the All-Russian Radio-Telegraphic Congress has been postponed.

Telephonic Reception of Cable Messages.—It appears that the telephone receiver may take the place of the Kelvin siphon recorder in the reception of cable messages at no distant date. Recently a number of experiments were carried out under the direction of Lieut.-Colonel G. O. Squier, in which the receiving apparatus made use of the "ticker" principle and the audion, both of which figure prominently in the wireless apparatus of to-day. The cable used for the test was 1,086 miles long, and the actual receiver was an ordinary telephone. The feeble current received was broken up by means of the sliding contact "ticker" and rendered audible, and in order to secure greater sensibility, a tuned audion amplifier was used in connection with the "ticker." It is reported that the sensitiveness of the apparatus is so great that less than one-twentieth of the voltage necessary for operating the siphon recorder is sufficient to give good traffic signals. —*Telephone Engineer.*

CONTRACTS OPEN and CLOSED.

OPEN.

Aldershot.—July 17th. E.L. installation at Cargate House, for the U.D.C. Mr. F. Garside, Electrical Engineer.

Australia.—**SYDNEY.**—August 22nd. N.S.W. Government Railways and Tramways. Thirty-six induction motors (Specification No. 488). September 19th.—One 225-H.P. synchronous motor (Specification No. 489). Particulars from Electrical Engineer's Office, 61, Hunter Street, Sydney.

Dublin.—July 16th. Electricity Supply Committee. Transformers for one year. See "Official Notices" July 6th.

Glasgow.—Electricity Department. Boiler-house plant, E.H.T. switchgear (20,000 volts). See "Official Notices" June 15th.

Hull.—July 19th. T.C. Machinery oils for the electricity works and sub-stations. Mr. J. F. Magoris, Acting Electrical Engineer.

Keighley.—August 3rd. 12,000 tons best slack and small slack coal for Electricity Department. Six-monthly and twelve-monthly period. Mr. H. Webber, Boro' Electrical Engineer.

London.—**ISLINGTON.**—July 19th. B. of G. Supply and fitting of complete X-ray apparatus. See "Official Notices" to-day.

Spain.—The municipal authorities of Fuentesancho (Province of Zamora) have recently invited tenders for the concession for the electric lighting of the town during a period of 20 years.

West Ham.—July 17th. Corporation. Two motor ambulance vehicles. See "Official Notices" July 6th.

CLOSED.

Aldershot.—U.D.C. Setting up electrically-equipped chain-cutting machinery: Burch & Vertue, £12.

Bridlington.—T.C. 1,000 tons of Bullcroft Main washed small coal for the electricity works: W. P. Wilson, York, 13s. 9d. per ton.

Buxton.—T.C. 2,000 tons of Pilsley hard slack coal for the electricity works: Day & Ferguson.

Dartford.—U.D.C. 2,000 tons of Aberclwyd rough small coal free on rail at Dartford for the electricity works, at £1 4s. 6d. per ton.

Derby.—T.C. 100 illuminated route-number indicators for the tramways: General Seating Co., Ltd., £250.

Dewsbury.—Council. Electric vehicle (£911), Messrs. Mossay & Co.

Halifax.—Guardians. Mr. C. J. Casse, Bradford, at £29, electric wiring of Craigie Lea.

Hull.—Electricity Committee. Mr. Con. Greenwood, at £2,195, for cooling water tower foundations for the electricity works extension.

Sheffield.—City Council. Accepted tenders:—

T. W. Ward, Ltd.; M. C. Burnby & Son; George Turner; Loughbottom and Co.—32,000 tons of coal for 12 months, for Kelham Island power station.

Longbottom & Co.—208,000 tons of coal for Neepsend. Jonathan Longbottom & Sons—375 tons per month, from July, 1917, to June, 1918, of Bentley wash smalls, for Neepsend.

R. White & Sons.—Extension of contract for relaying the crane track on the coal-storage ground at Neepsend, £229. George Cooper.—Steel chimney.

Sunderland.—T.C. Electricity Committee. Redpath, Brown & Co., rolled-steel joists.

Wolverhampton.—Council. Accepted tender:—

Melville Dundas & Whitson.—Construction of new boiler-house wing, including overhead coal-bunkers, foundations and skeleton structure for the boilers, economisers, &c., £5,936.

FORTHCOMING EVENTS.

Birmingham and District Electric Club.—Saturday, July 14th. Visit, in conjunction with the Association of Mining Electrical Engineers, Warwickshire and Staffordshire Branch, to the Walsall Corporation generating station at Birchills. Paper will be read by Mr. H. A. Howie on "Recent Extensions to the Walsall Electricity Undertaking."

NOTES.

Useful Wrinkles.—In the course of certain experiments, Mr. Harry W. Brown, of Ballycarry, Co. Antrim, has discovered that upon charging a condenser from a 500-volt circuit, and then discharging it through the primary of a spark coil, he is able to get good sparking effects from the secondary terminals. The idea may not be new, but he has not yet seen it described in any text-books. He has also found an interesting method of making the calculation of the combined resistance of two circuits in parallel more amenable to the slide rule by using the following formula:—

$$R = \frac{R_1}{1 + R_1/R_2}$$

where R_1 and R_2 are the resistances of the two parallel circuits and R is their combined resistance. This also may not be new, but is certainly more convenient than the usual form.

Volunteer Notes.—**COUNTY OF LONDON VOLUNTEER ENGINEERS (FIELD COMPANIES).**—Headquarters, Balderton Street, Oxford Street, W.

Orders for the week, by Lieut.-Colonel C. B. Clay, V.D., commanding:—**Monday, July 16th.**—Technical instruction for No. 3 Company, Right Half Company, at Regency Street. Drill, No. 3 Company, Left Half Company. Signalling Class. Recruits' Drill, 6.30.

Tuesday, July 17th.—Lecture, 6.30. Physical drill and bayonet fighting, 7.30.

Wednesday, July 18th.—Drill, No. 1 Company, Left Half Company.

Thursday, July 19th.—Drill, No. 2 Company, Left Half Company. Ambulance Class, 6.30. Signalling Class.

Friday, July 20th.—Technical instruction for No. 3 Company, Left Half Company, at Regency Street. Drill, No. 3 Company, Right Half Company. Recruits' Drill, 6.30.

Saturday, July 21st.—N.C.O.'s Parade, 2.0. Map Reading.

Sunday, July 22nd.—Parade will be at Esher for engineering instruction.

MACLEOD YEARSLEY, Adjutant.

Women's Work Exhibition.—An exhibition of official technical photographs and samples of women's work in the engineering and allied industries connected with munitions of war was opened on Monday last at the City Art Gallery by the Lord Mayor of Leeds. It will contain examples of the very latest developments in the employment of women in these industries; its object is to demonstrate the extent to which women have been and can be employed upon responsible work of all kinds. It will remain open until July 21st.

Standardisation in Electricity Supply in France.—In view of the large amounts of hydro-electric power now employed for war purposes, which will be set free on the return of peace, and the scarcity of coal, a Lyons correspondent of the *Revue Générale de l'Electricité* points out the importance of adopting uniform practice in the construction of new power stations, in order to facilitate their interconnection, and enable them to transmit power to distances of several hundred kilometres. Seven or eight generating stations situated on different rivers would thus be able jointly to supply some 200,000 H.P. at 150,000 volts in the region of Paris, thereby saving large quantities of coal.

Municipalities and Electricity Problems.—Reporting upon the Board of Trade Committee on Electricity Supply, the Council of the Association of Municipal Corporations makes the subjoined interesting observations on the Electric Lighting Acts and Orders, with suggestions for reform:—

The section of the Act of 1888, giving to the local authority a provisional veto, was, in our opinion, a useful enactment at that time, but we think it is not suitable to the new conditions already referred to, and we recommend the Association to assent to a reasonable modification of the terms of that section.

The provision giving local authorities the power of purchase also calls for consideration as affecting the position of local authorities supplying energy outside their municipal boundaries. Where this has been authorised, the purchase by an outside local authority of the part of the undertaking in its area would undo the work done in the way of reducing the cost of supply through increased and diverse demand, and consumers throughout the whole area would suffer in consequence. We suggest, therefore, that it should be no longer obligatory to apply to undertakings authorised by provisional orders the provisions of the Electric Lighting Act, 1888, as to purchase. Where, however, rights of purchase already exist we do not think that there should be any interference with them, except upon agreed terms.

A less important provision relating to the promotion of Provisional Orders is contained in Sec. 4 (1) of the Electric Lighting Act, 1882, which requires notice of the intended application to be given to the local authority on or before the first day of July in the year in which the application is made. This was amended by Sec. 9 of the Electric Lighting Act, 1909, by enabling the local authority to waive its right to receive the notice. These provisions have no doubt been useful in the past, but, on the other hand, the necessity to give the notice, unless waived, is liable to cause the loss of a year in obtaining statutory powers, and constitutes, therefore, a hindrance to the extended supply of electricity, and we accordingly recommend that the provisions should be repealed.

Another step to be taken to ensure a cheaper supply of electricity would be to encourage and facilitate the linking-up of two or more generating stations in neighbouring areas, thereby making more economical use of their plant and allowing some of the stations to be closed at times when the demand is reduced, and in some cases to close down stations which, by reason of the general alteration of areas of supply, linking-up, and other economical considerations, have become unnecessary. The adoption of this course in any particular case must necessarily depend upon the circumstances and upon the terms that can be arranged.

Suggestions have been put forward from time to time with reference to uniting in one department the functions now performed by various Government Departments in connection with electrical matters. The department primarily concerned in the supply of electricity is the Board of Trade, who make the Provisional Orders, and who under those Orders and the Electric Lighting Acts have numerous duties to perform. The authority for sanctioning loans for electricity purposes is, however, the Local Government Board, and the Home Office have certain powers in connection with the use of electricity in factories and some other matters. Some advantage would, no doubt, be derived from uniting these several powers in the hands of one department, but we are doubtful whether the scheme would prove altogether practicable, and we further think that the disadvantages attaching to the setting-up of any fresh Government Department would outweigh any advantages there may be; it would, however, be well to strengthen the technical side of the Board of Trade. If any changes are made in regard to Government Departments on this subject, we trust that nothing will be done to relieve them of their responsibility to Parliament.

Board of Trade Committee on Electric Supply.—In connection with the above, at the last meeting of the Bristol Electrical Committee, the following resolutions were passed:—
“That this Committee are surprised and disappointed that the I.M.E.A. has not been invited to nominate a member for the Board of Trade Committee, and further resolves that the Board of Trade be again requested to appoint one or two members recommended by the I.M.E.A. on the Committee, so that the technical side of the municipal case can be adequately represented.

“That the chairman and Mr. Serenington, and the engineer and general manager be requested to interview members of Parliament on the matter.”

The Bradford Electricity Committee has received a letter from the Hammersmith B.C. intimating that its Electricity Committee felt that all Electricity Committees should combine for the purpose of demanding that the Board of Trade Committee as at present constituted should be dissolved, and that a new Committee consisting of a small number of competent, unbiased persons, not directly interested in electrical matters, should be constituted in lieu thereof.

It was decided fully to endorse and support the action taken by Hammersmith.

Scottish Electricians' Wages.—Sir Richard Lodge, Edinburgh, arbitrator in a difference between the Electrical Contractors' Association of Scotland and the Electrical Trades Union, has issued the following award, dated June 25th:—

The workers concerned in the employ of firms in the Electrical Contractors' Association shall receive the war advances granted by the Committee on Production to the shipbuilding trades on March 1st last, on the terms laid down in the Committee's award. Payment of these war advances shall be on and from the first full pay day of the current month. I grant no change in the payments for country money, in the assurance that employers will make allowance whenever extra expenditure is involved on a country job.—*Glasgow Herald.*

Institution and Lecture Notes.—**Canadian Electrical Association.**—The twenty-seventh annual meeting of the Canadian Electrical Association, the first convention of this kind since the European war began, was held at Montreal on June 7th and 8th. It was very well attended, particularly by engineers and executives of systems in the Eastern Provinces of Canada, and was most encouraging in retrospect and prospect. Mr. D. H. McDougall, of the Toronto Power Co., who was recently elected vice-president of the National Electric Light Association, was re-elected president of the Association. In his address President McDougall outlined the difficulties imposed on the Canadian companies by the war, and said the industry had passed through, perhaps, the most eventful year since the founding of the first central-station company in 1881. The demands for energy had in most cases been abnormal, owing to munition manufacture, and to the fact that Canada herself was prosperous, but all the conditions had been met by the companies for the most part, in spite of the inroads on operating and commercial staffs, and difficulties of financing and of securing fuel. Both in Montreal and in Toronto about 35 per cent. of the normal number of men employed have enlisted.

Mr. Julian C. Smith, chief engineer and vice-president of the Shawinigan Water and Power Co., Montreal, read a paper showing the enormous use made of electricity since 1870, and presented the following list showing the kw.-hours used per capita as supplied by the electric service companies in the United States and Canada for all purposes except railways:—

	kw.-hours per capita.		kw.-hours per capita.
Shawinigan Falls, Que.	41,000	Minneapolis	450
Niagara Falls, N.Y.	33,000	Cleveland	400
Three Rivers, Quebec	3,400	Boston	350
Montreal	700	Philadelphia	250
Toronto	700	New York	225
Buffalo	585	Quebec	200
Pittsburg	500	Newark	180
Rochester	450		

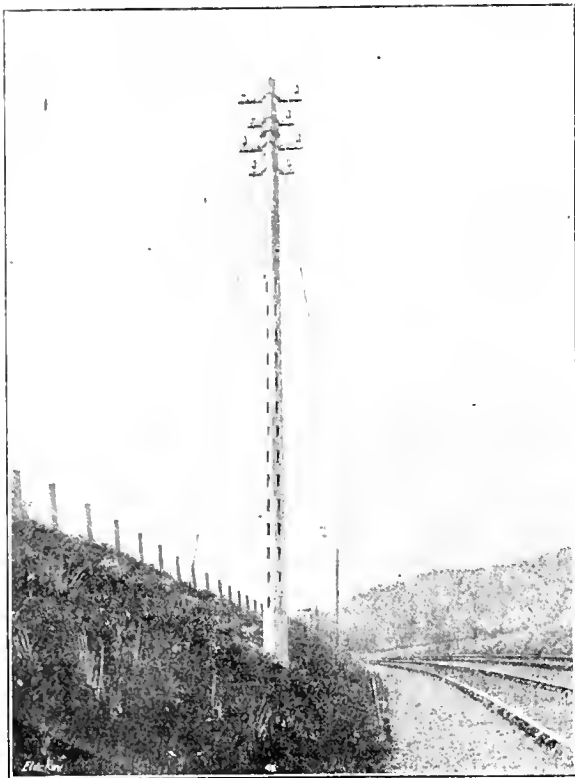
To-day in the United States and Canada, in those places where normal industrial life exists, the kw.-hours used per annum per capita amount to about 500, of which 400 kw.-hours are used for factory purposes and 100 kw.-hours for household uses. With the increased use of small accessories and the development of electric cooking Mr. Smith predicted that the use of electricity in the household would increase 300 per cent. within the next five or six years. At the same time, the industrial use is bound to increase, so that there is every probability that in 10 years from to-day the use of electrical energy will be twice what it is at the present time.

—*Electrical World.*
Society for Electrical Development.—The results of the \$1,250 prize contest, conducted by the Society in connection with the nation-wide house-wiring campaign, April 1st to May 15th, has been announced. The Society offered 35 prizes, ranging in value from \$150 to \$10, to employees of member companies in cities of five classes, from under 15,000 inhabitants to 500,000 and over. For contest purposes, the definition of a contract was construed as “a signed agreement with a new customer for wiring at least three rooms with four sockets or over, in a house already built, located along existing lines, and requiring no other than ordinary service connection.” In two classes there were two winners of the seventh prize. The 37 prize winners wired 2,663 houses, an average of 72 houses each, or an average of two houses during each working day during the six weeks of the contest, and connected up 1,813 kw., an average of 49 kw. each. Salesmen not eligible for entrance in the campaign contracted for wiring over 10,000 houses.

Electric Smelting of Titaniferous Iron Ores.—Prof. Albert Stansfield, McGill University, has recently prepared an article for the Canadian Department of Mines dealing with a big magnetite deposit in Quebec. According to the *Financial Times*, he states that on the north shore of the Saguenay River, Province of Quebec, is a deposit of titaniferous magnetite estimated to contain from 1,000,000 to 5,000,000 tons of ore. Electric power may be obtained at two points on the river—9 miles west and 12 miles east of the deposit. Charcoal and limestone, necessary for electric smelting, are conveniently situated. The ore contains approximately 50.53 per cent. Fe, 10.55 Ti, 0.02 S, 0.03 P, and is susceptible to magnetic separation, yielding a concentrate containing approximately 56.20 per cent. Fe and 8.3 Ti, by which it will be seen that either crude or concentrated, a titaniferous magnetite must be treated. It is stated that 175 tons of concentrates treated in an electric furnace such as is used in Sweden would, with the addition of 0.4 ton charcoal and 0.5 ton limestone, produce 1 ton of pig iron. The electrical power required would be approximately 3,000 kw.-hours per ton of metal produced. To smelt the original ore 0.4 ton of charcoal and 0.7 ton of limestone or dolomite would be required and about 3,500 kw.-hours per ton of pig iron would be consumed. Assuming a plant to consist of three furnaces of 4,000 H.P. each and the output to be 80 tons per day, the total cost of pig iron would be about \$21, and it would be marketable as an exceptionally high-grade iron.

Electric Heating and Cooking.—Under this title we published on June 1st part of a paper purporting to be read by Mr. C. Scott before the Birmingham and District Electric Club. The paper, we find, was read by Mr. R. Weaving before the club on February 13th, 1915, while the paper read on May 12th, 1917, was one by Mr. E. K. Scott, entitled “Electric Furnaces for Nitrates from the Air.” We regret the mishap, due to a contributor's error and tender our apologies to Mr. Weaving.

The Marriott Concrete Pole.—The accompanying illustration shows a 30-ft. triangular hollow telegraph pole, constructed of reinforced concrete on the system patented by Mr. W. Marriott, of Melfou Constable. Many such poles have been erected on British railway lines, which also use the system for signal posts, gate posts, girders, sleepers, and other purposes. The manufacturers and licensees are Messrs. John Ellis & Sons, Ltd., of Leicester, and



MARRIOTT TELEGRAPH POLE.

Mr. W. Jones, of 154-5, Upper Thames Street, E.C., is sales agent. It is claimed that with the Marriott system of reinforcement, posts, &c., can be so designed as to weigh little more than double as much as wood, with greater strength, and that the work is not only cheap—in some cases cheaper than wood—but also practically everlasting.

The British Westinghouse Changes.—Commenting on the sale of the American holding in the British Westinghouse Co., the *New York Electrical World* says:—

"A powerful financial group in London, through the control of the British Westinghouse Co., the French Westinghouse Co., and the Italian Westinghouse Co. are said to have further plans which will rival the great German company, the Allgemeine Electricitäts Gesellschaft. It is significant that the American Westinghouse Co. not only retains a financial interest in this combination, but that the sale of its shares is based upon and made in connection with an agreement of alliance with the London group under which the American company trades in the Western Hemisphere and the Far East, including Asiatic Russia, and the British company in Europe, Africa, and Australia, each company representing the other as sole agent in its respective territory for business that naturally gravitates towards the other. This is especially interesting as it is the first great Allied business combination that has been announced since the beginning of the war, and marks another important development in the affairs of the Westinghouse Co.

Fatalities.—An inquest was held at Bolton, last week, on George Edward Hosler (32), who was employed at the Corporation electricity works cleaning a switchboard, when he caught hold of a live wire by mistake, and was killed. A verdict of "Accidental death" was returned, and the jury recommended that cubicles containing live wires should be locked, so as to prevent any future accident.

An inquest was held at Dudley, on Friday, concerning the death of W. H. Dudley, aged 29, who met with fatal injuries while following his employment at the Electric & Ordnance Accessories Co., Saltley, Birmingham. He was engaged on a circular saw, cutting timber, when a piece of the wood flew back and struck him in the abdomen, causing a rupture of the intestines. The saw was driven by a 7½-h.p. motor. Verdict, "Accidental death."

Irish Peat and Electrical Power.—Strong representations are being made to the Government for the appointment of an expert in electrical engineering on the Committee set up by the Department of Scientific and Industrial Research to inquire into Irish peat resources, and, as peat is such an important factor in electrical development, it is being urged that there should also be some connecting link between the Committee and that appointed by the Board of Trade to inquire into the question of electrical power for industrial purposes. Sir John Griffiths, of Dublin, is chairman of the Irish Committee.

Educational.—**BOARD OF EDUCATION.**—The transfer of the offices of the Board of Education to a part of the premises of the Victoria and Albert Museum took place during the first week in July. As from July 9th, the official address of the Board will be at the Victoria and Albert Museum, Exhibition Road, South Kensington, London, S.W. 7. The official telephone number will be Western 804. The main entrance door to the offices for persons having official business with the Board will be the door in Exhibition Road, hitherto used as the western entrance to the Museum. The President, the Parliamentary Secretary, the Permanent Secretary, the Permanent Secretary of the Welsh Department, and the Chief Medical Officer will continue to occupy rooms in the Board's present offices in Whitehall. Personal letters to them may be addressed to Whitehall. Telephone number, Victoria 6,082.

UNIVERSITY COLLEGE, LONDON.—The new chemical laboratories at University College have been designed to meet the requirements of modern chemical teaching and research, including provision for physical chemistry, in which branch immediate and rapid progress is urgent. The cost of the site, building, and equipment will be £120,000; £100,000 has already been raised, and Sir Ralph C. Forster, who has already subscribed generously to the cost of the laboratories, has promised £5,000 on condition that the remaining £15,000 is raised speedily. Subscriptions may be sent to Lord Glenconner at the College.

Appointment Vacant.—The Liverpool Education Committee wants a lecturer in electrical engineering (£250) for the Central Municipal Technical School.

Some Uses of Magnetic Separators.—The use of a series of magnets of different strengths makes it possible to separate materials having different magnetic permeabilities and also to separate magnetic from non-magnetic ores or concentrates. In treating monazite sands, magnetite is removed by the weakest magnet, ilmenite by the intermediate, and monazite by the strongest. The non-magnetic material passes away, giving three concentrated products. Magnetic separators of the multiple-pole type have found application in the dressing of zinc ores. Marmatite, a ferruginous sphalerite, is slightly magnetic, and is separated from the raw pyrite by the most powerful magnet. Non-magnetic zinc-iron sulphide ores require a slight roast to make the pyrite magnetic, and the separation of these two constituents is accomplished by low-strength magnets. Franklinite, fowlerite, and garnets are separated from willemite, zincite, quartz, mica, and calcite by means of such machines.

Magnetic separation seems to be in use in several tungsten camps in the United States. It is absolutely essential that the concentrates obtained from tungsten mills be high grade and uniform in composition. The magnetic tungsten minerals, wolframite, huebnerite, and ferberite, lend themselves particularly well to treatment by the magnetic separator, according to some authorities. In the wet concentration of tungsten ores, the heavy sulphides of iron, lead, zinc, &c., as well as the heavy oxides of tin, magnetic iron, arsenical sulphides, carbonate of lead, garnets, and other impurities pass off the tables and contaminate the tungsten concentrates. The multipolar magnetic separator completely eliminates these detrimental minerals. Again, there is no market for a mixed product of tungsten and tin, or for wolframite and scheelite mixed, as each of these minerals requires a different method for the extraction of the tungstic acid. By passing the combined wolframite-scheelite concentrates over the magnetic separator, the wolframite is removed by the magnets, while the non-magnetic scheelite passes off at the end of the machine.

Magnetic separation is also possible for the following: the separation of pyrrhotite from other sulphides, garnet, or gangue; of roasted chalcocopyrite from garnet and epidote; of roasted chalcocopyrite from iron or nickel sulphides; of magnetite from weakly magnetic minerals; roasted limonite from smithsonite and calamine; pyrolusite from quartz gangue; leucite from lava; magnetite from corundum; magnetite, menaccanite, chromite, and pyrrhotite from diamond-bearing concentrates; magnetic galena (probably iron-bearing) from zinc ore and gangue; and, finally, hematite from gangue minerals.—*Metallurgical and Chemical Engineering.*

Additions to the B.E.A.M.A. Membership.—The B.E.A.M.A. announces that the following firms have been elected members of the Association:—

Adamson, Daniel & Co., Ltd., Manchester.	Heenan & Froude, Ltd., Manchester.
Andrews, Cuthbert, London.	Macfarlane Eng. Co., Ltd., Cathcart.
Benjamin Electric Ltd., London.	Micanite and Insu., Ltd., London.
Burnley Ironworks Co., Ltd., Burnley.	Newton & Wright, Ltd., London.
Butt, Fredk. R., & Co., Ltd., London.	Newtons, Ltd., Taunton.
Cambridge Scientific Instrument Co., Ltd., Cambridge.	Pinchin, Johnson & Co., Ltd., London.
Cavendish Elec. Co., Ltd., London.	Pirelli General Cable Works, Ltd., London.
Cosser, A. C., Ltd., London.	Reid Bros., Eng., Ltd., London.
Cox, Harry W., & Co., Ltd., London.	Roberts, Wm., & Sons, Ltd., Nelson, Lancs.
Creed & Co., Ltd., Croydon.	Saxon, George, Ltd., Manchester.
Davey, Pixman & Co., Ltd., London.	Schall & Schall, London.
Dean, A. E., & Co., London.	Small Elec. Motors, Ltd., Beckenham.
Douglas & Grant, Ltd., Kirkcaldy.	Submersible and J. L. Motors, Ltd., Southall.
Gent & Co., Ltd., Leicester.	Urmson & Thompson, Ltd., Oldham.
Greville, Ernest, London.	Wood Bros., Sowerby Bridge.
Hathorn, Davey & Co., Leeds.	

Auction Sale.—By order of the Controller in the case of the United Machine Tool Co., Ltd., Messrs. Wheatley Kirk, Price and Co. will, on July 25th, offer the stock of 350 lots of new machine tools, also the goodwill of the business, &c., for sale by auction. Particulars will be found in our advertisement pages.

Congress of Civil Engineers.—On the initiative of the Société des Ingénieurs Civils de France, a Committee has been constituted to organise a general congress of civil engineering of the Allied nations. The purpose of the congress will be the scientific, technical, and economic organisation of all industries. The first meeting will take place in November next, and will be of a purely national character; later on, the Allies will be invited to assist at a second session. One of the 10 sections of the programme (Section VI) is entitled "Electricité Industrielle," but almost all are of more or less interest to electrical men.—*Revue Générale de l'Electricité.*

Conference of Electrical Engineers in India.—We have received a copy of the proceedings and report of the second Conference of Electric Inspectors and Electrical Engineers to Government, which was held in Calcutta last December. The volume, which was edited by Mr. J. W. Meares, Electrical Adviser to the Government of India, can be obtained from the Superintendent, Government Printing, Calcutta, price 3s. 7d. The proceedings dealt with questions of law and the interpretation of the Indian Electricity Acts; the Indian Electricity Rules, 1911, including draft rules for electricity in mines; electric inspectors and Government electrical engineers; questions relating to licensees and consumers; matters relating to electric wiring and installations; electrotechnical questions, &c.

In his opening speech the chairman, Mr. J. W. Meares, pointed out that India was in advance of England in respect of wayleaves, as transmission lines there could be run as though they were telegraph lines. The total number of licensed undertakings was only 21, owing mainly to the difficulty of obtaining capital; when it was obtained in the home market promotion expenses were apt to mount up and drown the enterprise with "water." Lately indigenous capital had taken a hand, and the undertakings so financed were paying dividends—but they should see to it that they did not neglect their reserve and depreciation funds. Another difficulty was the scattered character of the area of supply in Indian towns, but this was partly off-set by the domestic fan load, which resulted in exceptionally high load factors. The jerry-wiring trouble was a thorny problem, which needed attention, and the Indian Electricity Rules required amendment.

Draft rules for electricity in mines were approved, and numerous points in connection with the general rules were considered. It was decided that the testing pressure for high-pressure lines and apparatus should be applied for one minute instead of half an hour, and should be twice the maximum working pressure, but in no case less than 2,000 volts; the Electric Inspector could accept the manufacturer's tests as complying with the rule, and where the normal working pressure exceeded 6,600 volts, the test pressure need not exceed the working pressure. It was also agreed that the use of high-pressure motors under 20 H.P. should be prohibited. The rule for wind pressure on overhead lines was considered on the basis of meteorological records, which showed that the maximum pressures recorded varied widely in different areas, and it was resolved that the specified pressures to be provided for should range from 10 lb. per sq. ft. on the plains in the interior, up to 40 lb. in certain exposed coastal districts. It was held that in all new licences the British standard pressures should be adopted, and that steps should be taken with a view to the modification of existing undertakings in the same direction. In connection with contracts, it was resolved that where a contractor proposed to use material of other than British manufacture, the country of origin should be stated in the tender, and that the use of British standards for accessories was desirable. Proposals for licensing contractors and workmen were discussed. The next conference is to be held in Bombay in January, 1918.

Training Disabled Men.—The Leeds Corporation has given permission for disabled soldiers who are being trained for electrical work under the direction of the Local Naval and Military War Pensions, &c., Committee to attend the electricity works for instruction, at the discretion of the manager.

The British Association.—Sir Arthur Evans is to be president of the British Association for another year. Sir Charles Parsons will preside at the meeting which it is hoped to hold at Cardiff next year.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station and Tramway Officials.—The Burnley Tramways Committee recommends that the salary of Mr. MÖZLEY, general manager, be increased from £450 to £525 per annum.

Walthamstow U.D.C. has confirmed the appointment by the electrical engineer of Mr. G. L. SMITH as station superintendent, at £175 per annum, rising to £200.

The Heckmondwike D.C. Electricity Committee declined to grant an increase of salary to Mr. CARTER, the electrical engineer, under present circumstances, but referred applications for increased wages from the workmen to the Working Committee.

Tunbridge Wells T.C. has granted an honorarium of £50 to the borough electrical engineer, Mr. R. N. TORRY, for services rendered in laying down new plant, &c., without a consulting engineer being engaged.

Mr. W. J. BEST, who was appointed on probation in January last, by the Sheffield City Council, as shift engineer at Kelham Island power station, has been transferred to the official staff at £180 per annum.

Walsall Corporation Tramways Committee proposes to increase the salary of the tramways manager by £100 a year.

The Walsall Electricity Supply Committee has placed on record its high appreciation of the valuable services rendered by Mr. T. LLEWELLYN as clerk of works at the Birchells generating station, and has decided to pay him £25 for his extra services.

Burton-on-Trent T.C. has agreed to Mr. HALL, the electrical engineer, rendering part-time service to assist on the technical side of the Government Coal Distribution Scheme. Mr. Hall was nominated by Mr. Wilson, Technical Adviser to the Controller of Mines, Steam Raisers' Section. Mr. Hall's duties will be to visit the various works in the district selected using coal supplies, and to advise on questions relating to the necessary class and grade of fuel which the firms need to carry on their businesses.

Sheffield Electric Supply Committee has decided that the salary of Mr. H. E. YERBURY (deputy general manager and engineer) be increased from £600 to £700 per annum.

Mr. A. S. HUGHES, electrical engineer with the Carron Co., Ltd., Falkirk, was on Monday evening appointed electrical engineer to Falkirk Corporation, at £325 per annum. Mr. Hughes served his apprenticeship with Messrs. Ernest Scott and Mountain, Ltd. Eleven years ago he became electrical engineer at the Carron Iron Works.

Mr. ROBERT CAVEN, who for the past 10 years has been manager of the Bessbrook electric tramway, has retired. He has been succeeded by Mr. Robert Hamilton, of Bessbrook.

General.—Mr. J. A. LYCETT, general manager of the Black Country tramway systems, is in a new list of Magistrates for Staffordshire.

Mr. THEODORE ZETTEL, of 30, Gloucester Square, Hyde Park, and 67, Queen Victoria Street, London, electrical engineer, has changed his name to Theodore Settle.

Mr. A. W. MAKOVSKI, electrical engineer of Reigate, and Mr. J. E. J. GOUNDRY, electrical engineer, of Reigate, have been elected members of the Council of the Reigate and Redhill Chamber of Commerce.

Corporal YATES, East Lancs. R.E., elder son of Mr. Walter Yates, of Messrs. Matthews & Yates, Ltd., has been gazetted second-lieutenant in the R.E.

At Falwood Parish Church, Sheffield, on June 30th, the marriage took place of Mr. W. MEDLEY, electrical engineer, of Wootseats, Sheffield, and Miss Margaret Crofts, Pontefract.

Mr. F. R. C. ROUSE, who has been connected with Messrs. Venner and Messrs. Chamberlain & Hookham for some years, and is now a Lieutenant and I.O.M. in the Army Ordnance Department, would be glad if Old Students of the Electrical Department of Finsbury Technical College would in future communicate particulars of their doings, &c., to Mr. J. F. Shipley, 35a, Upton Road, Birkenhead, instead of to himself.

Mr. H. C. GREENWOOD, M.I.E.E., chief electrical engineer to the Amritsar Municipal Committee, has been called to war service, and is appointed Electrical Garrison Engineer, Lahore Cantt., in the Military Works Department, and was gazetted on May 3rd, 1917.

Messrs. George Schultz & Co., Ltd., electrical insulation manufacturers, &c., announce that their managing director, Mr. GEO. SCHULTZ (though not at any time a German subject), has by Deed Poll changed his name to George Leonard Scott. No change, however, has taken place in the title of the company, which is composed entirely of British subjects.

Roll of Honour.—We regret to see in the list of wounded officers the name of Major B. ZIANI DE FERRANTI, M.C., R.G.A.

We regret to state that Mr. WILLIAM WILMOT, who was one of Messrs. Falk, Stadelmann & Co.'s country representatives for 15 years, latterly covering more particularly the Manchester district, has died after a few days' illness from pneumonia. He recently joined the R.N.A.S., and was attacked almost immediately with the illness which caused his death. His loss will be keenly felt by his many trade friends.

Private REGINALD CLAUD WHEWELL, who was employed at the Lancashire Electric Power Co.'s station at Radcliffe, has been awarded the Military Medal for keeping up communications under shell fire. He was awarded the D.C.M. in the Battle of the Somme. He is 21 years of age.

Corporal EDGAR JACKSON, West Riding Regiment, who was previously an electrician with Messrs. R. F. Winder, Leeds, has been awarded the D.C.M. for gallantry displayed in making raids on enemy trenches and bringing back prisoners early in June. Three months ago he was awarded the Military Medal.

Private L. S. ROE, Tyneside Scottish, who is in hospital at Exeter, wounded, was employed by the Phoenix Dynamo Co., Ltd., Bradford.

Private C. V. WHITEHEAD (21), who before joining the King's Own Royal Lancasters was serving his apprenticeship as an electrical engineer with Messrs. Storey Bros., Ltd., White Cross Mills, Lancaster, is reported to have died of wounds.

Company-Sergeant-Major G. LEWIS, Sherwood Foresters, reported killed, after being missing since September 3rd last, was an employé of Messrs. Fraser & Chalmers, Erith.

Private A. BANNISTER, Sherwood Foresters, presumed killed after being missing since October 31st last, was with Messrs. Whiting & Taylor, electricians, Derby.

The Times reports that Second-Lieutenant LEONARD SOLOMON, K.O.S.B., who was killed on April 23rd, aged 32, was educated partly at the City and Guilds Engineering College, at South Kensington. He was in Canada when he joined the Forces, but on medical grounds was discharged. He accordingly underwent an operation, came to England, and got a commission. He was an Associate Member of the I.E.E.

Mr. LAURENCE A. GRIPPER, an official at the Blackburn electricity works, who is now a motor-ambulance driver in the Friends' Ambulance Unit of the British Red Cross, attached to a division of the French Army in France, has had conferred upon him the Croix de Guerre—the equivalent to our D.C.M. He is one of five members of the unit to be thus distinguished for conspicuous bravery in rendering ambulance service to the wounded under heavy shell fire, and the presentation was made by a French General at a parade and march past which was ordered as a special honour to the recipients. All the chief officers present shook hands with them, and the proceedings will be formally communicated to the Commanders-in-Chief of the French Army (General Petain) and the English Army (General Sir Douglas Haig).

Captain G. S. THORNE, R.F.C., who, according to the Times, had been missing since March 18th, died of wounds on that day after bringing his machine safely to earth. He was engineer to the Chinese Government power and lighting station at Canton.

Obituary.—ALD. J. MILES.—Ald. John Miles, J.P., the "father" of the Bolton Town Council, died last week at the age of 76 years. For over 40 years he was a member of the Council, and was Mayor in 1901-3. He was Chairman of the Gas Committee when electric lighting was undertaken, and, in addition to laying the foundation-stone of the new electricity works in December, 1893, he switched on the current at the "opening" in the following October. For close on 14 years he was Chairman of the Tramways Committee, and last year was elected Chairman of the Municipal Tramways Association. He was chairman of several companies, including Meters, Ltd., and the Standard Lamp Co., Ltd.

NEW COMPANIES REGISTERED.

C. A. Carpenter, Ltd. (147,868).—Private company. Registered July 3rd. Capital, £4,000 in 3,000 10 per cent. non-cumulative pref. shares of £1 and 20,000 def. shares of 1s. each. To take over the patent rights of C. A. Carpenter connected with burglar and fire alarms, and to carry on the business of electrical and general engineers, &c. The subscribers (each with one pref. share) are: C. A. Carpenter, 38, Brailsford Road, S.W. 2, electrical engineer; A. H. Freeman, 5, Holborn, E.C. 1, secretary. The first directors are to be appointed by the subscribers. Registered office: 79, Gresham Street, E.C.

Grove Engineering & Utilities, Ltd. (147,860).—Private company. Registered July 2nd. Capital £1,500 in £1 shares. Ironfounders, engineers, manufacturers of agricultural implements, electrical engineers, manufacturers and dealers in aeroplane parts, dry-cell battery manufacturers, chemists, druggists, drysalers, manufacturers of and dealers in cases and parts for electric torches, &c. The subscribers (each with one share) are: A. Maher, 29, Croft Road, Merton, S.W. 19, accountant; Miss T. H. Cole, 9, King's Road, Wimbledon, S.W. 19. The first directors are A. Maher and Miss T. H. Cole. Registered office: 196, Merton High Street, Wimbledon.

Fleetway Press, Ltd. (147,853).—Private company. Registered June 30th. Capital, £10,000 in 4,700 pref. and 4,700 ord. shares of £1 each and 12,000 founders' shares of 1s. each. Printers, &c. Agreement with Electrician Printing & Publishing Co., Ltd. The subscribers (each with one share) are: A. Morris, 18, Richmond Avenue, Kingston Road, Merton Park, S.W., printer's manager; A. J. Wilder, 61, Tradescent Road, South Lambeth Road, S.W., accountant. The first directors are to be appointed by the subscribers. Remuneration, as fixed by the company. Solicitors: Biddle, Thorne, Welsford & Gait, 22, Aldermanbury, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Veritys, Ltd.—Mortgage dated June 26th, 1917, to secure £3,850, charged on freehold land, Arrol Works (in the occupation of Jointless Rim, Ltd.), coal basin, &c., at Aston, Birmingham. Holder: G. H. Cartland, Boveré Cottage, near Worcester.

Electrical Contracts & Maintenance Co., Ltd.—Particulars of £3,000 debentures created June 20th, 1917, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

African Direct Telegraph Co., Ltd. (21,895).—Capital, £300,000 in 110 shares. Return dated June 6th, 1917. 23,600 shares taken up, £296,000 paid. Mortgages and charges: Nil.

CITY NOTES.

Marconi International Marine Communication Co., Ltd.

Mr. GODFREY ISAACS presided at the annual meeting last week in the absence of Mr. Marconi, who was representing his Government on a Special Commission to the United States. After going over the accounts, Mr. Isaacs said that in view of the fact that their business was still being conducted under exceptionally unfavourable conditions the figures were satisfactory. Practically the whole of their profits were derived from ships' subsidies, for there was practically nothing doing at the present moment in commercial or private telegrams at sea. Normally they derived a very substantial revenue from those telegrams, and when Peace conditions returned they would no doubt see a very substantial increase in receipts from this source. Not only had the number of ship telegraph stations been immensely augmented during the war, but there had been also a large addition to the coast stations, which would give far greater facilities for communication with the land than obtained prior to the outbreak of hostilities. They were making very considerable losses in consequence of the submarine warfare, all of which they were debiting to profit and loss account. It was to be hoped that those losses would cease, and that they would show additional revenue in consequence. They felt justified, having regard to the sound development of the business, to recommend an increased dividend, which they felt confident of being able to at least maintain, notwithstanding the necessity for increasing the capital. Up to June 30th this year they had already fitted 595 additional ships, making the total number of ships installed, after deducting losses, 1,855, which was by far the biggest rate of increase in the history of the company. Orders on hand were very considerable indeed, and they would be very largely increased in the near future. For that they must make provision. After referring to the additions made to the board, the chairman paid a tribute to the staff. To June 16th they had 3,347 operators and students. Of these, to that date 333 had been saved from vessels sunk, 45 were drowned, 29 had been injured, one killed, and 19 had been taken prisoners of war. A number of instances of splendid heroism were given by the speaker. One man had been torpedoed three times within three months, standing to his post unflinchingly on each occasion; they had now given him a post on shores, because if his nerves had not suffered they ought to have done so.

The net profits for the year ended March, 1917, were £265,220, plus £48,053 brought forward, making £313,273. After deducting debenture interest and normal and special depreciation amounting to £38,541, £274,732 is available, and it is appropriated as follows:—6 per cent. preference dividend, £42,000; employees and managing director's bonus, £18,468; 10 per cent. dividend on ordinary shares, free of tax, £62,500; reserve, £40,000; grants to war dependants, £11,477; repayments of income-tax to preference shareholders, £10,500; balance to carry forward (subject to excess profits duty, if any), £89,786. The reserve account has been increased by £100,000 transferred from pre-war suspense accounts of provision for contingencies which have not arisen, and with the addition of the above £40,000, the total amount to the credit of the account will be £400,000. The operations during the year consisted mainly in continuing and developing the policy initiated at the outbreak of the war. The results have again been satisfactory. The works have all been fully occupied, and almost exclusively in the production of material and electrical equipment for war purposes, so that practically the whole of the output normally employed in the supply of the electrical trade has been diverted to meet such purposes and for controlled establishments. About 1,700 members of the staff and workpeople were now serving with the Colours, so that substitution and dilution of labour had become more imperative than ever. Thanks, however, to the loyalty and united efforts on the part of those members of the company's technical and commercial staff whom the authorities had allowed to remain, it had been possible to overcome successfully most of their difficulties. The scarcity of raw material and the difficulty in obtaining machinery, together with the Government restrictions placed upon all building operations, had not enabled the company to proceed with the preparations for the developments awaiting the electrical industry after the war. Capital expenditure during the year on new works of immediate importance had amounted approximately to £15,000, and £11,000 had been expended, under permit from the authorities, to advance the Kingsway building sufficiently to protect the steelwork. The sales organisation at home and abroad had adapted itself well to prevailing conditions, as was evidenced by the year's results. The investment account of the company had again considerably increased, with an eminently satisfactory return. Nearly £300,000 had been invested in the Osram-Robertson Lamp Works, Ltd.; a further £50,000 had been required by the Pirelli-General Cable Works, Ltd.; and certain smaller sums had been invested in minor factories essential for the production of material for the company's requirements. The Pirelli-General Cable Works, in which the company was largely interested, had this year—the second year of its existence—

shown satisfactory results. All the allied and subsidiary companies continued to do well, with the exception of one or two which had been adversely affected by conditions of war. During the year Mr. Fred S. Sells retired from the board. Annual meeting: July 17th.

We give below the comparable figures from the reports for the three years ended March, 1915, 1916, and 1917:—

	1915.	1916.	1917.
Net trading profit and income from investments ...	£161,877	£196,275	£265,220
Depreciation and debenture interest ...	26,855	27,260	38,541
Prof. dividend ...	38,681 (6 %)	42,000 (6 %)*	42,000 (6 %)*
Available balance ...	136,081	163,716	274,732
Managing director's and employees' bonus ...	9,931	12,701	18,468
War grants ...	7,182	12,962	11,477
Ordinary dividend ...	48,142 (10 %)	50,000 (10 %)	62,500 (10 %)
To reserve account ...	20,000	40,000	40,000
Balance carried forward ...	36,701	48,053	89,786
Reserve fund total ...	220,000	260,000	400,000

* A resolution is to be brought before the annual meeting authorising the payment of a special bonus at December, 1917, to the then registered holders of preference shares, the sum payable to be equal in amount to the total income-tax deducted from the dividends paid in respect of the said shares on December 31st, 1916, and June 30th, 1917.

Edmundsons' Electricity Corporation, Ltd.

The net profit for the year ended March, 1917, after providing for mortgage and debenture interest and redemption, and for £1,165 additional income-tax, amounts to £12,294, as against £13,259 last year. Adding £4,625 brought forward, the total profit available is £16,918, out of which £12,000 is required for dividend on the preference shares, and £4,919 is to be carried forward. We extract the following figures from the schedule, showing gross profits of subsidiary and other companies for the years 1915 and 1916:—

	Gross profit (before providing for capital charges and depreciation).		Load connected in kw.	
	1916.	1915.	1916.	1915.
Alderley ..	£2,813	£3,060	1,133	1,092
Bromley ..	9,125	11,067	4,499	4,254
Folkestone ..	17,189	17,064	5,212	5,064
Guernsey ..	5,208	5,797	5,004	4,850
Isle of Wight ..	8,971	10,493	5,493	5,096
Hfracombe ..	502	816	771	741
Lancashire Co. ..	39,839	32,842	22,828	21,634
Lymington ..	949	1,438	741	730
Melton Mowbray ..	1,763	2,475	904	883
Newmarket ..	1,624	1,970	1,051	1,035
North of Scotland ..	7,550	7,038	3,503	3,391
Ramsgate ..	2,732	3,075	1,499	1,499
Scarboro' Trams ..	-1,068	-1,722	—	—
Salisbury ..	4,885	6,670	1,666	1,545
Urban Co. ..	67,713	70,001	33,886	30,376
Wycombe ..	5,748	6,881	2,621	2,392
Cromer ..	130	368	620	609
Dorking ..	1,932	2,603	988	930
Frome ..	2,076	1,405	1,942	1,777
Hamilton ..	4,883	4,528	2,882	2,799
Surbiton ..	2,877	2,369	1,852	1,736
	£187,441	£190,238	99,095	92,423

* Nine months.

The Lancashire Co.'s figures are included for the first time. The total capital expenditure increased during 1916 from £3,826,409 to £3,854,931.

The Paris Metropolitan Railway.

The report of the *Compagnie du Chemin de Fer Metropolitain de Paris* for 1916 first gives the customary details concerning the works carried out by the City of Paris on the one hand, and by the company on the other. After mentioning that the terminal trunk Opera-Palais Royal No. 7 line was opened on July 1st, the report states that the average length of the network was 48½ miles, of which two miles were worked by the company for the account of the City. The service and the working of the trains were further improved in the measure which was compatible with the difficulties incidental to the maintenance of the rolling stock and the necessity to spare it. At the end of 1916 the rolling stock comprised 703 motor cars, 270 first-class trailers, and 335 trailers for second-class passengers. A beginning was made in 1915 in the direction of providing the doors of the second-class carriages with electro-pneumatic pushers, which permitted of the doors being automatically closed from a distance. This measure was generalised in 1916, and was extended to the end doors of the first-class carriages. In addition, no seats had been provided in a certain number of compartments in some of the second-class carriages for the use of passengers with bulky parcels.

The accounts show total receipts from passenger traffic and sundry receipts amounting to £2,311,000, the working expenses having been £1,089,000. The ratio of working expenses to receipts was 47.14 per cent., as compared with 43.69 per cent. in 1915. After deducting the share paid to the City out of the gross revenue according to the terms of the concession—£755,000, as contrasted with £596,000 in 1915—and after meeting the interest charges on the loan capital of £5,000,000, the accounts show net profits of £271,000, which has permitted of the declaration of a dividend at the rate of 5.6 per cent.

on the ordinary share capital of £3,000,000, leaving £56,000 to be carried forward. The report also deals with the difficulties arising from the scarcity and dearness of raw and other materials, and states that the coal bill alone increased by £240,000 in 1916 as compared with a normal year. Under the circumstances, the directors had approached the City of Paris, whose share in the profits had largely increased, with a view to securing a revision of the concession contract, so that one of the parties should not have to incur all the risks and the other obtain larger profits due to unforeseen circumstances. At the same time permission is being sought to raise first-class fares, so as to defray the cost of war increases already granted to the company's servants.

Swiss Companies.

The Société Paul Girod, of Neuenburg, earned gross profits of £418,000 in 1916, as compared with £143,000 in the previous year, the net profits being £281,000 and £57,000 in the two years respectively. It is proposed to pay a dividend of 10 per cent., as against 8 per cent. in 1915. The company is to be amalgamated with the *Acieries Girod, of Ugine, France*, by means of an interchange of shares.

The Motor A.G. für Angewandte Elektrizität, of Baden, which owns electricity supply works, and is interested in others, reports that the demand experienced by these works in 1916 was exceptionally active, although it was impossible to raise prices in proportion to the growth in the cost of production. It was to be assumed that constructional work in regard to new undertakings would be brisk after the war, especially in those countries which were largely dependent upon imports of coal, and which would develop their water power resources. The accounts show net profits of £90,000, as compared with £89,000 in 1915, and a dividend at the rate of 7 per cent. is proposed on the ordinary share capital of £1,200,000, being the same as in each of the four preceding years.

The Société Franco-Suisse pour l'Industrie Electrique, of Geneva, which is an investment company, reports that no occasion arose in 1916 for embarking upon new business, but various subsidiary companies experienced considerable development in which the company participated within the limits of its funds. The losses on the rate of exchange, which was again seriously felt, had been equalised by the higher quotations which prevailed for a number of securities as contrasted with 1915. The receipts from interest, dividends, and other investments reached £75,000, as against £74,000 in the previous year. After defraying general expenses and meeting interest on the loan capital of £879,000, the accounts show net profits, including £4,000 transferred from the special reserve fund, amounting to £44,000, as compared with £11,000 in 1915. It is intended to pay a dividend of 4 per cent. on the share capital of £1,000,000, this contrasting with no distribution in 1915 and 1914, and 5½ per cent. in 1913.

Electric & General Investment Co., Ltd.—Mr. J. B. BRAITHWAITE, presiding at the annual meeting of the company last week, said, according to the *Times*, that since the outbreak of the war the ordinary financial business out of which the company usually made its living had been almost non-existent. They had therefore simply to conserve their resources and quietly await the return of peace. Instead of paying a dividend, the board considered it better to strengthen the company's financial resources.

Chile Telephone Co., Ltd.—During the year ended at March, 1917, the subscribers increased by 936 to 14,243. The total length of lines in operation increased by 1,379 miles. The gross revenue advanced by £30,209 to £152,182, and the total expenditure (exclusive of income-tax) by £26,674 to £92,597. The net revenue was £59,584, an improvement of £3,535. Dividend already paid 3s. per share, free of tax; a final dividend of 5s. per share is now recommended; £16,386 is put to reserve, and £2,000 to reserve against loss on investments, carrying forward £5,202.

Havana Electric Railway, Light & Power Co.—The accounts for 1916 show a net profit of \$2,421,291, as compared with \$2,236,257, and an available sum, including \$1,709,956 brought forward, of \$4,131,248, out of which dividends amounting to 6 per cent. on the common shares have been paid, as compared with 5½ per cent. for the previous year, and after transferring \$75,000 to reserve for depreciation, and \$123,083 to reserve for bad and doubtful debts and other adjustments, \$2,024,501 remained to be carried forward.—*Financial Times*.

Dublin United Tramways (1896), Ltd.—Interim dividend, 4 per cent. per annum (4s. per share), less tax, on ordinary shares.

Sao Paulo Tramway, Light & Power Co., Ltd.—Dividend of 2½ per cent. on the issued common stock.

Direct United States Cable Co., Ltd.—Interim dividend, 2s. per share, less tax, for the quarter ended June.

Fraser & Chalmers, Ltd.—Interim dividend of 7½ per cent. on the preference shares, less tax.

Winnipeg Electric Railway Co.—There is a decrease of \$35,742 in net income, and no dividend is recommended for 1916.

Dublin United (Electric) Tramways, Ltd.—Interim dividends, 6 per cent. per annum, less income-tax, on the preference shares, and 4 per cent. per annum, less income-tax, on the ordinary shares.

STOCKS AND SHARES.

TUESDAY EVENING.

AERIAL, rather than financial, interest has been a feature in Stock Exchange markets this week, although it is surprising how very quickly London settles down to its accustomed grooves as soon as immediate danger is past. Brisk business has been done in aircraft policies—brisker than that, in fact, which has characterised the market in stock and shares. At the same time, the strength of the latter is extremely well maintained; and the way in which the prices of Consols, the War Loan, and other gilt-edged securities keep up constitutes something of a standing marvel to those who preach a forthcoming War Loan and, as a sequel, further depreciation of values.

Home Railway stocks continue to make an extremely good showing; and there has been a little more inquiry for some of the home electrical shares. Amongst telegraphs, West Coast of America shares are once again better; while in the group of cable manufacturing concerns, the scarcity of shares remains the outstanding feature.

The Home Railway market is one of the best in the House. At first, the demand centred upon the stocks of the trade lines, but the improvement quickly spread to others, and the Undergrounds were included in the all-round firmness. Underground income bonds have risen to 83½, Metropolitans to 24½, and Districts to 16½. The near approach of the half-yearly dividend payments is held responsible for the renewed attention that has caused the rises in prices. Holders of the stocks naturally do not want to sell at this particular season of the year, so that it takes very little demand to produce an effect which in reality is exaggerated.

West India and Panama shares have risen to 28s. 9d., and, amongst the heavier cable stocks, Eastern ordinary is good at 140½. The rest of the list is distinctly strong. Attention is being called in the market to the shares of the Marconi Marine Co. as being cheap and holding possibilities of early improvement. Maybe the prophets will turn out right, because the present price of 47s. 6d. includes the dividend recently declared, and, judging from the statements made at the meeting at the end of last week, the Marine Co. is doing extremely well. In the shares of the parent undertaking there is little going on, and apparently the recent operators intend to see what the Government is really going to do before they—the buyers—venture further into the market.

Oriental Telephones are ½ up at 2½, which seems a remarkably high price, considering the extremely trifling yield afforded at that level. The company's last report was a good one, and showed that amounts equal to about 20 per cent. had been placed to various reserves, so obviously anticipation is looking for an increase in the next dividend. Still, the probable advance is certainly discounted in the present figure. Of the manufacturing shares, Callenders are 5s. better at 13½, and Henleys are 10s. up at 16, both of them being difficult to get hold of. Castner-Kellners eased off to 3 5/16.

There is not much doing amongst home electricity shares. The feature continues to be the strength of the London varieties. Cities at 12½ and Counties at 10½ are both half-a-crown higher on the week, and Counties changed hands within the last day or two as high as 10½. South Metropolitan preference drooped to their par price of £1, the return being, therefore, 7 per cent. on the money. Having regard to the appetite which has sprung up just lately for sound preference shares in the industrial market, South Metropolitan preference do not look dear.

The General Electric Co. aroused considerable interest with its dividend announcement at the rate of 10 per cent. on the ordinary shares, free of tax, at the same time recommending the repayment to the preference shareholders of the income-tax for two half-years. The question immediately arose as to whether this latter action was *not ultra vires*, but it was taken for granted that the directors were fully armed with the necessary powers to carry out the recommendation—otherwise they would hardly have made it.

The company's gross profit for the year ended March 31st last came to £265,220, an increase of nearly £70,000 over that of the previous twelvemonth. The reserve fund is strengthened by £100,000, making it £400,000 altogether; and £89,876 goes forward, against £18,000 brought into the accounts. Upon this, the price of the ordinary shares rose to 16 and the preference to 10, these prices being somewhat nominal, inasmuch as there are very few shares to be obtained. The preference bonus is a substantial one, but the directors announce that it is in respect of one year only.

Armament shares keep good, though some irregularity has developed in the iron and steel group as a whole. Amongst

rubber shares, there was a fall upon the refusal of the Chancellor of the Exchequer to modify the incidence of the excess profits duty, though subsequently the list rallied upon a re-reading of the speech and appreciation of the fact that the Chancellor did not entirely close the door upon some possibility of relief being afforded. The base-metal list is steady, the strength of the commodities helping to keep prices good.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.									
	Dividend		Price July 10, 1917.	Rise or fall this week.	Yield p.c.				
	1916.	1916.							
Brompton Ordinary	10	9	6½	—	£6 18 6				
Charing Cross Ordinary ..	5	5	8½	—	7 2 10				
do. do. do. 4½ Pref..	4½	4½	8½	—	6 18 6				
Chelsea	4	3	2½	—	5 4 4				
City of London	8	8	12½	+ ½	6 12 0				
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0				
County of London	7	7	10½	+ ½	6 10 3				
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0				
Kensington Ordinary	7	10	6½	—	5 11 7				
London Electric	8	8	1	—	Nil				
do. do. 6 per cent. Pref.	6	4	8½	—	6 6 8				
Metropolitan	8	8	2½	—	6 0 0				
do. do. 4½ per cent. Pref.	4½	4½	8xd	—	7 10 0				
St. James' and Pall Mall ..	8	8	6½	—	6 3 1				
South London	5	5	2½	—	7 5 6				
South Metropolitan Pref.	7	7	20/-	-1/-	7 0 0				
Westminster Ordinary ..	7	7	6½	—	6 1 9				
TELEGRAPHS AND TELEPHONES.									
Anglo-Am. Tel. Pref.	6	6	98	—	6 2 0				
do. do. Def.	83½	1½	22½	—	6 16 4				
Chile Telephone	5	5	7	—	6 14 4				
Cuba Sáb. Ord.	5	5	8½	—	6 17 8				
Eastern Extension	5	5	13½	—	6 16 6				
Eastern Tel. Ord.	5	5	14½	+1	6 14 0				
Globe Tel. and T. Ord.	7	7	12½	—	6 9 10				
do. do. Pref.	6	6	10½	—	6 17 1				
Great Northern Tel.	22	24	85	—	6 13 4				
Indo-European	13	13	51	—	8 7 5				
Marconi	10	10	3½	—	8 1 6				
New York Tel. 4½	4½	4½	99	—	4 11 0				
Oriental Telephone Ord.	10	10	2½	+ ½	3 12 9				
United R. Plate Tel.	8	8	6½	—	5 18 6				
West India and Pan.	6d.	6d.	1½	+ ½	1 14 9				
Western Telegraph	8	8	14	—	6 14 4				
HOME RAILS.									
Central London, Ord. Assented	4	4	60½	—	6 8 0				
Metropolitan	1	1	24½	+ ½	4 2 6				
do. do. District	Nil	Nil	16½	+ ½	Nil				
Underground Electric Ordinary	Nil	Nil	1½	—	Nil				
do. do. "A"	Nil	Nil	6/9	—	Nil				
do. do. Income	6	6	83½	+ 1	6 19 9				
FOREIGN TRAMS, &C.									
Dividend									
		1916.	1916.						
Adelaide Sup. 6 per cent. Pref.	6	6	6	—	6 0 0				
Anglo-Arg. Trams, First Pref.	6½	6½	2½	—	7 16 6				
do. do. 2nd Pref.	5½	—	2½	—	—				
do. do. 5 Deb.	6	5	68½	—	7 6 0				
Brazil Tractions	4	4	48	— ½	—				
Bombay Electric Pref.	6	8	10	—	6 0 0				
British Columbia Elec. Rly. Pfee.	6	5	57½	—	8 13 10				
do. do. Preferred	Nil	Nil	82½	—	Nil				
do. do. Deferred	Nil	Nil	27½	—	Nil				
do. do. Deb.	4½	4½	57½	—	7 8 6				
Mexico Trams 5 per cent. Bonds	Nil	Nil	37	—	Nil				
do. do. 6 per cent. Bonds ..	Nil	Nil	30	—	Nil				
Mexican Light Common	Nil	Nil	14½	—	Nil				
do. do. Pref.	Nil	Nil	22½	—	Nil				
do. do. 1st Bonds	Nil	Nil	33½	—	—				
MANUFACTURING COMPANIES.									
Babcock & Wilcox	15	15	3	—	5 0 0				
British Aluminium Ord.	7	10	28/9	—	6 19 2				
British Insulated Ord.	17½	20	12½	—	7 15 0				
British Westinghouse Pref.	7½	7½	23	—	6 6 4				
Callenders	20	20	13½	+ ½	7 8 2				
do. do. 5 Pref.	5	5	4½	+ ½	5 17 8				
Castner-Kellner	22	22	8½	—	6 10 2				
Edison Swan, £3 paid	—	—	16½	—	Nil				
do. do. fully paid	—	—	13	—	Nil				
do. do. 4 per cent. Deb.	4	4	70½	—	6 18 6				
Electric Construction	7½	7½	1½	—	8 0 0				
Gen. Elec. Pref.	6	6	10	—	6 0 0				
do. do. Ord.	10	10	16	—	6 5 0				
Henley	25	25	16	—	7 16 8				
do. do. 4½ Pref.	4½	4½	4	—	5 12 8				
India-Rubber	10	10	12½	—	8 5 0				
Telegraph Con	20	20	87½	—	6 8 2				

*Dividends paid free of income-tax.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.
		£	£		£	£	
Bristol (Trams)	June 29	23,848	+ 3,307	26	268,804	+ 13,863	80½
Cork	" 28	2,584	+ 332	26	13,108	+ 692	9½
Dublin	" 29	29,859	+ 2,546	26	163,976	+ 19,599	54½
Hastings	" 24	6,452	+ 1,421	25	25,606	+ 4,289	19½
Lancashire United	" 27	10,791	+ 8,285	26	53,173	+ 8,924	42
Llandudno-Col. Bay	" 29	1,549	— 235	304	7,246	— 518	6½
Anglo-Argentine	July 1	204,470	+ 13,568	26	1,337,059	+ 11,000	—
Auckland	June 1	21,742	+ 580	48	259,101	+ 6,043	26½
Calcutta	" 30	17,511	+ 91	—	—	+ 1,257	—
Kalgoorlie, W.A.	March	2,772	+ 293	13	7,896	+ 483	20½
Madras	June 30	4,309	+ 840	26	27,227	+ 2,638	—
Montevideo	June	27,158	+ 2,158	35	242,796	+ 1,728	—
Dublin-Lucan Rly.	June 15	806	+ 145	24	3,404	+ 836	7

ELECTRICAL WORK IN THE TROPICS.

[COMMUNICATED.]

THE white man in the Tropics very seldom does any manual work. It is true that, owing to the advances of medical and engineering science, life in such regions is much more healthy for the European than it used to be. Where the sun's rays are vertical, however, the manual labour of the world is, and should be, done by the native. The European adjusts himself to new conditions, and, whether it is because he finds the climatic conditions enervating, or whether it is that he wishes to maintain the white man's prestige, the fact remains that he seldom, if ever, does manual work in the Tropics.

Unfortunately, the climatic conditions of that belt of the earth's surface which lies near to the Equator are especially bad for all electrical apparatus. The atmosphere is usually saturated with moisture. The degree of humidity is almost unbelievable. Often the walls inside the buildings have water running down them, and it is, of course, quite impossible to have wall papers for decorating the interior of houses. In many parts of the Tropics granite is found, and great masses of rock or stone act as condensers. They cool at night, and in the early morning, when the sun heats the air, the atmosphere deposits its moisture when it is brought against the comparatively cool surface of the stone. This humidity affects clothing; a pair of boots which look normal at sundown will grow a peculiar greenish-blue covering before sunrise.

From these few remarks it will be seen that the electrical engineer in the Tropics has much to try him. Nothing could be worse for insulation than such a climate. Nothing is worse for the nerves than the joint effect of climate and native indolence. For the races which inhabit the equatorial regions are most exasperating, when they are employed in industrial work. Nature has so richly endowed mankind in the Tropics that, until the restless energy of the white man sought to reduce chaos to order, the inhabitants had no incentive to work. The fecundity of the animal and vegetable world is so great that food is obtainable with but little exertion, while there is no need to provide clothing.

The New Conditions.—The earth is changing rapidly, and the native of the Tropics is being lifted up out of his state of indolence and savagery by the new civilisation. The world is so small, that the fighting on the battle fields of Europe will determine the methods by which the economic development of the Tropics will take place. The German method of dealing with natives was brutal. It is not racial conceit to state that no nation has more successfully developed tropical regions than the British. The secret of our success has been honest administration and the stimulus of great rewards to all men who would show enterprise. An example of what is possible for any man to do, irrespective of colour, is furnished by the case of the late Mr. Loke Yeow, C.M.G. The Chinese who became a British subject, and died a sterling millionaire, left his native village, near Canton, in China, a penniless coolie. He went South to the tropical regions of the Malay States, and, by dint of industry and the opportunities given to him by a generous system of government, he amassed a fortune.

Machinery is needed in the Tropics, and as cultivation of the agricultural products is intensified and the mines are developed, more and more electrical apparatus will be needed. Efforts are being made to train the young generation of natives, and technical education will certainly stimulate a demand for machinery. But the technical education should be for the non-commissioned officers; Europeans will always direct and take the initiative. It is folly to expect the native of, say, Java, to become suddenly intelligent enough to become a captain of industry. Such human material has its limitations, and that fact must be recognised.

The Technical Difficulties.—There are all sorts of engineering problems to be solved in the Tropics which never occur in temperate climates. There should be some inducement offered to electrical engineers in such regions to place on record their experiences. Take the simple case of storage batteries. The humidity of the atmosphere affects

them, and there are other difficulties. It may be that some special design of battery is necessary. It may be that most of the troubles one hears about are almost entirely due to neglect and ignorance. (If the white man is inexperienced, the native will certainly encourage neglect.) It may be that temperature conditions affect the plates. It may be that all would be well if pure water were used. Whatever the reasons, the fact remains that storage batteries have a bad reputation in the Tropics. Let us obtain some definite data as to their life and actual working behaviour in such a climate. The writer has not had sufficient experience to offer anything except suggestions. It does seem to be either a fact, or a superstition, that storage batteries should be worked at below their rated capacities when they are used in the Tropics. If it is a fact, perhaps there is a known reason.

The white people near the Equator demand the new conditions of life. They expect electric light and the priceless boon of the electric fan. They will demand electric motors for ice plants in the near future. Telephones, and even electrically driven carpet-sweepers, are among the first inquiries of the bride out from home. The market for one type of electrical apparatus, the fan, must be enormous: the demand must run almost into millions per annum, and the demand increases each year.

The problem which awaits the Allied nations as soon as peace is concluded is the systematic exploitation of the vast resources which Nature has placed in the Tropics. In that great work of reducing chaos to order the electrical engineer will play a prominent part. Those who have had experience in the Tropics should be encouraged to place on record the methods by which they have overcome the many difficulties which beset them.

ELECTRIC STEEL FURNACES.

WITH SPECIAL REFERENCE TO THE GREAVES-ETCHELLS TYPE.

By E. KILBURN SCOTT, A.M.Inst.C.E., M.I.E.E.

SINCE the war, one of the most striking developments of the steel industry of Great Britain has been the rapid increase in number of electric steel furnaces; so successful have they been that the prejudice against this type of furnace is rapidly disappearing, and the change will probably rank as the most radical one since the time of Bessemer.

Amongst factors which have helped to bring the electric furnace into favour are the war demand for special tool steel for tools, dies, gauges, &c.; the demand for chrome and other special alloy steels for aircraft tubing, rustless steel, &c.; the difficulty in obtaining Swedish iron, which, besides being scarce, is extremely expensive; the difficulty in obtaining skilled labour to work the crucible steel process; the necessity of profitably using turnings, millings, ends of tubes, bars, and other scrap steel; and the ease with which high-class steel can be made from second-grade materials in electric furnaces.

Certain electric supply authorities, as, for example, those at Sheffield, Newcastle, Rotherham, and Luton, have done much to encourage electric furnace loads by reducing charges for energy, and by moderating the requirements as regards power factor, the unbalancing of phases, &c. The foresight of the city electrical engineer at Sheffield is especially commendable in preparing for an electric furnace load.

For the manufacture of high quality steel castings the electric furnace is ideal. The superiority of electric steel castings over those made by any other process has been conclusively proved by the extremely severe conditions to which these castings have been subjected under specialised war conditions. The castings produced can be finished off dead mild, and a 1-in. square bar can be bent double as cast, no expensive annealing operations being necessary. The carbon contents usually vary between .2 per cent. and .25 per cent., while the sulphur and phosphorus are each reduced below .015 per cent., and manganese and silicon are adjusted to suit the work.

The tensile properties of ordinary electric cast steel are:—

Maximum tensile strength ... 35 tons per sq. in.

Yield point ... 25 tons per sq. in.

Reduction of area, 50 per cent. Elongation, 30 per cent.

The maximum tensile stress can be readily increased to even 100 tons per sq. in. by the introduction of special elements, such as nickel, chromium, and vanadium.

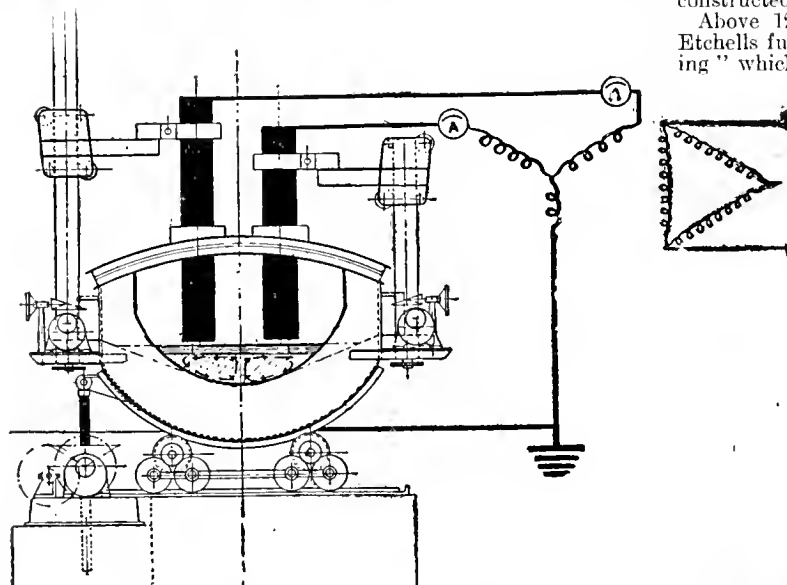
Many works that sell their steel swarf and scrap, cast-iron borings, &c., at very nominal prices, and purchase all their steel castings, could very profitably install an electric furnace and make their own castings from the scrap. The charge can be made up entirely of scrap and turnings; no expensive

raw materials are necessary. The melting loss is almost negligible, while in other processes it is from 7 per cent. to 15 per cent.

Steel from the electric furnace is finished off under a reducing atmosphere of carbonic oxide and a slag out of which the metallic oxides have been reduced, and is singularly free from blowholes when properly cast. This is due to the elimination of the gases that molten steel usually holds in solution, and the ease with which the steel can be poured into small and intricate moulds, flowing smoothly like milk, and setting perfectly quietly, is largely due to its purity.

For small, light castings furnaces of not more than 30 cwt. are recommended; steel of such low carbon content has a high melting point, and must be cast at a very high temperature, and though the temperature is easily obtainable in the furnace, difficulties occur in handling large quantities of such hot metal in ladles if a large number of castings are to be made. For small, mild steel castings—many of which have proved a better substitute for malleable iron castings—smaller furnaces are recommended, and several firms have installed furnaces of 10 cwt. capacity to melt steel for small engine parts of motor cycles and motor cars instead of using stampings.

Where large quantities of good quality steel are required "The Hot Metal Process," as it is called, combines cheapness and quality. It has been adopted extensively in the United States. The metal is first heated in a basic lined, tilting, open-hearth furnace of large capacity, and is then run into



SECTION THROUGH SIX-TON GREAVES-ETCHELLS FURNACE, SHOWING CIRCULATION OF METAL.

a number of electric furnaces for final refining and addition of alloys. The process is continuous, and as the energy for the first melting of the steel is obtained direct from fuel, the amount of electrical energy is only that required to maintain the temperature during refining and the assimilating of the alloys. Steel so produced commands high prices.

Electric furnaces are used for the melting of ferro alloys for open-hearth and Bessemer plants, as it is found much more economical to make alloy additions in the molten form. The electric furnace is ideal for this.

TYPES OF FURNACES.

As the earlier furnaces were for small outputs, single-phase alternating current was used, and to obtain a balance on a polyphase supply several furnaces had to be worked together.

Polyphase furnaces are better than single-phase furnaces, because for a given output of steel one such furnace is cheaper, takes up less room, and requires less attention than several single-phase furnaces. With single phase, if one arc fails the circuit is broken, and the load falls to zero. This is liable to happen during the melting-down period, when the pieces of scrap metal change position under the electrodes.

Some arc furnaces have all the electrodes above the bath of metal, one of this class being the *Heroult*. As arranged for three-phase supply it has three vertical electrodes through the roof, and the arcs are between each electrode and the bath, so that the molten metal forms part of the electrical circuit. Two furnaces, namely the *Girod* and the *Snyder*, employ water-cooled steel studs, which pass right through the bottom or hearth. As the ends of the studs project into the metal of the charge they burn away, and have to be renewed at intervals. This form is also not good practice, because of the danger of the metal finding its way through the hearth, and the liability of trouble with water connections. It will be noted that in all the above-named furnaces the refractory material of the hearth does not require to carry current. The material may be, therefore, either acid (silica) or basic (magnesite).

The furnaces mentioned below have also bottom electrodes, but come under a different category because the hearth itself

conducts electric current. It is, therefore, made of magnesite material, as this, when heated, is a fairly good conductor. A furnace of this class is that of Electro-Metals, Ltd., which was invented by Gronwall. It works with two phases, and has two electrodes above the bath, whilst a third electrode below the hearth acts as a common neutral for the two phases.

Another furnace which has met with considerable success is that of Greaves-Etchells, more than 30 having been installed or put under construction since January, 1916. This is an all-British production, both in inception and manufacture.* It is designed to operate on a three (or two) phase supply, and has two of the phases connected to electrodes above the bath, the third phase being connected to a copper plate below the electrically conductive hearth of magnesite.

The roof is made of silica bricks, as these are fairly good insulators. They are set in a steel framing which rests on the silica brick walls projecting above the steel body of the furnace. The roof is domed and brought as low as possible, so as to reduce the wasting away of the electrodes by the action of the gases. A roof will last about 100 heats, and a duplicate one is provided with each furnace, so that the steel melting can be carried on, except for the short time taken to change the roof.

In order to obtain an even temperature through the bath of molten metal in the electric furnace, it was realised that heat must be applied below, as well as above, the bath, and in order to effect this the hearth of the furnace is specially constructed.

Above 12 per cent. of the total energy of the Greaves-Etchells furnace is used in the hearth, and the "bottom heating" which results is found to be of great advantage in melting down alloys. The heavier alloys—chrome, tungsten, vanadium, and nickel—sink to the bottom of the bath, and if there is no bottom heating are apt to remain for a considerable time in a semi-fluid state.

The hearth lining is never less than 20 in. thick, and is constructed mainly of dolomite and magnesite, in such a manner that the electrical resistance is high at the inside of the bath in proximity to the charge, and decreases rapidly to a negligible quantity at the outside. The current flowing through the hearth generates a considerable amount of heat immediately below the liquid in the most efficient manner possible, while the electric arcs arranged over the bath maintain the slag and surface at the desired temperature.

The effect of this bottom heating is to cause convection currents in the molten metal, which ensure a constant circulation, and a uniform product. The outside of the furnace bottom remains cold, little or no heat being lost in this direction.

This system of connection at first sight would appear to cause an out-of-balance load on the primary supply, but the system of transformer ratios is arranged to give a perfect balance when the upper electrodes are in equal adjustment.

The Greaves-Etchells system of transformer connections is such that the short-circuit current of one electrode must traverse two transformers in series and in different phase, which automatically lowers the power factor momentarily, and has a very strong buffer effect; the fact that there is always a permanent resistance in the path of the current through the hearth also limits very considerably the effects of short circuits. The combination of these factors provides the most effective means yet devised for protecting the supply system from shock, while allowing a high power factor to be obtained on normal load.

For the manufacture of high-speed steels or special alloy steels, a $\frac{1}{2}$ -ton or 1 $\frac{1}{2}$ -ton furnace is usually adopted, and the former can finish a charge from cold material and alloys in two to two and a half hours, with an energy consumption of 400 units.

To make up a charge from scrap, it is usual to place steel turnings and millings on the hearth, then pieces of bar and rail ends, tube ends, and finally large pieces of steel. The interstices between the large pieces are filled with turnings, &c., and some iron ore may be added. The amount of iron ore depends on the amount of iron oxide present in the form of rust on the scrap.

As the charge is melted, a slag of lime and fluorspar is made in order to eliminate the phosphorus as phosphate of lime. After this phosphate slag has been skimmed off, a new slag is made of best Buxton lime, fluorspar, and white sand in the proportions of 30, 10, and 5. When this has fluxed, a small quantity of finely powdered anthracite coal is spread on the slag, and this is continued until the slag is deoxidised.

The steel is thus finished off under an atmosphere of carbonic oxide and a slag out of which the metallic oxides have been reduced. When entirely deoxidised a sample of slag falls to a fine white powder as it cools. Deoxidisation of the slag results in deoxidisation of the steel, through the constant reduction of silicon from the slag, and it may be hastened by addition of small quantities of ferro-silicon.

* The Greaves-Etchells furnace was described, with illustrations, in the ELECTRICAL REVIEW, April 13th, 1917.

As a comparison with the crucible steel process, it may safely be stated that a 10-cwt. electric furnace running a charge every two and a half hours, or, say, nine charges per day, will do as much as 36 crucible furnace holes each having two 56-lb. pots.

The electric furnace is operated by one skilled man, one unskilled man, and one ammeter boy, whereas the crucibles require 15 men, most of whom are skilled, or, at any rate, classed as indispensable. At two Sheffield works, girls are employed to regulate the electrodes.

Such an electric furnace, with its transformers and switch-gear, will occupy about a quarter of the space occupied by the crucible plant, and the initial cost of the electric furnace will be about half that of the crucible plant.

The charge of the electric furnace can be made entirely from turnings, millings, &c., whereas in the crucible steel process only a very limited quantity of turnings, &c., can be used.

Owing to the low heat efficiency and high cost of labour, crucible steel is much more expensive to manufacture. The cost of renewing crucibles is considerably higher than the renewal of an electric furnace for the same output. Already several steel works have shut down their crucible plant after installing electric furnaces.

The introduction of the Bessemer and open-hearth processes of making steel left crucible steel makers indifferent owing to the fact that these methods were employed for making ordinary kinds of steel in great quantity for structures, rails, &c. The coming of the electric furnace is a different proposition, as it competes directly and successfully in the special field that the crucible steel process has held so long.

The crucible steel process has been largely responsible for great waste of the nation's resources by reason of the coke being made in beehive ovens, this quality of coke being necessary for the crucible steel process. The introduction of the electric furnace should help to stop this waste in the future.

In conclusion, it may be mentioned that very soon there will be 50 electric furnaces at work in the Sheffield district, and the output of steel from them will be at the rate of over 200,000 tons per annum.

In the United States over 100 electric furnaces are already at work, and a single electric steel plant is being erected in South Chicago which will give an output of 200,000 tons per annum.

In view of the rapidly increasing demand for high-grade steels, makers cannot afford to be second-best, and electric furnaces offer the only certain method of obtaining and holding the market.

TRADE STATISTICS OF INDIA.

THE following figures of the imports of electrical and similar goods into British India in the year ended March 31st, 1916, are taken from the recently-issued official trade statistics; details for the year ended March 31st, 1915, are added for purposes of comparison, and notes of any increases or decreases are given:—

	1914-15.	1915-16.	Inc. or dec.
<i>Brass, wrought.—</i>	£	£	£
From Great Britain ...	31,000	46,000	+ 15,000
„ Germany ...	2,000	—	— 2,000
„ Italy ...	4,000	—	— 4,000
„ Other countries ...	30,000	72,000*	+ 42,000
Total ...	67,000	118,000	+ 51,000

* Japan £42,000.

Copper and copper ware.—

	1914-15.	1915-16.	Inc. or dec.
From Great Britain ...	950,000	309,000	— 641,000
„ Germany ...	487,000	45,000	— 442,000
„ Belgium ...	12,000	10,000	— 2,000
„ France ...	126,000	7,000	— 119,000
„ Austria ...	2,000	—	— 2,000
„ Japan ...	254,000	108,000	— 146,000
„ Other countries ...	18,000	15,000	— 3,000
Total ...	1,849,000	494,000	— 1,355,000

Iron wire.—

	1914-15.	1915-16.	Inc. or dec.
From Great Britain ...	82,000	140,000	+ 58,000
„ Germany ...	19,000	1,000	— 18,000
„ Belgium ...	7,000	1,000	— 6,000
„ United States ...	26,000	71,000	+ 45,000
„ Other countries ...	5,000	1,000	— 4,000
Total ...	139,000	214,000	+ 75,000

Prime movers, other than locomotives.—

	1914-15.	1915-16.	Inc. or dec.
From Great Britain ...	428,000	268,000	— 160,000
„ Germany ...	1,000	—	— 1,000
„ United States ...	10,000	14,000	+ 4,000
„ Other countries ...	8,000	5,000	— 3,000
Total ...	447,000	287,000	— 160,000

	1914-15.	1915-16.	Inc. or dec.
<i>Electrical generators.—</i>	£	£	£
From Great Britain ...	11,000	8,000	— 3,000
„ Other countries ...	1,000*	7,000†	+ 6,000
Total ...	15,000	15,000	—

* Belgium £1,000. † Italy £6,000.

Electrical motors.—

	1914-15.	1915-16.	Inc. or dec.
From Great Britain ...	71,000	50,000	— 21,000
„ Germany ...	1,000	—	— 1,000
„ United States ...	1,000	2,000	+ 1,000
„ Other countries ...	3,000*	2,000	— 1,000
Total ...	76,000	54,000	— 22,000

* Italy £2,000.

Other electrical machinery.—

	1914-15.	1915-16.	Inc. or dec.
From Great Britain ...	213,000	120,000	— 93,000
„ Germany ...	6,000	—	— 6,000
„ Italy ...	4,000	9,000	+ 5,000
„ United States ...	6,000	10,000	+ 4,000
„ Other countries ...	1,000	2,000*	+ 1,000
Total ...	230,000	141,000	— 89,000

* Switzerland £1,000.

Mining machinery.—

	1914-15.	1915-16.	Inc. or dec.
From Great Britain ...	49,000	63,000	+ 14,000
„ Switzerland ...	—	9,000	+ 9,000
„ United States ...	48,000	58,000	+ 10,000
„ Other countries ...	1,000	2,000	+ 1,000
Total ...	98,000	132,000	+ 34,000

Machinery, other (except textile, agricultural, and printing).—

	1914-15.	1915-16.	Inc. or dec.
From Great Britain ...	563,000	387,000	— 176,000
„ Germany ...	22,000	1,000	— 21,000
„ Italy ...	—	3,000	+ 3,000
„ United States ...	34,000	30,000	— 4,000
„ Other countries ...	17,000	13,000	— 4,000
Total ...	636,000	434,000	— 202,000

Electric fans.—

	1914-15.	1915-16.	Inc. or dec.
From Great Britain ...	28,000	19,000	— 9,000
„ Italy ...	10,000	26,000	+ 16,000
„ United States ...	13,000	25,000	+ 12,000
„ Germany ...	2,000	—	— 2,000
„ Other countries ...	2,000	—	— 2,000
Total ...	55,000	70,000	+ 15,000

Electric lamps and parts.—

	1914-15.	1915-16.	Inc. or dec.
From Great Britain ...	24,000	40,000	+ 16,000
„ Germany ...	3,000	—	— 3,000
„ Austria ...	2,000	—	— 2,000
„ Japan ...	—	1,000	+ 1,000
„ United States ...	—	4,000	+ 4,000
„ Other countries ...	2,000	9,000*	+ 7,000
Total ...	31,000	54,000	+ 23,000

* Holland £7,000.

Electric wires and cables.—

	1914-15.	1915-16.	Inc. or dec.
From Great Britain ...	149,000	145,000	— 4,000
„ Germany ...	2,000	—	— 2,000
„ Japan ...	—	2,000	+ 2,000
„ United States ...	1,000	2,000	+ 1,000
„ Other countries ...	1,000	2,000*	+ 1,000
Total ...	153,000	151,000	— 2,000

* Italy £1,000.

Other electrical instruments, apparatus, &c. (except telegraph and telephone materials).—

	1914-15.	1915-16.	Inc. or dec.
From Great Britain ...	290,000	257,000	— 33,000
„ Germany ...	7,000	—	— 7,000
„ Japan ...	—	7,000	+ 7,000
„ Austria ...	1,000	—	— 1,000
„ United States ...	19,000	20,000	+ 1,000
„ Other countries ...	6,000	12,000*	+ 6,000
Total ...	323,000	296,000	— 27,000

* Holland £6,000.

Scientific, &c., instruments.—

	1914-15.	1915-16.	Inc. or dec.
From Great Britain ...	63,000	48,000	— 15,000
„ Germany ...	2,000	—	— 2,000
„ United States ...	1,000	7,000	+ 6,000
„ Other countries ...	3,000	9,000*	+ 6,000
Total ...	69,000	64,000	— 5,000

* France £4,000.

Telegraph construction materials.—

	1914-15.	1915-16.	Inc. or dec.
From Great Britain ...	18,000	10,000	— 8,000

	1914-15.	1915-16.	Inc. or dec.
	£	£	£
Machinery. —			
From Great Britain ...	212,000	127,000	— 85,000
„ United States ...	—	1,500	+ 1,500
„ Other countries ...	1,000	500	— 500
Total ...	213,000	129,000	— 84,000
Telephone construction materials. —			
From Great Britain ...	17,000	18,000	+ 1,000
„ Sweden ...	—	3,000	+ 3,000
„ Other countries ...	—	1,000	+ 1,000
Total ...	17,000	22,000	+ 5,000
In addition to the foregoing, the following were imported as Government stores:—			
Instruments, apparatus, &c. (except musical). —			
From Great Britain ...	181,000	171,000	+ 10,000
„ Other countries ...	2,000	1,000	— 1,000
Total ...	183,000	172,000	— 11,000
Iron wire. —			
From Great Britain ...	10,000	16,000	+ 6,000
Telegraph construction materials. —			
From Great Britain ...	102,000	80,000	— 22,000
Copper and copperware. —			
From Great Britain ...	113,000	128,000	+ 15,000
„ Other countries ...	78,000	238,000*	+ 160,000
Total ...	191,000	366,000	+ 175,000

* New South Wales £193,000.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

TRANSIT OF GOODS THROUGH FRANCE.—The Board of Trade are informed that for goods in transit through France to Switzerland which are accompanied by the "pink certificate" issued by the British Customs Authorities, no transport permits are required:—(a) When consignments (without limitation as to weight) are sent *via* Bordeaux, Cette, or Marseilles on Swiss rolling stock; and (b) when consignments are sent *via* other French ports (except Havre) in Swiss trucks, to the amount of one metric ton a day from any one shipper to any one consignee. In all other cases it is necessary to obtain a transport permit from the 4th Bureau of the Ministry of War, in Paris.

PERU.—The Peruvian Customs Bulletin for January 8th contains a Decree dated December 27th, 1916, providing that the duties of 2, 4, and 6 per cent. prescribed by the earlier Decree—referred to in the REVIEW of January 5th last—are to be levied on the market prices of rubber from the Yavari, i.e., the reduction of 30 per cent. from the current prices allowed in respect of rubber from the Madre de Dios is not to be allowed for rubber from the Yavari.

NEW ZEALAND.—An Order-in-Council, dated February 5th, prohibits the importation of electric apparatus known as the Violetta high-frequency generator, and of all accessories specially adapted for use therewith, and of all written or printed advertising matter relating solely or principally to such apparatus.

CANADA.—By a recent decision of the Customs Department, the rates of import duty on electric welded furnaces to be used in the manufacture of boilers for ships or vessels are leviable as follows:—20 per cent. *ad val.* under the Preferential tariff, 2½ per cent. *ad val.* under the Intermediate tariff, and 30 per cent. *ad val.* under the General tariff. [It should be noted that in addition to these duties, a war tax of 5 per cent. *ad val.* is levied under the British Preferential Tariff, and of 7½ per cent. *ad val.* under the Intermediate and General Tariffs.]

FRANCE AND ALGERIA.—A French Ministerial Decree, dated May 12th, amends and amplifies the Decree of April 13th restricting the importation of goods into France and Algeria—see the REVIEW for June 1st. Among the articles added by the new Decree to List No. 3 (goods the importation of which is placed under the control of the Inter-Ministerial Commission of Woods and Metals) are:—Frames and carcasses of dynamos and of electric motors; armature spiders; covers of electrical collectors; solid poles of dynamos and alternators, of iron or steel, wrought or swaged, of cast iron or steel, of malleable cast iron, of shaped or welded plate.

Applications for French import licences must now be addressed by the proposed importer in France or Algeria to the competent authorities in France, the issue of such licences in London having been discontinued. The French Customs Office in London (Bank Buildings, Kingsway, W.C. 2) is prepared to advise exporters as to the classification of their goods for the purposes of the import prohibitions and to give general information on the subject.

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

- 9,073. "Potentiometers, variable resistances, and rheostats." W. E. BAKER. June 25th.
- 9,086. "Terminal sockets for electrical conductors." ST. HELENS CABLE AND RUBBER CO. & J. C. WHITE. June 25th.
- 9,108. "Electric signalling devices." J. ATHERTON. June 25th.
- 9,111. "Electrical condensers for high-tension and high-frequency currents." A. KOWALSKI. June 25th. (Switzerland, June 24th, 1916.)
- 9,134. "Electrical switches." J. H. COWELL & H. W. COX. June 26th.
- 9,146. "Trolley heads of electrically-propelled vehicles, &c." A. WOOD. June 26th.
- 9,153. "Devices for fixing fuse wires to electrical installations." R. A. KERMAN & T. MATHIAS. June 26th.
- 9,165. "Electro-pneumatic brake system." W. V. TURNER. June 26th. (U.S.A., December 6th, 1916.)
- 9,182. "Magneto controlling device enabling semi-heavy motors to be started by hand." M. Y. DELAGE. June 26th. (France, July 1st, 1916.)
- 9,208. "Ignition plugs for internal-combustion engines." W. A. CLARKE, H. G. LONGFORD AND W. W. LONGFORD, & SPHINX MANUFACTURING CO. June 27th.
- 9,232. "Electrolytic cells for production of chlorine." T. W. S. HUTCHINS. June 27th.
- 9,239. "Electrical boat raising and lowering apparatus." F. N. PICKETT AND A. WEST, AND A. WEST & CO. June 27th.
- 9,243. "Electric gun or apparatus for propelling projectiles." A. L. O. VILLEFLEEE. June 27th. (France, August 5th, 1916.)
- 9,245. "Electric drive of submarines." SOC. ANON. ITALIANA G. ANSALDO AND CO. June 27th. (Italy, June 27th, 1916.)
- 9,251. "Electrical advertising device or sign." H. E. GILL & W. E. GRANT. June 27th.
- 9,267. "Electric generators." V. CRABB. June 28th.
- 9,287. "Wireless signalling system." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). June 28th.
- 9,302. "Spark-plug energiser." W. M. BAUCHELLE & J. D. GRUMMON. June 28th.
- 9,305. "Ignition dynamos." C. T. MASON. June 28th.
- 9,308. "Electrical condensers for high-tension and high-frequency currents." A. KOWALSKI. June 28th. (Switzerland, April 13th.)
- 9,312. "Electro-magnetic lock-out switch." R. P. BOSSOM AND A. WEST AND CO. June 28th.
- 9,320. "Mechanical and electrical horns." E. T. COOK & KLAXON CO., AND J. F. MONNOT. June 28th.
- 9,321. "Spark-plug for ignition." K. E. L. GUINNESS. June 28th.
- 9,335. "Telephone receivers, gramophones, &c." C. T. BUCKELL. June 28th.
- 9,339. "Terminal-box electrical cable or conductor insulators." R. W. BLADES AND BRITISH INSULATED & HELSLEY CABLES, LTD. June 29th.
- 9,350. "Dynamo-electric machines." J. W. BURLEIGH. June 29th.
- 9,371. "Electrical telephones." G. M. MASTERS. June 29th.
- 9,383. "Electrical motor control." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). June 29th.
- 9,386. "Electrical contact devices." A. H. BAILEY. June 29th.
- 9,404, 9,405. "Interrupting devices for ignition of internal-combustion engines." R. BOSCH & O. IMRAY (Bosch). June 29th.
- 9,412. "Apparatus for starting electric motors." N. J. AUSTIN & T. D. TODD. June 29th.
- 9,450. "Dynamo-electric machines." A. G. A. KAULBACH. June 30th.
- 9,470. "Electric switches." A. H. MIDDLEY AND VANDERVELL & CO. June 30th.
- 9,477. "Spark-plug connections." V. PERRETT. June 30th.
- 9,480. "Protective apparatus for alternating electric current circuits." H. PEARCE. June 30th.
- 9,482. "Insulated electric conductors or cables." F. JACOB. June 30th.
- 9,488. "Control of combined engines and electric generators." J. SANKEY AND SONS & W. A. STEVENS. June 30th.
- 9,489. "Treatment of magnetic material suitable for use in static transformers, &c." A. F. BERRY. June 30th.

PUBLISHED SPECIFICATIONS.

1916.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

- 10,672. APPARATUS OF THE DASHPOT TYPE FOR EFFECTING AUTOMATICALLY A DESIRED FUNCTION WITHIN A CERTAIN TIME LIMIT. E. A. FAGERLAND. July 28th. 1916. (106,719.)
- 11,161. TORPEDO-FIRING CONTROL APPARATUS. W. C. Fairweather (Lake Torpedo Boat Co., U.S.A.). August 8th, 1916. (106,723.)
- 14,391. ALARM APPARATUS. V. Grima. October 10th, 1916. (106,758.)
- 14,412. WEAPERS FOR FRAGILE ARTICLES. British Thomson-Houston Co. (General Electric Co., U.S.A.). October 10th, 1916. (106,759.)
- 18,245. ILLUMINATED SIGNS. Dingleys, Ltd., & C. W. Hobson. December 20th, 1916. (106,788.)
- 6,916. HEATING APPARATUS. N. E. Brookes (Good Inventions Co., U.S.A.). May 30th, 1916. (Divided application on 7,645/16.) (106,812.)
- 3,530. AUTOMATIC TRAIN SIGNAL AND STOP. National Safety Appliance Co. (April 24th, 1915. (100,353.)
- 8,191. ELECTROMAGNETIC LOCK-OUT SWITCHES OR CONTACT MAKERS. Igranic Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.). June 9th, 1916. (106,869.)
- 8,199. ELECTRIC TRUCKS. F. J. Decker. June 9th, 1915. (100,648.)
- 8,574. ELECTRIC MOTORS FOR SHIP PROPELLION AND OTHER PURPOSES. British Thomson-Houston Co. (General Electric Co., U.S.A.). June 17th, 1916. (106,877.)
- 9,277. DRIVING AND CONTROLLING DYNAMO-ELECTRIC GENERATORS. W. F. W. Rhodes & J. Firth. July 3rd, 1916. (Addition to 221/16.) (106,886.)
- 9,742. PORTABLE ELECTRIC LAMPS. F. Westwood. July 11th, 1916. (Cognate application, 11,581/16.) (106,891.)
- 9,819. FRANGING GLASS TUBES FOR USE IN THE MANUFACTURE OF ELECTRIC LAMPS AND APPARATUS THEREFOR. Morris & Whitman and J. A. Allison. July 12th, 1916. (106,892.)
- 10,677. CONTROLLERS FOR ELECTRIC MOTORS AND THE LIKE. Electric Control, Ltd., & O. Elfsen. July 24th, 1916. (106,898.)
- 12,148. CERTAIN KINDS OF ELECTRICAL SWITCH BOXES. A. E. Read, J. E. Franks & M. Brooks. August 28th, 1916. (106,912.)
- 15,021. CARRIERS FOR FUSIBLE ELECTRIC CUT-OUTS. Major & Coulson and W. Lawrence. October 23rd, 1916. (106,934.)
- 17,733. METHOD OF AND APPARATUS FOR ELECTRIC HEATING AND TEMPERING. Sneyd & Co. Ironworks. June 14th, 1916. (106,940.)
- 17,209. ELECTRIC SWITCHES. H. H. Berry & W. J. Markham. November 30th, 1916. (106,946.)
- 17,334. TIME-LIMIT ELECTRIC CIRCUIT BREAKERS. Akt. Ges. Brown, Boveri & Cie. January 3rd, 1916. (Addition to 14,498/15.) (103,113.)

THE ELECTRICAL REVIEW.

VOL. LXXXI.

JULY 20, 1917.

No. 2,069

ELECTRICAL REVIEW.

AFTER THREE YEARS.

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It may not seem that the political changes that are now in progress in Germany are a matter which directly concern us in these pages, yet we cannot but regard them as important milestones indicating that we are on the way toward the end, and that end assuredly is a matter of the deepest concern for us all. After three years of terrible war, the originators of it may banish their Bethmann-Hollweg because he is not regarded as a fit man to negotiate Peace, but they cannot escape the haunting foot-tread of Nemesis. With all conceivable forms of ingenuity they may try to dodge it, but fate follows relentlessly in the wake of those who have shocked all outside Civilisation with deeds as foul as they have been dishonourable. Many parties seem to be finding their voice to-day, but in the main they are uttering two distinct cries. Peace without Indemnities is the boon clamoured for, and the concession condescendingly approved, by those whom sheer necessity has driven to want Peace speedily at all costs. Peace *with* Indemnities is the demand of those who, looking ahead, see Germany ruined for many a year unless indemnities can be secured to strengthen credit, so that industry may be able to purchase raw materials abroad and re-establish the economic and industrial position which the folly of Prussian ambition has broken up.

We are not suggesting that the end is near—who has any means of knowing?—the position is very involved, and fate only knows the hour of the final issue; but if recent events have brought the only end there can be appreciably nearer than it seemed a few weeks ago, they have also brought nearer for all the nations that period of very serious problems which, as the Chancellor of the Exchequer told the House of Commons, would be more difficult to handle than all the problems of even the war itself. The apostle of gloom is of all men the most unwelcome and the most unhelpful, but the optimist who tries to humour us into the belief that all will be well when the war is ended is a dangerous and an undesirable companion, for the plainest facts of the situation should compel us all to approach the times that lie ahead with the utmost seriousness and foresight. It is not only in the countries that will lose the war that there will be unparalleled difficulties of various kinds to be faced; the nations that win, and the nations that are neutral, will also have their period of anxiety and stress and their own peculiar problems to solve. Nemesis will inevitably punish our enemies, and they will settle between themselves, perhaps quarrel over, their own difficulties. But the effects of colossal expenditures and the disorganisation of three years will be felt by the victors, too, though the problems of the Allies will be different from those of their enemies. There will be a freer inter-trading and a strong bond of sympathy between them, while many markets of the world will be wider open to them than ever before if they are in a position to take advantage of the situation, but the German business man has to learn that he has, through his Government, set practically all the world by the ears, and will not easily regain the prestige of pre-war days. We shall inevitably witness some hard striving for terms which will open the way for economic security and the resumption of former activities. At present the industrial magnates of Berlin and their satellites may recognise

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Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 8d.; Canada, £1 3s. 10d. (\$5.80). To all other countries, £1 10s.

FOREIGN AGENTS:

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LAUNCESTON: Gordon & Gotch, Cimitiere Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

MELBOURNE: The Mining & Engineering Review, 90, William Street; Gordon & Gotch, Queen Street.

MILAN: Fratelli Treves.

NEW YORK: D. Van Nostrand, 25, Park Place.

PARIS: Boyveau & Chevillet, 22, Rue de la Banque.

PERTH, W.A.: Gordon & Gotch, William Street.

ROME: Loescher & Co., Corso Umberto I° 307.

SYDNEY: The Mining & Engineering Review, 273, George Street; Gordon and Gotch, Pitt Street.

TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.

WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

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1917 EDITION

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the economic menace of the future, but apparently the people are still blinded to their future hardships unless the return of the Stockholm visitors has adequately informed them of the feelings of revulsion of the whole world against them.

So far as the British Empire is concerned, we have been discussing our own after-the-war trade problems ever since the outbreak of war. Great things have been done here, and in the Colonies, which will prevent our falling back into positions of apathy and unpreparedness. Much of our old susceptibility to attack will no longer remain. But the changing phases of the whole war situation throughout the world have necessarily interfered with the elaboration of definite policies respecting trade. Our Government-appointed committees have made their investigations, but apparently, in the opinion of the Government the time has not yet arrived when any concrete propositions can be based upon these and announced. Our relations with our Allies naturally greatly affect these matters, and the conclusions of the Paris Economic Conference were arrived at and adopted before America had brought her vast resources definitely on to our side. We may reasonably anticipate that new economic and trading agreements will be entered into in many directions, and it may well happen that after the war a near approach to commercial co-operation will take place among some of the great peoples who in the past have been in competition with each other. There is the possibility of closer working arrangements being introduced between parts of the British Empire and the United States, and the latter is strengthening some of her concerns so that they may be in a position to defeat any efforts that German trust organisations may be able to put forth abroad.

Before the end, the situation may yet undergo other changes, for we must recognise that most things are still in the melting-pot. The German mind is a thing fearfully and wonderfully made. Looked at from the point of view of the Allies, the economic position can only become worse and worse for her people the longer the war is continued if the Allies remain solid, with the substantial reinforcement of the United States. But the German people cannot speedily throw down the Prussian forces that have brought them face to face with ruin; if they fully knew the temper of the world that is against them they probably would do so in order to save some measure of their former international trade for the millions of workers. Almost inevitably, as it seems, they must yet curse the day when they were first led to bow down before the clay-footed idol of Prussian ambition.

We may leave our enemies to work out their own salvation. Necessity requires that we should centre our attention and effort on our own measures of preparation for the future. A speech recently delivered in the Canadian Senate, by the Hon. Frederic Nicholls, on "The Conservation and Extension of Canadian Trade" shows that anxiety there has led to proposals for immediate preparations to be set on foot for the after-the-war period of disorganisation. "When the war ends," said Mr. Nicholls, "we run great danger of a panic through disorganised trade conditions unless the Government lends a helping hand." He calls for constructive statesmanship and the risking of millions of State funds in the development of trade.

"Constructive statesmanship," based upon a full appreciation of all the difficulties, will be what all our Colonies and the Allied nations will need in the momentous years to come. Heaven grant it may not fail us!

We now have a "Minister in Charge of Reconstruction" in the person of Dr. Addison, whose experience of practical life at the Ministry of Munitions should render him better fitted for the intro-

duction of workable measures for Social Reform. From him and from the Ministry of Labour we shall require much "Constructive Statesmanship."

The Electric Power Supply Committee. INTEREST in the constitution and intentions of the Board of Trade Departmental Committee on Electric Power Supply continues unabated. As reported in our "Notes"

columns to-day, the representation of various interests on that body has been the subject of questions in the House of Commons; not only the municipal supply authorities, but also the provincial companies and the metropolitan undertakings are endeavouring to secure a voice in the deliberations of the Committee. Sir Albert Stanley considers that the Committee as now constituted is sufficiently representative of all parties, and is disinclined to make further additions to its membership.

The demand for direct representation of particular interests on deliberative bodies is a familiar feature of our social system; but we are not at all sure that the principle is a good one. Allowance must be made, no doubt, for personal predilections; a man immersed in a certain mode of thought must necessarily arrive at conclusions in harmony with his experience, and perfect freedom from bias cannot be attained by him. Hence, if members of one section of a profession or trade are appointed on a committee, it is not only fair but necessary that members of other sections, whose interests diverge from those of the former, should also be nominated. But it is the duty of each member of the Committee to endeavour to do justice to all sections, not to further the interests of any one section, and for this reason it would be far preferable that the Committee should be constituted as a judicial body with no sectional interests to serve at all. The idea may be Utopian, but if it could be carried out, it would make for efficiency and justice.

Electric Furnaces. ONE of the most noteworthy of the many advances in electrical applications which the war has directly brought about in this country

is the remarkable popularity which the electric steel furnace has acquired in a short period. It is true that before the war electric furnaces had been installed here and there—mainly in Sheffield—but progress was slow, and manufacturers regarded the new practice as experimental in character, while the irregular nature of the load largely discounted its obvious advantages in the eyes of the central-station manager.

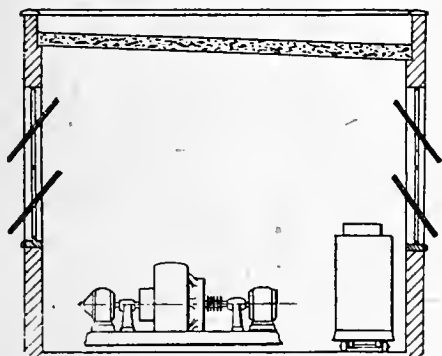
However, war conditions brought the matter to a head in a hurry; the urgent necessity of increased supplies of special alloy steels of the very highest quality, and of utilising all scrap to the best advantage, compelled steel manufacturers to make investigations, with the result so often experienced in connection with the applications of electricity—they found that not only was the output increased and the quality of the product vastly improved by the electrical process, but also the cost of labour was greatly reduced, and the cost of energy was quite reasonable. Moreover, the supply authorities under the new conditions were more solicitous for the fulfilment of the manufacturers' requirements than for the uniformity of their voltage records, and did all in their power to ensure an ample supply of electrical energy. Consequently, the electric furnace has scored a signal triumph, and has proved of inestimable value to the nation. It is for this reason that we have published all the information regarding it that has been available, for the assistance of makers and users of steel furnaces. When the war is over we hope to place before our readers particulars regarding developments in this connection, such as the provision of generating plant, &c., at certain centres, that will astonish them.

THE THEORETICAL CONSIDERATION OF THE VENTILATION OF SUB-STATIONS AND TRANSFORMER HOUSES.

By T. H. WOOD.

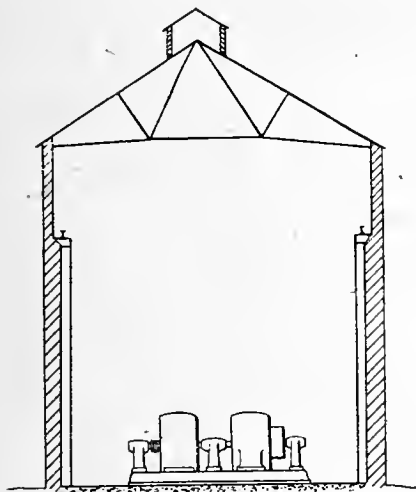
ALTHOUGH this subject is so important a factor in the design of sub-stations, it does not always receive the consideration which it deserves, especially as the results obtained by theory agree so well with the conditions found in well-designed sub-stations. *or NO. 2069*

Between the two modes of ventilation, mechanical and natural, it is impossible to fix any hard and fast rule, as each has its own particular advantages, and local conditions must always be the deciding factor. Natural ventilation has the great advantage of utilising the heat derived from the energy losses of the plant, so that the running cost is nil, and the initial cost of the louvre ventilators is not



SECTION OF SUB-STATION WITH SIDE WINDOWS ($k = 0.5$).

excessive. A common form of construction is to have them about 2 ft. high, running the length of the roof. The disadvantage of the louvre type is that it is not easy to vary the ventilating area, so that on light load in winter time the sub-station gets very cold. This can be remedied to a certain extent by employing a double row of windows, made to open and close as desired, and arranged in the form



SECTION OF SUB-STATION WITH LANTERN ($k = 0.6$).

of a roof lantern, thereby serving the double purpose of lighting the centre of the building and providing a means of ventilation which can be regulated.

Mechanical ventilation is usually carried out by means of a propeller fan fitted in a circular hole near the roof, the chief advantage being the much reduced ventilating area required; and if it is fitted in the gable end, it can often be made to assist in the architectural design of the building, but one must not overlook the running cost.

In the following calculations, only the total plant which is likely to be running at one time and at its rated capacity is taken into account. The converting machinery is only designed for overloads over a certain period of time; when the machinery is taking an overload, the total extra

heat given out would probably only balance the heat absorbed in heating the plant and room, &c., through the 20° F. rise allowed, and, for practical reasons, has not been included in the formula.

The power lost in the whole plant, transformers and converters combined, will be converted into heat, so that it is an easy matter to find the exact amount of heat generated in the station.

The power loss is $(100 - \text{eff. per cent.}) \times \text{size of plant in KW.} \div 100$. This will be denoted by $E \text{ kw}$.

To convert $E \text{ kw}$ into British thermal units per minute, $E \text{ kw} \times 1.34 \times 33,000/778 = 56.8 E \text{ kw} = \text{B.T.H.U. per minute.}$

As the specific heat of air is 0.24 , one B.T.H.U. will raise $1/0.24 = 4.2$ lb. of air through 1° F. at constant pressure, and at 70° F. 4.2 lb. of air occupies 55 cu. ft.

The total number of cubic feet of air per minute raised through $(T - t)$ degrees F., where T is the inside temperature and t the outside temperature of a building, is given by—

$$C = 56.8 E \text{ kw} \times 55/(T - t) \quad \dots \quad (1)$$

and this quantity of air will have to pass through the station every minute.

It will now be necessary to find the velocity at which the air will pass through the ventilators due to reduction in specific gravity; this will depend upon the height of the building and the difference in temperature between the inside and outside air, and is given theoretically by—

$$V = 480 \sqrt{[h(T - t)(t + 460)]} \quad \dots \quad (2)$$

where V = velocity of air in feet per minute, and h = height of sub-station from centre of bearings to under side of louvres.

In actual practice this will vary according to the design of the station, and the above should be multiplied by a constant k varying from 0.4 to 0.6, the constant approaching the higher value the nearer the station approaches a straight shaft. The values given below have been found suitable for the particular types of buildings concerned (see figures).

The area of the ventilators will be:—

Cubic feet of air to be removed per minute \div velocity of air through ventilators in feet per minute, and substituting from equations (1) and (2)—

$$A = 56.8 E \text{ kw} \times 55 / (T - t) \div k 480 \sqrt{[h(T - t)(t + 460)]}.$$

This can be greatly simplified if we take the average temperature in England at 62° F. and the permissible rise at 20° F.

The equation then becomes—

$$A = 56.8 E \text{ kw} \times 55/20 \div k 480 \sqrt{[h \times 20/522]} \\ = 156.2 E \text{ kw} / k 480 \sqrt{[0.383 h]}. \quad \dots \quad (3)$$

Where $E \text{ kw}$ = loss of power in KW.; k a constant depending upon the design of the station and varying from 0.6 to 0.4; and h height of louvre ventilators from centre of machine bearings or half height of transformers.

As a practical example, let us take the case of a 1,000-kw. rotary converter with transformers, the combined efficiency being 92 per cent., height of sub-station 25 ft., taking $k = 0.5$.

$$\text{Area} = 156.2 E \text{ kw} / k 480 \sqrt{[0.383 h]} \\ = 12,496/235 = 54 \text{ sq. ft.}$$

One must bear in mind the difference between the ventilation of a sub-station and that of a public building; in the former case, the main object is to keep the temperature within certain limits, and not, as in the case of a public building, to change the air for sanitary purposes. Therefore, the cooling effect of the walls, roof, and windows tends to reduce the ventilating area required in the case of a sub-station, but in the case of a public building this would have the reverse effect if natural ventilation were employed. A better result can, therefore, be obtained by taking into account this loss by radiation, and the following gives the B.T.H.U. loss by radiation per sq. ft. per hour per deg. F. difference between the inside and outside air temperatures:—

Brick wall. Thickness	9 in.	14 in.	18 in.	22½ in.
B.T.H.U. per hour	45	3	25	21
1 sq. ft. of window	...	...	1	B.T.H.U.
1 " " skylight	...	...	1.03	"
Outside door	...	...	0.41	"
Slates	...	...	1.04	"
1½ in. boards in roof	...	...	0.38	"

As the temperature rise in the station is fixed at 20° F., the total loss of heat in B.T.H.U. per minute is given by—

$$\begin{aligned} \text{Loss B.T.H.U. per minute} &= (\text{area of walls} \times k_1 \\ &+ \text{area of windows} \times k_1 + \text{area of skylight} \times k_1 \\ &+ \text{area of roof} \times k_1) \times 20 \div 60 \\ &= \frac{1}{3} \Sigma (\text{areas} \times k_1), \end{aligned}$$

and this quantity will have to be subtracted from the heat generated in the station, and modifies formula (1)—

$$[56.8 E kw - \frac{1}{3} \Sigma (\text{areas} \times k_1)] \times 55 \div 20 \quad \dots (4)$$

This gives the quantity in cu. ft. of air to be changed after allowing for loss in radiation through the walls, roof, &c., and the modified ventilating area will be from equations (4) and (2)—

$$[56.8 E kw - \frac{1}{3} \Sigma (\text{areas} \times k_1)] \times 2.75/k \times 480 \times \sqrt{(0.383 h)} \quad \dots (5)$$

Working out the previous example of a rotary converter of 1,000 kw. with transformers, the combined efficiency being 92 per cent., height of sub-station 25 ft., again taking $k = .5$, the area of 14-in. brickwork = 1,488 sq. ft., area of glass in roof 216 sq. ft., area of slates on 1½-in. boards 360 sq. ft. —

$$\begin{aligned} [56.8 \times 80 - \frac{1}{3} (1,488 \times .3 + 216 \times 1.03 \\ + 360 \times .38)] \times 2.75/.5 \times 480 \times \sqrt{(0.383 \times 25)} \\ = 50 \text{ sq. ft.} \end{aligned}$$

By taking into account the loss of heat by radiation, the ventilating area has been reduced 4 sq. ft. for a 1,000-kw. machine.

Mechanical Ventilation.—If the ventilation is to be done by fan the quantity of air in cubic feet per minute to be moved will, of course, remain the same as with natural ventilation, and is obtained from equation (4). If a propeller fan is used the diameter can best be obtained from the maker's catalogue, or approximately from the formula—

$$D = \sqrt[3]{[c/0.75 N]},$$

where D = diameter of fan in feet; N = number of revs. per minute; and c = cubic feet of air moved.

By substituting equation (4) in place of c in the above expression—

$$D = \sqrt[3]{[56.8 E kw - \frac{1}{3} \Sigma (\text{areas} \times k_1)] \times 2.75/.75 N}. \quad (6)$$

Working out the diameter of fan required for a station exactly as in the previous example, and taking revs. of fan per minute as 400—

$$D = \sqrt[3]{[(4,544 - 272) \times 2.75/.75 \times 400]} = 3 \text{ ft. 4 in. diameter.}$$

Therefore, by using mechanical ventilation, the area has been reduced by $50 - 8.72 =$ about 41 sq. ft. for a 1,000-kw. set.

Finally, let us consider two cases which occurred in actual practice: the first, a sub-station lay-out of two rotary converters with transformers, each 1,500 kw. rated capacity and 92 per cent. efficiency, one of which only was to be used, the other kept as stand-by. The overall dimensions of the building were 35 ft. \times 50 ft. \times 23 ft. high to eaves and 32 ft. to under-side of ventilators. The radiation areas were 11-in. walls, 1,120 sq. ft., roof slates on boards, 1,250 sq. ft., and glass in skylight 600 sq. ft. In this station the ventilating area was 61 sq. ft., and the temperature rise 15° F. Let us see how this compares with the formula:—

$$\begin{aligned} \text{Area} &= [56.8 \times 120 - \frac{1}{3} (1,120 \times .3 + 1,250 \times .38 + \\ &600 \times 1.03)] \times 2.75/.6 \times 480 \times \sqrt{(0.383 \times 32)} \\ &= (6,816 - 776) \times 2.75/288 \times 1.1 = 16,610/317 \\ &= 52.5 \text{ sq. ft.} \end{aligned}$$

And as the formula allows for a 20° rise, I think the results were very satisfactory.

The second case, one that was much more suitable for

comparison, the station being full of plant under a fairly steady load, was a transformer house with three 500-K.V.A. transformers under full load, the efficiency being 98 per cent. The ventilation was by a fan 2 ft. in diameter, making 600 R.P.M., and the temperature rise about 20° F. The area of 14-in. brickwork was 594 sq. ft., 9-in. brickwork 774 sq. ft., iron doors 242 sq. ft., and roof (slates only) 364 sq. ft.

The diameter of fan required as obtained from the formula is—

$$\begin{aligned} D &= \sqrt[3]{[56.8 \times 30 + \frac{1}{3} (594 \times .3 + 774 \times .45 + 242 \\ &\times 1 + 364 \times 1)] \times 2.75/.75 \times 600]} \\ &= \sqrt[3]{[(1,704 - 377) \times 2.75/450]} = \sqrt[3]{8} = 2 \text{ ft. diameter.} \end{aligned}$$

The formula in this case agrees exactly with the results found in practice.

WESTINGHOUSE TURBO-ALTERNATORS.

THE constant progress that is taking place in the evolution of the turbo-generator causes special interest to attach to two brochures which have been issued by the British Westinghouse Electric and Manufacturing Co., Ltd., describing respectively their steam turbines—high-pressure, low-pressure, mixed, and back-pressure—and their alternators for coupling to them. At an early stage, when licensees of the Parsons type of turbine, the Westinghouse Companies saw the desirability of combining the advantages of the impulse type with those of the reaction type that they were building, and substituted for the high-pressure stages of the Parsons turbine a velocity-compounded element on the impulse principle, thus producing the "disk and drum" type of turbine which has become so popular. Later, after a thorough investigation of the systems available, they took out licences to manufac-

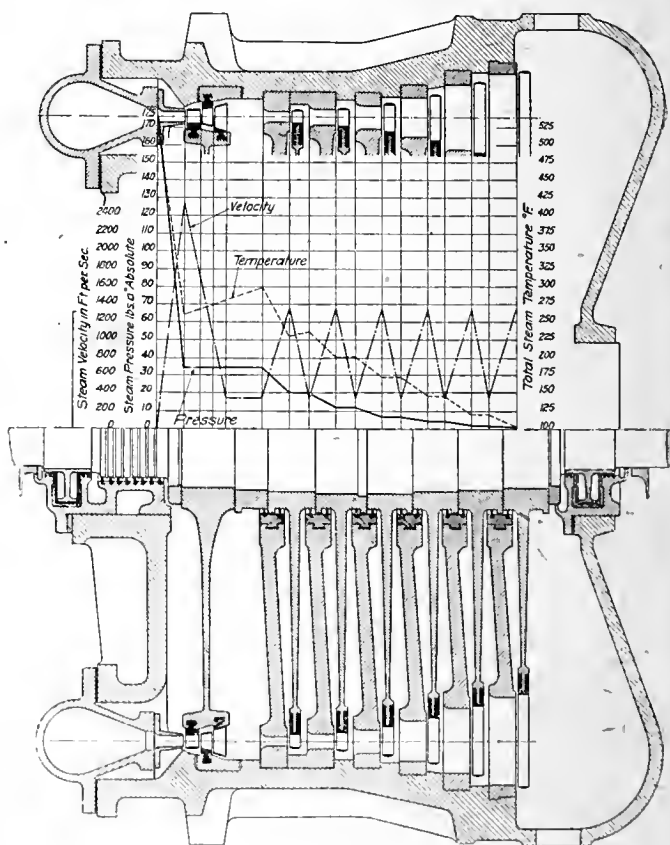


FIG. 1.—DIAGRAMMATIC SECTION OF WESTINGHOUSE-RATEAU HIGH-PRESSURE TURBINE.

ture under the patents of Prof. Rateau, of Paris, and eventually adopted the impulse principle for their standard machines.

It was, however, considered desirable to employ a velocity wheel at the high-pressure end instead of following the pure Rateau system throughout, as the latter would give a pressure inside the casing, with steam at 175 lb. per sq. in. absolute (12.3 kg./cm.²) superheated to 525° F. (274° C.), of 85 lb. per sq. in. (6 kg./cm.²) at 415° F. (213° C.), whereas the modified design, as shown in the accompanying section, fig. 1, enables the pressure in the casing to be reduced to 35 lb. per sq. in. abs. (2.5 kg./cm.²) and the temperature to 265° F. (130° C.), thus lightening the construction and avoiding distortion of the cylinder; at the same time with the velocity wheel the machine is shortened between the bearings, the shaft is stiffer, and the critical speed is raised. While the drum turbine is cheaper to construct, the disk type lends itself to

more accurate calculation of the stresses. Each wheel can be balanced separately on the shaft, and thus the whole spindle is balanced throughout. The drum construction may be balanced statically, but be considerably out of running balance.

For these and other reasons, the British Westinghouse Co. adopted as their standard the pure impulse turbine, having a velocity wheel at the high-pressure end and the Rateau impulse wheels for the succeeding stages.

The steam first expands through nozzles in which its potential energy is partly converted into kinetic energy, acquiring sufficient velocity to do work efficiently on two rows of moving blades, the intermediate fixed blades being merely deflecting or guide blades. After the steam leaves the velocity wheel its expansion is con-

The blade wheels are of the finest wrought steel, of taper section, and are machined all over: large holes are provided to ensure that the pressure on both sides shall always be the same.

The blades are machined out of the solid bar to a curve defined by a former fixed on the machine, so that they are all exactly alike in shape and weight. The methods adopted for attaching them to the wheels are shown in figs. 5 and 6; the former applies to the velocity wheel, the blades being dovetailed into and accurately fitting a T-slot, while the "straddle" type is used for the disks, to which the blades are attached with rivets in double shear. The wheels are forced upon the shaft and driven by feather keys, the last wheel being fixed with a nut. The axial clearance between the blades and stationary parts varies from $\frac{1}{16}$ to $\frac{1}{8}$ in. (3 to 5 mm.).

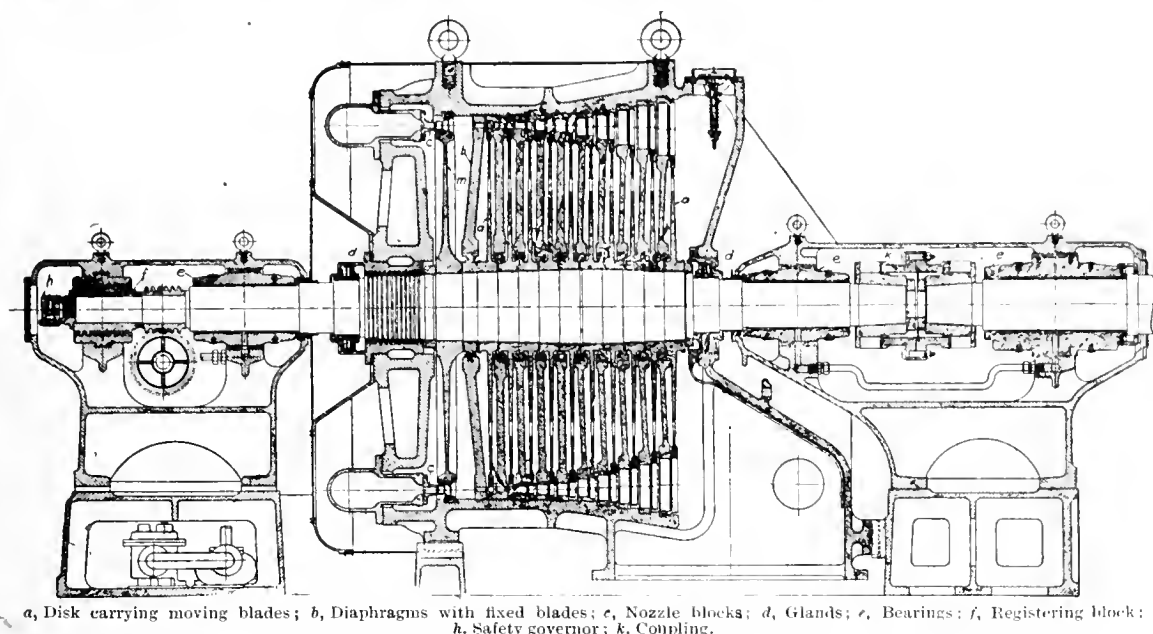


FIG. 2.—LONGITUDINAL SECTION THROUGH WESTINGHOUSE-RATEAU H.P. IMPULSE TURBINE.

tinued in single stages until the exhaust pressure is reached, each stage consisting of a diaphragm fixed in the cylinder and a moving wheel on the shaft: the velocity acquired by the steam in expanding through the diaphragm nozzles is completely used up on the moving wheel. A section of the complete turbine is given in fig. 2.

There are usually three nozzle blocks, the number in use depending upon the load. The main governor is driven by a worm on the shaft between the main bearing and the registering or thrust block, the duty of which is not to resist end thrust, as there is none, but to maintain the shaft in its correct position with regard to the cylinder. The oil pump is driven from the main governor shaft. It will be noticed that one end of the cylinder is fixed to the bedplate, while the other is free to slide on a guide to allow of expansion; the transverse expansion of the cylinder is likewise provided for. The cylinder is of special cast-iron, strengthened with ribs, but the high-pressure nozzles are of wrought steel, machined all over. The diaphragms are cast in halves, as shown in fig. 3, with spigot and socket joints to prevent leakage of steam from one side to the other, and the respective halves in the upper and lower portions of the cylinder are not disturbed when the machine is

and the radial clearance between the tips of the revolving blades and the cylinder is never less than $\frac{1}{8}$ in. (6 mm.).

The shaft is of steel, stepped in diameter for each wheel, and is fitted with the Westinghouse water gland at each end, as well as with a labyrinth gland at the high-pressure end (where the pressure is about 20 lb. by gauge at full load): between the two glands at the high-pressure end is a connection to the exhaust space, so that both water glands are under identical conditions. They are absolutely air-tight, keep the bearings cool, prevent escape of steam into the engine room, and are perfectly self-adjusting under all conditions of load and vacuum.

The governor valve and overload valve are operated by an oil relay. The valves are of the balanced double-seated type, with self-aligning plates. The governor is of simple design, with provision for varying the speed whilst running, and an overspeed safety device is fitted on the end of the shaft, which trips the stop valve

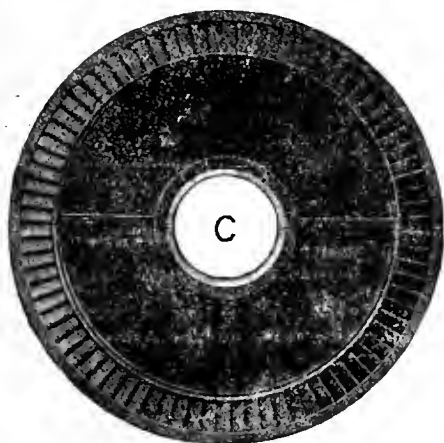


FIG. 3.—SPLIT DIAPHRAGM.

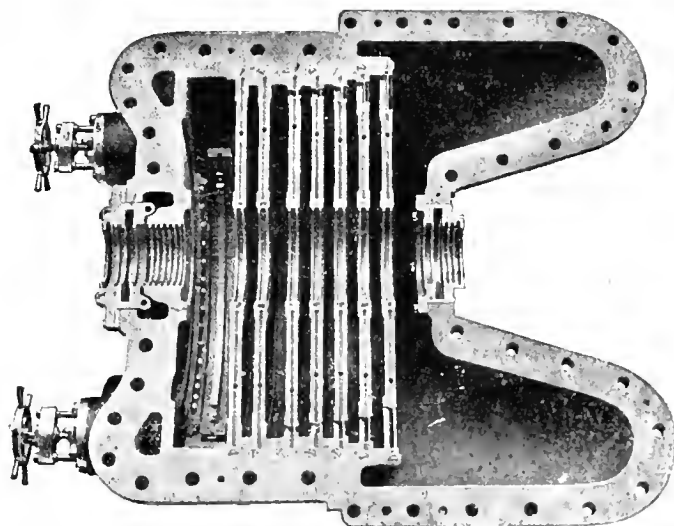


FIG. 4.—DIAPHRAGMS IN POSITION IN HALF-CYLINDER.

opened: the outer periphery of each diaphragm fits in a groove in the cylinder, and the inner periphery is provided with special glands, which almost touch the shaft. The guide blades are of special steel, cast into the cast-iron diaphragms, or segmentally fixed to the diaphragms when cast-steel is used for the latter. The advantage of split diaphragms, with regard to accessibility, as compared with the practice of threading one-piece diaphragms on the shaft alternately with the blade wheels, is self-evident.

in case of excess of speed by releasing the oil pressure in the relay cylinder.

The bearings are usually of cast-iron lined with white metal and are provided with liners allowing the main spindle to be adjusted in any direction. A rigid shaft coupling is used for high-speed turbines, and a flexible type for low speeds, the latter consisting of two serrated heads engaging with a cylindrical sleeve, which can be slid to either side on removing a cover plate so that

either of the revolving elements can be removed without interfering with the other.

Exhaust, mixed-pressure, back-pressure, and reducing turbines are built on the same general lines, the design being varied to suit the conditions. Small turbines for driving electrical generators of 25 to 200-kw. output are also made, with a single two or three-row velocity wheel; these, it is said, can compete in price and efficiency with the high-speed steam or gas engine. They are extremely light, compact, and simple in construction, and find many useful applications.

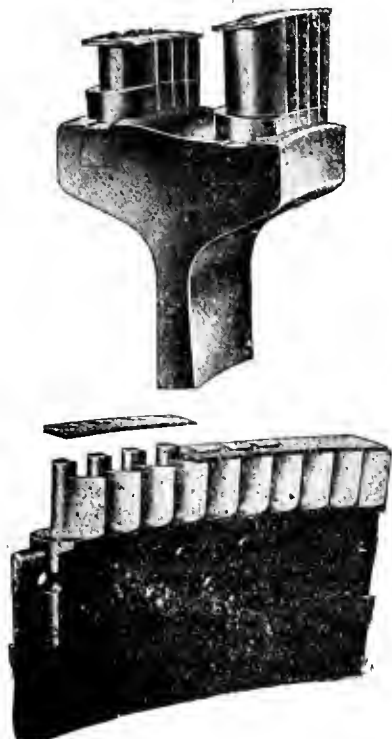
Fig. 7 shows the arrangement of the steam-chest, over-speed trip gear, &c., of a high-pressure turbine.

Turning to the subject of alternators, there is no such choice of rival systems as in the case of turbines; practice tends towards

In small machines former-wound coils are used: one end is left open, to enable the coils to be pushed into the slots axially, after which the ends are connected together.

Fig. 9 shows in detail the method of clamping the end connections with wood blocks and metal bolts. Short-circuit tests at full voltage have been made in many different sizes of machines, demonstrating the ability of the winding to withstand the resulting stresses.

The rotor is the crux in the design of a turbo-alternator, owing to the necessity of perfect balancing at high speeds, ample strength, and adequate ventilation. The end windings in particular present difficulties in design, as they are often of considerable weight, and must be absolutely immovable. The Westinghouse Co. has adopted the smooth cylindrical type with radial slots, which lends itself to the easy anchoring of the winding, large output for size, good wave form, silent running, and facilities for ventila-



FIGS. 5 AND 6.—BLADING OF VELOCITY-COMPOUNDED AND IMPULSE WHEELS.

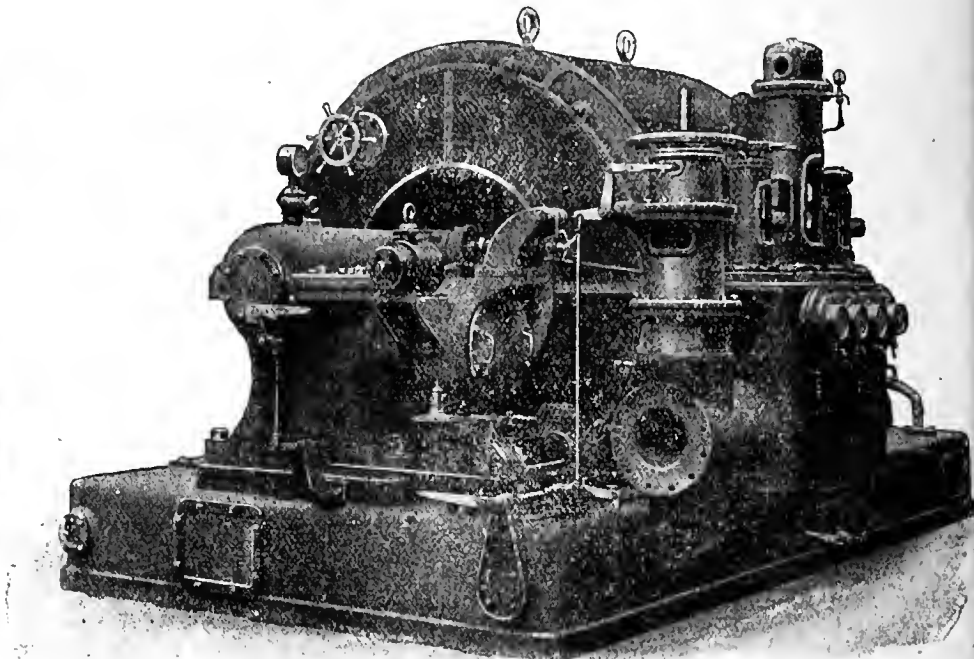


FIG. 7.—END VIEW OF WESTINGHOUSE-REATEAU H.P. IMPULSE TURBINE.

uniformity in the main design, and the differences between one and another make depend rather on details of design as regards methods of winding, ventilation, &c., than upon broad principles.

The Westinghouse turbo-alternator has a stator of the usual cylindrical type, consisting of steel punchings rigidly held in a substantial yoke, with air outlet chimneys at both top and bottom;

tion. The core is usually forged solid with the shaft, of high-class material; the coils are held in the slots by metal wedges, and the end connections are enclosed in steel or bronze end rings. The slots are wide and comparatively few in number, so that the end connections are substantial straps, from 1½ to 2 in. (38 to 51 mm.) wide in large machines, which resist deformation, even if the machine is short-circuited and the rotor brought to a sudden standstill. The blocking at the ends can therefore be reduced to a minimum, and the space utilised for ventilation. Fig. 10 shows a rotor partly wound, and fig. 11 the completed rotor.

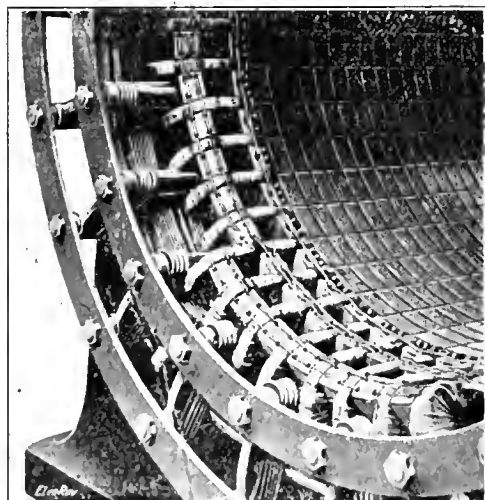


FIG. 8. ARMATURE WINDING OF 5,000-KW., 11,000-VOLT 1,000-R.P.M. TURBO-ALTERNATOR.

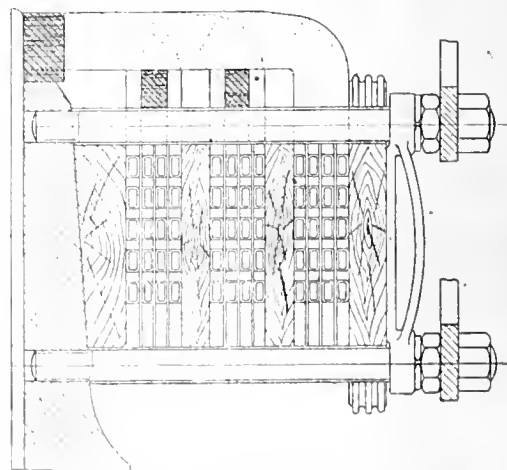


FIG. 9. SECTION OF END WINDING, SHOWING METHOD OF CLAMPING.

either of these can be used for the discharge of heated air, which is preferably carried away by ducts to the exterior of the building, to ensure quieter running and a cooler engine room. The winding consists of separate bars and end connectors, which can be withdrawn independently for repairs; this system, as shown in fig. 8, allows of a solid bracing of the end connections, a most important matter, without interfering with the ventilation. The conductors are laminated to prevent eddy currents, and in large machines each conductor is insulated for the full voltage between the terminals.

In order to compress the winding and insulation to a practically solid condition, a clamping system consisting of heavy steel rings and radial screws is employed, as shown in fig. 12. By this means a pressure is applied to each coil approximately equivalent to the centrifugal force at full speed, amounting to from 50 to 100 tons per slot on the larger rotors. This high pressure, combined with baking at a high temperature, eliminates all possibility of "breathing" of the coils in service. Each coil is made in one piece without joints.

In turbo-alternators, which give a large output from a small volume of material, efficient ventilation is of supreme importance. In the smaller Westinghouse machines cold air is drawn into the casing by means of fans mounted on the ends of the rotor, and discharged through radial ducts in the stator. The larger machines are provided with the Westinghouse patent radial-axial system, according to which axial ducts carry air from both ends of the machine to radial ducts, from which it passes outward into the yoke (fig. 13). Local heating is prevented by causing the air to be

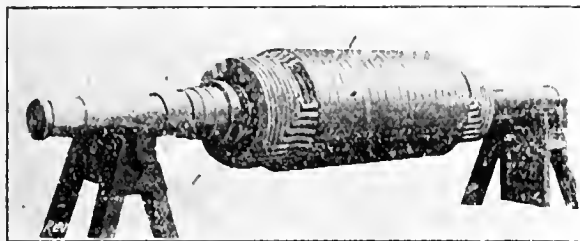


FIG. 10.—8,000-K.V.A., 2,400-R.P.M. ROTOR, IN COURSE OF WINDING.

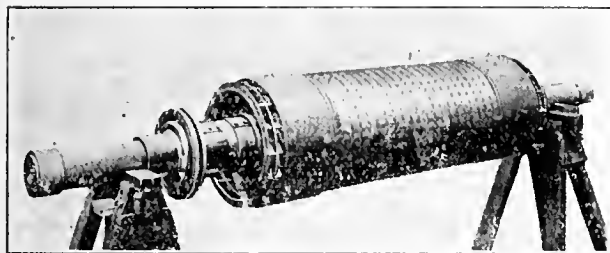


FIG. 11.—COMPLETED 8,000-K.V.A. ROTOR.

discharged from the axial ducts over the whole length of the stator core, part of the air from each end being led the whole length of the core. Thus the advantages of uniform temperature and large volumes of air are combined.

The air enters the rotor by way of axial holes extending the whole length of the core, which feed radial ventilation ducts at

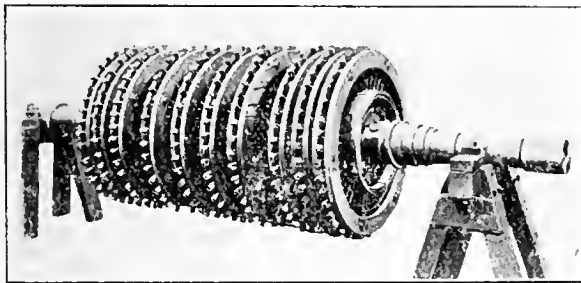


FIG. 12.—PRESSING GEAR IN POSITION ON 5,000-KW. ROTOR.

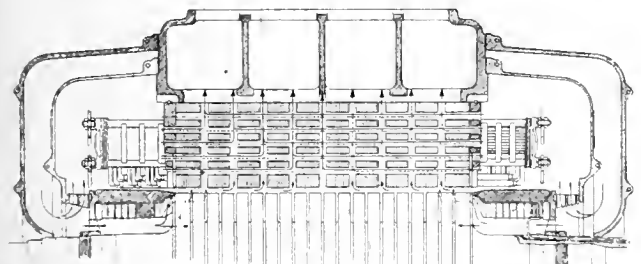


FIG. 13.—RADIAL-AXIAL SYSTEM OF VENTILATION.

intervals, the air passing across the air-gap and through the radial ducts in the stator core. Special care is taken to cool the rotor end connections, and all machines are made self-ventilating.

The exciter is usually overhung on an extension of the rotor shaft, and generally has a radial commutator, which eliminates the effects of vibration.

In conformity with British traditions, reliability and soundness of construction, combined with high efficiency, have been the fundamental considerations in the design of the Westinghouse turbines and alternators alike, and that success has been attained in respect of these will be admitted. Several machines of 23,500 K.V.A. have been or are being supplied to British power stations, and we have no doubt that larger sizes will be called for at no distant date.

ELECTRIC VEHICLES IN SHEFFIELD.

BY J. A. PRIESTLEY.

(Abstract of paper read before the INSTITUTE OF CLEANSING SUPERINTENDENTS.)

SHEFFIELD is easily the largest user of battery-operated vehicles for refuse collection, a purpose for which they are particularly suitable. In 1914, on the author's recommendation, the T.C. made extensive inquiries, and purchased an Edison 2-ton vehicle, which has been at work continuously since September, 1915. The results were so satisfactory that others were ordered, the number at work at the time of writing being eight, with two to follow. In order to facilitate comparison of costs, the author explains that the conditions relating to bin refuse collection in Sheffield are less favourable to the use of motors than in any other place known to him, but the opportunity of using the vehicles on both day and night service is a decided advantage. There are no back streets in the city; refuse collected during the day is carried from bins at the rear of the houses to the street by the workmen, the minimum distance being 20 yards. With horse wagons there are two men, who both help to load; with "electrics" there are three labourers, and a driver who only loads occasionally. The costs given below for bin refuse include all labour in collecting.

Ashpits are emptied by "getters-out," who are paid at piece rates, and wheel the refuse into the front street, where it is loaded into wagons, chiefly at night. Horse wagons are loaded by the driver alone, and electrics by the driver and one labourer. The costs in the case of ashpit refuse are for loading and removal only. The weekly wages at present paid are:—Electric vehicle drivers, 16s.; ditto labourers, 43s.; horsemen, 11s.; horse wagon labourers, 38s. The cost of horse, carter, and wagon is taken at 13s. 6d. a day, to which figure is added the wages paid for labourers.

The working costs of the "electrics" include wages, vehicle costs, tires, and electricity. The vehicle costs are as follows:—

Interest and depreciation (10 years' life) ...	£123	5	10
Insurance ...	8	10	0
Garage, cleaning, charging, and watering, ...	25	2	8
Waste, oil, grease, &c. ...	6	10	0
Repairs and renewals ...	13	2	0

£206 10 6

or £3 19s. 6d. per week, divided equally between day and night work. The tires are maintained under contract.

The batteries are guaranteed to give 100 per cent. of their original efficiency after eight years' constant service. The life of the electric vehicle is necessarily longer than that of a steam or petrol vehicle, with many working parts, and the strains and shocks which it endures are far less with the electric drive, while the allowance for repairs and renewals represents 10 per cent. on the cost of the chassis—an ample provision for 10 years' life. The total mileage per week is very low, and nearly one-half of this is run without load.

The period reviewed is comprised principally between March 26th, 1916, and March 25th, 1917, during which five electric vehicles were in use for different periods. In this year 51,499 tons of bin refuse were collected by horses at a cost of 65'4d. per ton, and 7,040½ tons by "electrics" at a cost of 57'8d. per ton. Of ashpit refuse, 27,878 tons were collected by horses at a cost of 44'5d. per ton, and 10,670 tons by "electrics" at a cost of 26'3d. per ton. The details of the costs of electric vehicles for bin refuse are:—

Vehicle costs, about 3½ years ...	£331	1	11
Drivers' and labourers' wages ...	1,230	9	8
Tires—12,640 miles at 1d. per mile ...	52	13	4
Electricity—19,639 units at 1d. per unit ...	81	16	7

£1,696 1 6

For ashpit refuse, the electric costs were:—

Vehicle costs, about 3½ years ...	£362	16	0
Drivers' and labourers' wages ...	641	5	11
Tires—15,313 miles at 1d. per mile ...	63	16	1
Electricity—24,716 units at 1d. per unit ...	102	19	8

£1,170 17 8

As the electrics, with one exception, were working on the longest distances, the comparison is not strictly fair to them. As the long-distance work is taken over from the horse wagons, the horse costs over the city area have decreased, while the electric costs remain at a maximum. In one ashpit district horses and an "electric" worked side by side, with the result that over a period of 23 weeks the average cost was: horses, 66'2d. per ton, and "electrics" 34'2d. per ton.

In addition to dealing with house refuse, the author has used electric vehicles for the removal of clinker residue from the destructor works to tips at a cost of 21'9d. per ton (or 16'4d. per ton-mile), compared with horse labour on the same work, 26d. per ton. On another route, removing clinker, the respective costs were 18'6d. per ton (18'1d. per ton-mile) and 21'6d. per ton; and on a longer route, 19'3d. per ton (11'7d. per ton-mile) and 26d. per ton.

The result of 12 months' working of electric vehicles in Sheffield considered on a financial basis alone is eminently satisfactory.

The work of the five vehicles for varying periods is equivalent to that of 3½ vehicles for the whole year: the saving over horse costs over the whole city amounts to £1,051; capital has been

written off to the amount of £293; electricity supplied from the destructors represents a further sum of £192, making a total of £1,535. Thus 3½ vehicles in one year have cleared off more than the initial cost of 1½ vehicles. If the comparison with horses were made only for the districts now served by the "electrics," the saving would amount to more than £2,000.

The author believes that "electrics" would also be profitable on single shifts only.

Average tons per day	horses	...	...	Bin. refuse.	Ashpit refuse.
.. .. .	electrics	...	...	3.42	3.63
.. .. .	.. .. .	...	...	7.67	10.58
Value of each electric in horses	...	...	...	5.15	

These figures relate to the whole city; the number of horses actually replaced by each electric is a fraction under six.

LEADS FOR ELECTRIC FURNACES.

BY PROF. ARVID LINDSTROM.

(Translated from *Teknisk Tidskrift in Metallurgical and Chemical Engineering*. Abstract.)

With the increasing size of arc or resistance furnaces the difficulties of conveying the current from the transformer to the furnace have become more pronounced. With electrode potentials as low as 50 and 100 volts the current necessarily will be very high, requiring in turn conductors of a large cross-section, and under such conditions two difficulties are met with.

One is due to the "skin effect," or the tendency of the alternating current to concentrate in the portion of the conductor nearest the surface; the other is due to the self-inductance of the conductor loop which connects the transformer with the furnace, resulting in a low power factor.

It is from the above two points of view that the problem of furnace conductors is dealt with in the following article, and an endeavour will be made to show how the best results may be attained when designing the leads, and also how the results may be investigated by tests. As an illustration, a known furnace installation will be taken for an example.

I.—THE EFFECTIVE RESISTANCE OF LARGE CONDUCTORS.

For round conductors Hospitalier has calculated a table for the ratio—

$$\frac{R_c}{R_d} = x = \frac{\text{effective resistance with alternating current}}{\text{resistance with direct current}}$$

as function of f and d , where f is the frequency, and d is the diameter of the conductor in cm. (1 cm. = 0.394 in.).

From this table the following values only will be given:—

$f d^2$	720.	1,280.	2,000.	2,880.	5,120.	8,000.
x	1.32.	1.68.	2.04.	2.39.	3.10.	3.79.

The furnace chosen for the example has a capacity of 900 kilovolt-amperes at the lowest pressure of 50 volts, so that the highest current is consequently 18,000 amperes. The frequency is 50. The conductors consist partly of four bars 200 × 15 mm., spaced comparatively close and connected in parallel. This corresponds to a cross-section of 120 sq. cm., or a round solid conductor with diameter $d = 12.4$ cm.; $f d^2 = 7,700$, and therefore $x = 3.7$.

It may be objected that the conductor did not consist of one single solid round conductor. This is true, but it must be remembered that even if the conductor is split, no gain is made if the spaces between the laminations do not take away any appreciable part of the section, and if instead of being round, the conductor had a rectangular or nearly square cross-section, of the same area, the conditions would not be much improved.

In our case, the four bars are arranged about as shown in fig. 1. The bars are spaced wider apart, and the average specific conductivity is consequently less, but not to such an extent that any



FIG. 1.

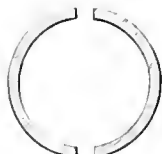


FIG. 2.

CONDUCTOR ARRANGEMENT.

appreciable decrease of x is obtained. At the same time as this specific conductivity has decreased, the linear dimensions of the cross-section have increased, and without introducing a too great error, it may be assumed that the resistance in this case is approximately three times as great for the 50-cycle alternating current as for direct current, or $x = 3$.

Now the question arises: How shall the conductors be arranged in order that a considerably better result may be obtained? The

first thing which suggests itself is the use of only one bar, not too thick, but much wider—a bar whose width is 20 to 50 times its thickness.

If h = half the thickness of the conductor in cm.,

$$c = 2 \pi \sqrt{\mu \lambda f}$$

where

μ = permeability of the material,
 λ = specific conductivity in C.G.S. units,
 f = frequency,

and x may be obtained directly from the curve in fig. 3. This is on the assumption that the width of the conductor is infinite in

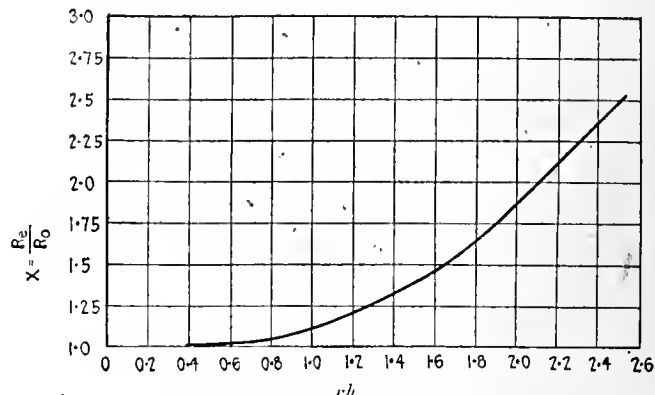


FIG. 3.—DIAGRAM FOR FINDING x .

comparison to the thickness, an assumption which may be considered to apply approximately to our case. When—

$\lambda = 1/2,000$ for copper, $\mu = 1$ for copper, $f = 50$, then $c = 1$.

If now the thickness = $2h = 1.5, 2.0, 2.5$ cm.

then $ch = 0.75, 1.0, 1.25$.

and according to fig. 3, $x = 1.03, 1.09, 1.21$.

In all three cases, but especially in the first and second, a considerable reduction in the loss has been attained with the same weight of copper. We could use a conductor 500 × 8 mm., or only one-third of the originally assumed weight, and obtain the same loss as that now prevailing. Two-thirds of the installed copper could therefore be saved, and the temperature would certainly not be materially higher for this conductor than that of the four bars actually installed.

Even with a single bar 500 × 8 mm., a concentration of the current towards the edges must take place, so that a somewhat increased resistance will result. To avoid this, the conductor may be shaped as a pipe or tube, and if its diameter is fairly large as compared to the thickness of the walls, the calculation used for a bar of infinite width may be applied without appreciable error. With a thickness of 8 mm. the outside diameter of the tube would, therefore, be $500/\pi + 8 = 168$ mm., this being based on the assumed area of 4,000 mm.², which is one-third of that installed (12,000 mm.²).

Instead of an entirely closed tube, it can be separated into two halves as in fig. 2, but in the former case it is possible to provide for a very effective cooling inside the pipe.

II.—THE SELF-INDUCTANCE IN ELECTRIC FURNACE LEADS.

The connections between the transformer and the furnace are made as shown in fig. 4. The loop in which the self-induction takes place is a, b, c, d, e, a , and this should obviously be made as small as practical conditions will permit, consideration, of course, also being given to copper weight and energy loss. The distances

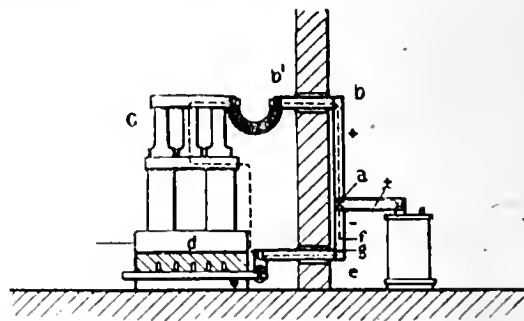


FIG. 4.—CONNECTION BETWEEN TRANSFORMER AND FURNACE.

bc and de are each, as a rule, approximately 3 m. at least. The question then arises, how can the self-induction in such a small loop, consisting of only one turn, reach such a value as to cause undue difficulties? The inductance L in itself is not large, but the voltage drop caused thereby, $E_s = 2 \pi f L I$, is considerable. This is naturally due to the large value of I , and the value seems particularly large when compared to the voltage of the furnace (50 to 100 volts).

By means of the following formula the self-inductance of a round conductor forming a circular loop, fig. 5, can be calculated :

$$L = 4 \pi R (0.58 + \log_e (R/r) - 2 r/R) 10^{-9} \text{ henry}$$

where R = the radius of the loop in cm.
 r = the radius of the conductor in cm.

If, in fig. 4,

$$bc = de = l = 300 \text{ cm.} \\ cd = be = l_1 = 400 \text{ cm.}$$

and if the rectangular arrangement is assumed to be changed to a circular one with the same circumference, its radius will be

$$R = (2 \times 300 + 2 \times 400)/2\pi = 220 \text{ cm.}$$

If we also assume that the leads are so heavy and so constructed that the radius of an equivalent tubular conductor is $r = 12$ cm., then the self-inductance will be

$$L = 0.934 \times 10^{-6} \text{ henry.}$$

With a current of 18,000 amperes we get

$$E_s = 53 \text{ volts.}$$

For a rectangular loop it is, however, possible approximately to deduce the self-inductance directly as follows : If the self-inductance for the two opposite parallel sides l is calculated in the usual manner and similarly for the two sides l_1 , it is evident that the total inductance of the loop will be approximately equal to the sum of the two, and thus

$$L = 4 (l \log_e (l/r) + l_1 \log_e (l_1/r)) 10^{-9} \text{ henry} = 0.934 \times 10^{-6}$$

—(accidentally) exactly the same value as before. This value is, however, too high on account of the fact that the entire side cd , which comprises the electrodes with their holders and the furnace itself, has a considerably greater cross-section (and consequently greater r) than the rest of the circuit. Taking this into consideration, and assuming

$$r_1 = 40 \text{ cm.,}$$

we get

$$L = 0.836 \times 10^{-6} \text{ henry,}$$

and

$$E_s = 47 \text{ volts.}$$

That part of the inductance which is caused by the magnetic field within the conductor itself has been neglected, but when, as previously stated, the current is concentrated near the surface, the error is not appreciable. On the other hand, it may be suspected that the value is too great on account of the fact that the side bc partly consists of cables which are spread out considerably, in



FIG. 5.



FIG. 6.

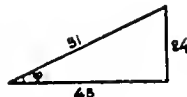


FIG. 7.

which case r , of course, is greater than assumed even for this part of the loop. Furthermore, these cables sag considerably, which makes the area of the loop less. On account of the many irregularities which the loop presents, it is evident that in general only an approximate result can be expected, and in this particular case we get possibly a somewhat too large value for the inductance.

III.—MEASUREMENT OF RESISTANCE AND INDUCTANCE IN FURNACE LEADS.

To measure exactly the effective resistance of the furnace leads in our case seems hardly possible. It is customary to measure the inductance by means of voltmeters, ammeters, and wattmeters connected on the primary side of the transformer, but this requires very accurate instruments.

The writer has used a more simple and direct method, consisting in measuring the inductive voltage component of the furnace leads directly with a voltmeter. A pressure wire was placed between the loop conductors, as shown by the dotted line in fig. 4, as well as in fig. 6, where the dot represents the relative position of the wire with respect to the copper bars. The potential between the ends f and g of this wire was determined by a hot-wire voltmeter, which is the only type which can be used within a reasonable distance from the leads on account of their strong magnetic field.

With the furnace in question, the following values were obtained :—

Current in furnace leads = 13,700 amperes.

Voltage at transformer terminals = 51 volts.

Voltage between f and g = 24 volts.

The current was measured on the primary side of the transformer, also with a hot-wire instrument.

The voltage triangle is as shown in fig. 7, so that

$$\cos \phi = 45/51 = 0.88.$$

If the current were 18,000 amperes and the total pressure of 51 volts were maintained, the voltage fg would be 31.5 volts, and the voltage triangle would give

$$\cos \phi = 40/51 = 0.785,$$

which value would apply for our circuit under full load.

One weakness of this measuring method is due to the difficulty in placing the pressure wire just right, in that it cannot, of course, pass centrally through the electrodes and the furnace itself. The inductance voltage will therefore be a little too low, but in any case it may be assumed that measurements with different arrangements of the leads are sufficiently accurate for comparisons.

This installation also contained some older furnaces, the leads of which consisted of copper tubing instead of bars. The leads were furthermore divided into two branches

(tubes) carried at some distance from each other. A pressure wire was placed inside one of the parallel pipes, and the following results were obtained :—

Current in furnace leads = 18,400 amperes.

Pressure at transformer terminals = 50 volts.

Pressure between f and g (fig. 4) = 22 volts.

$\cos \phi = 0.9$.

As $\cos \phi$ in the previous case for the same current was 0.785, it is seen that the older method gives considerably better results as far as the inductance is concerned. This depends partly on the fact that tubes are used instead of the laminated bars, but is principally due to the lead for each pole being divided into two separate tubes. In these tubes, as follows from the above, the increase in the resistance and the additional losses are considerably less than with laminated bars.

IV.—SUMMARY.

In those parts of the circuit between the transformer and the furnace where the two leads come near together (for example, between the terminals of the transformer and point a in fig. 4), there is no difficulty in keeping the inductance or the effective resistance within reasonable limits ; for example, by suitably transposing the positive and negative bars. In cases where the common distance is relatively great, much can be gained by making the leads of two concentric tubes. The inductance as well as the increase in the resistance will thus be a minimum.

In those parts of the circuit, on the other hand, where each lead has a separate path, the use of a single group of laminated bars for each lead would, in general, seem unsuitable, especially where large cross-sections are involved. As near as possible to the place where the leads separate, each conductor should be divided into two groups, placed sufficiently far apart with respect to the length. With a not too great current, each of these groups may consist of a single bar whose thickness should not exceed 15 to 20 mm. If the current is great, so that for practical reasons a total thickness of the bars for each group of more than 20 mm. would have to be used, tubes should be used instead of bars. Otherwise the arrangements should be as stated above—that is, two tubes for each lead should be used, placed at a suitable distance from each other and with a thickness of the walls from 15 to 20 mm. In general, a greater diameter of the tube (and consequently a less thickness of the walls) as well as a greater distance between the groups will give a better result with regard to the inductance as well as to the increased resistance.

LEGAL.

PRUST v. WESTMINSTER CORPORATION.

IN the Shoreditch County Court last Friday, before his Honour Judge Cluer and a jury, Mr. Prust, of Dalston Lane, N.E., a taxicab proprietor, sued the defendant Corporation for £34 damages to a taxicab. It appeared that at 11 o'clock, on a dark night, one of the plaintiff's cabs, while being driven along Knightsbridge, collided with another cab—a hansom—causing the damage. The alleged cause of the collision was that the Corporation had negligently allowed the electric light to go out at one standard, so that the plaintiff's driver was unable to discern his danger. He saw in front of him two red lights, which he took to be the danger signals put there in connection with an excavation in the roadway. He pulled to the right to avoid it, as he thought, and ran right into a cab which was coming in the opposite direction. As a fact, the red lights were those at the rear of stationary cabs on the rank. Had the electric light been on he would have seen what was happening and avoided any danger. It was argued by counsel that it was the duty of the Corporation to keep these lights going, and they would be responsible for anything that happened if they failed to do so.

For the defence, it was explained to the jury that at times, even though they used the very best of carbons, and took the greatest care, the carbon would fail to drop properly, and out would go the light. The electricity supply was carried out by the Westminster Electric Supply Corporation, who had three men constantly on duty to attend to these light failures. They knew the dangers in view of the darkened streets, and they had had to shade their lights to the required dimness ; besides which, they were even paying the police to give them information of any failure of light. On this occasion they were informed that the light had gone out, and sent as quickly as they possibly could, but unfortunately the accident occurred in the meantime. Counsel raised a number of points for the jury. Under the Defence of the Realm Act, it was an offence to leave a nuisance in the road, and the question was whether this could fairly be described as a nuisance under the circumstances. Again, there was the question whether the defendants had been negligent in having a standard where the light was liable to go out, at such a serious time as this, in the darkened streets. The jury found for the defendants, and judgment was entered accordingly, with costs.

RYAN v. L.C.C.

A SOUTH LONDON earman (G. Ryan) was awarded £350 damages, at the Southwark County Court, against the L.C.C. for personal injuries sustained through the wheel of his van catching in a defective tram-rail in Old Kent Road.

CONTROVERSY BETWEEN LONDON ELECTRIC LIGHTING COMPANIES.

At the Surveyors' Institution, Westminster, on Friday, Mr. JAMES SWINEBURNE, F.R.S., as Arbitrator, concluded the hearing of a claim by the Kensington & Knightsbridge Electric Lighting Co., Ltd., for damages against the Notting Hill Electric Light Co., Ltd., for an alleged breach of an agreement.

Mr. Vesey Knox, K.C., and Mr. H. B. Marriott were counsel for the claimants, while Mr. Honoratus Lloyd, K.C., and Mr. Bruce Thomas appeared for the respondents.

In opening, Mr. VESSEY KNOX said the question was whether the taking of a supply of electrical energy in bulk from the Metropolitan Supply Co., Ltd., and the Hammersmith Borough Council by the Notting Hill Electric Light Co. was a breach of an agreement made in 1909 with the Kensington Co.

Mr. HONORATUS LLOYD: I don't accept that. The point I venture to think we have to discuss is in relation to Kensal Town, and not Hammersmith. Kensal Town is the one we referred to the Arbitrator. Hammersmith has cropped up afterwards.

Mr. VESSEY KNOX said he thought he should be able to satisfy the Arbitrator that the question of the Hammersmith supply should be included. Proceeding, counsel said that in July, 1899, the claimants and respondents (both of whom had statutory powers to supply electrical energy in Kensington) agreed jointly to promote a Bill in Parliament for the purpose of enabling them to acquire land near Wood Lane, Hammersmith, and erect a generating station thereon. It was agreed that the joint station should be constructed with a generating plant of a total power of 1,800,000 watts continuously, and that this output might be used by the parties as they might require, but the claimants were not to be entitled to use more than 1,200,000 watts, and the respondents not more than 600,000 watts, without the consent in writing of the other, and any lesser output was to be available in accordance with the proportions above mentioned. Another clause of the agreement provided that the parties should bear the expense of working, maintaining, and repairing the joint station, and of outgoings and interest on the joint loan by means of a sinking fund, or otherwise rateably in proportion to the amounts of electrical energy taken by the parties respectively from the joint station. The Bill was passed, and by an agreement dated October 25th, 1900, it was agreed that the station should be constructed and equipped by the two companies by means of an issue of debenture stock of a nominal amount not exceeding £200,000, to be secured by a trust deed. Another clause—the one under which the Kensington Co. now claimed—provided:—

"That so long as any of the said stock shall be outstanding the two companies shall from time to time take from the joint station all such electrical energy as each company, having regard to its other sources of supply, may require for the purposes of its business in accordance with the provisions of the agreement of 1899, or such other provisions as may from time to time be agreed upon between the two companies or settled unanimously by the Committee of Management."

The trustees for the debenture-holders (said counsel) were obviously not satisfied to lend their money unless the principal agreement was strengthened in that manner. It was further provided that the property, after the redemption of the stock, should belong to the claimants and the respondents in the proportions to which they should be entitled, as tenants in common, in such shares as should be in proportion to the amounts of their respective contributions. The respondents had in 1909, and since, taken a supply of electrical energy in bulk from the Metropolitan Electric Supply Co., Ltd., and they had also taken a supply from the Hammersmith Borough Council. Claimants submitted that the Notting Hill Co. had thus committed a breach of their agreement. As a consequence, the expenses of the joint station to be paid by the claimants were increased to the extent of £1,650 from 1909 to the end of 1915. The figures for 1916 had yet to be supplied by the respondents. The Kensington and Knightsbridge Co. accordingly claimed damages, and a declaration that the respondents were bound to take electrical energy in accordance with the agreement. The respondents, in their defence, denied any breach of the agreement, and declared that the claimants expressly or impliedly requested them to take, or so agreed to them taking, the supply from the Metropolitan Co., and to waive such breach, if any. Respondents further stated that they relied upon the following circumstances:—"In 1907 certain parties in the Borough of Kensington, outside the areas of supply of both the claimants and respondents, being anxious to obtain a supply of electricity, representatives of the two companies met and discussed the question of such supply being given by the respondents. The parties in question were Messrs. W. N. Davis & Son, of Kensal Dye Works, South Row, Upper Westbourne Park, W. As a result of the discussions, it was determined that the respondents, not being able to give the supply themselves, should arrange for it to be provided by the Metropolitan Supply Co., Ltd. The respondents accordingly made such arrangements and obtained authority from the Board of Trade to give the supply. The decisions referred to were made at one of the weekly meetings which took place during July, 1907, at which the claimants were represented by their then secretary (Mr. Erskine), and the respondents by their

secretary (Mr. Rawkins) and their chief engineer and manager (Mr. G. Schultz), and had been acted upon ever since with the full knowledge of the claimants. Since Messrs. Davis & Son were first given a supply of electricity, other parties outside the respondents' area of supply had been supplied in the same manner, and the claimants had been at all times aware of it, and had acquiesced therein. These other parties included a L.C.C. school in Middle Row; the London General Omnibus Co.; Middle Row Garage; William Whiteley, Ltd., 222, Kensal Road; Globe Wernicke, Ltd., Kensal Road; and the Roman Catholic Schools, Bosworth Road. In the further alternative, if the supply in question was a breach of the agreement, the respondents contended that it was authorised by the London Electric Supply Act, 1908. They further submitted that they had at all times taken such a proportion of the output of the joint station as was reasonable, and, in the alternative, if the supply was not in compliance with the agreement, that the claimants were not entitled to any payment or to claim any damage in respect of any period prior to the date when the claimants first represented to the Committee of Management that the respondents were not taking such a proportion of the output of the joint station as was reasonable."

Proceeding, Mr. Vesey Knox said it was not till 1916 that the directors of the Kensington Co. had any knowledge of any supply being taken by the respondents from the Metropolitan Co. They immediately made a complaint, and as it had not been met they brought the matter before the Arbitrator. Counsel said it was apparent on the score of cost that the respondents had a strong motive for taking the supply from the Metropolitan Co. and not from the joint station.

Mr. HONORATUS LLOYD observed that the Metropolitan Co. laid the mains, and the Notting Hill Co. paid for them.

Mr. VESSEY KNOX: If the Metropolitan Co. laid the mains they broke the law. The Notting Hill Co. have got the power to break up streets by these "fringe" orders.

The Arbitrator inquired when the Hammersmith supply began.

Mr. LLOYD: In 1906, sir.

Mr. VESSEY KNOX (glancing at a document): It says 1908 here. It must have been trifling in 1906.

Mr. LLOYD: It has always been trifling. It would affect the Wood Lane account in respect of your supply not more than £5 a year.

Mr. VESSEY KNOX, continuing, submitted that it was clear that the supplying of various customers under the "fringe" orders by the Notting Hill Co. was part of their business. It was true that the annual accounts of the respondent company were sent to the claimants, because it was the custom of the London electric light companies to exchange accounts, but the directors did not notice that those accounts contained year by year an item of "Electricity purchased from other sources."

The first witness was Mr. HERBERT WOODFIELD MILLER, who said he had been managing director of the Kensington Co. since April, 1914, and that prior to that for some 20 years he was the chief engineer. Mr. Erskine was the secretary of the company during his (Mr. Miller's) association with it to June, 1913, when he died. During that time witness was practically in daily communication with Mr. Erskine, who never mentioned a word about any such arrangement as that alleged by the respondents. Witness had searched through Mr. Erskine's papers, and had not been able to find a single document or note relating to the alleged arrangement. Towards the end of 1914 Mr. Rawkins told him the respondents were going to enter into an arrangement with the Omnibus Co., that it would be a good stroke of business, and that the supply would be given by the Metropolitan Co. Prior to that he had no knowledge or notice that they were getting a supply from the Metropolitan Co.

Col. CROMPTON, C.B., a director of the claimant company since 1901, and chairman of the board of directors since 1903, said that if Mr. Erskine had mentioned anything to him about the respondents being supplied by the Metropolitan Co. he should have objected very strongly.

Sir HENRY BLOSS, a director of the Kensington and Knightsbridge Co., said that until Mr. Miller brought the matter before the board of directors on March 30th, 1916, it had never come before the directors in any shape or form.

Mr. G. S. BARTON, secretary of the Kensington Co., who succeeded Mr. Erskine, also gave evidence.

This was the case for the claimants.

Mr. HONORATUS LLOYD, for the respondents, said he began by protesting against the inclusion of the Hammersmith matter, and he adhered to that. The question arose with reference to two groups of consumers, one in Kensal Town and the other in Hammersmith. So far as the Kensal Town customers were concerned, they had never been in the area of the respondent company, and were not within their area now, and the respondents had no right to supply them or lay a main or anything else until after 1910, when they obtained some "fringe" orders. In Hammersmith the customers, originally 14 in number, now numbered four—at any rate, four had now come into the area upon the recasting of the boundaries. It was admitted that at the time of the agreement the respondents had one source of supply, which was their own generating station, and that this was sufficient to have supplied both the customers at Kensal Town and Hammersmith. Therefore, he submitted, under the agree-

ment, having a source of supply which was ample, the company was not obliged to take the supply from the joint station. If he was right in that construction of the clause in the agreement there was an end of the whole case. With reference to Kensal Town, it was not legal for the respondents to supply the consumers until the "fringe" orders were obtained. It had been said by his learned friend that Kensal Town came within the respondents' business. He (Mr. Lloyd) submitted that it must be a legal business, one they were entitled to carry on, and until the "fringe" orders it was an illegal business, and, as such, certainly could not be business which would come under the agreement. Regarding the position when the business became legalised, counsel quoted from the Act of Parliament sanctioning the erection of the joint station with the object of showing that it was "for the purpose of supply within the respective areas of supply" of the two companies, and to certain specified bodies—the Vestry of St. Mary Abbots, Kensington, and Hammersmith for the White City.

THE ARBITRATOR: Do you contend that the joint station is not even now available for supplying under the "fringe" orders?

MR. LLOYD: I do. Although I submit that the decision of the company has been legalised by the "fringe" orders, it has not enabled the supply to be given from the joint station for that purpose. Those are a few points of law I submit to you. Counsel went on to refer to the respondents' submission that the taking of the supply from the Metropolitan Co. was known and consented to by the claimants. In 1907, when they had an isolated request from Kensal Town Dye Works, who threatened them with the Board of Trade, they thought at the time those works were in their district, and that occasioned more worry still. Mr. Rawkins had interviews with Mr. Erskine, and the latter agreed that it was the wisest and best thing to give this one customer a supply. As time went on other customers came in, and Mr. Rawkins used to tell Mr. Erskine the price he was getting. The real point was that that was done as a perfectly reasonable thing, having regard to economic considerations. It was admitted that it would have been an uneconomical thing for the respondents to have supplied the customers direct from their own generating station because of the distance, and what was done was done with the knowledge and acquiescence of Mr. Erskine.

THE ARBITRATOR: The question is having done it, and received benefit, have the other side any right to part of that benefit? That is a legal question. The other question is economy—whether it would have been wise in the circumstances to take it on at all if you had had to do it yourselves. I appreciate your argument that the joint station still has no power to supply it. That, of course, stands out by itself. It has nothing to do with the other points.

MR. LLOYD submitted, lastly, that even if he was wrong in law and fact, the claimants had suffered no damage.

Evidence was then given in support of counsel's statement by **MR. RAWKINS**, who said he had been secretary of the Notting Hill Co. since 1903, and manager and secretary since 1913. **MR. ERSKINE** quite agreed that he should go to the Metropolitan Co., and upon the report of **MR. SCHULTZ** (who was manager and chief engineer up to 1913, and who since then had been consulting engineer), the directors determined to make arrangements to obtain the supply from the Metropolitan Co. On the report of **MR. SCHULTZ**, the respondents would not have supplied this had it not been possible to obtain a supply from the Metropolitan Co.

MR. SCHULTZ and **MR. MACDONALD** also gave evidence for the respondents, as well as **MR. SPARKS**, the President of the Institution of Electrical Engineers, whose testimony was of a technical character, dealing with economic considerations.

It appeared that the claimants had based the amount of their claim on figures supplied by the respondents of the quantities of electric energy purchased by them from other sources. The figures included a certain quantity supplied by the Hammersmith Borough Council. While not agreeing to the inclusion of the Hammersmith matter in the case, **MR. LLOYD** consented to the figures being included, and learned counsel on both sides agreed that for the purposes of the case the damages should be put at £1,900 up to 1916.

MR. VESSEY KNOX remarked that the primary object of the claimants was to get the agreement construed, although they did not know of the supply by the Hammersmith Council until respondents sent them the figures.

MR. LLOYD: It would be hard if you were found to be right over Hammersmith, and we had to pay all the cost when it is not in the reference.

THE ARBITRATOR pointed out that the costs were within his discretion, and observed that if he found that the Hammersmith question was not before him he could wipe it out.

At the conclusion, the **ARBITRATOR** intimated that he would state his award in the form of a special case, but in view of the Long Vacation there was no immediate hurry.

ELECTRICITY SUPPLY TARIFFS.

THE HACKNEY CASE.

The hearing of this case was commenced in the Chancery Division on Tuesday last. It will be reported in later issues.

WAR ITEMS.

More Appreciation from the Forces.—A Lieutenant with the Tyne Electrical Engineers, R.E., writes:

"The letter from a lance-corporal in the L.E.E. which appeared in this week's REVIEW awakens me to my sense of duty, and a very pleasing one it is. Unless one has actually been to all intents and purposes completely isolated from the outside and commercial world, it were impossible to realise the help and benefit derived from the good old ELECTRICAL REVIEW received each week. Although never in the same place for more than a few days at a time, I always receive the welcome copy from my central address, and I quite agree with our L.E.E. friend that without your weekly gift we should be out of the times to such an extent that in the better days to come we might find ourselves permanently handicapped. I'm sure there are many who would echo these sentiments, and were it not for military pressure of duties you would weekly be inundated with budgets of appreciative correspondence. Perhaps our occasional slackness in writing is due to the fact that we now consider the weekly advent of the ELECTRICAL REVIEW in the nature of a priceless institution. Be that as it may, you are undoubtedly doing the industry one of the best of modern services, and the thanks of the profession are due to you accordingly. May you continue to prosper and carry on the good work till the old times come again, when I doubt not but what your reward will be superabundantly fulfilled."

Leaving Certificates.—A protest was made at the meeting of the Radehill (Lanes.) Urban District Council last week against the decision of the Electricity Committee, by five votes to two, to refuse a leaving certificate to the second engineer, **COUN. ATHERTON** said the certificate should have been granted. It had not been granted because the applicant happened to be a working man who desired to improve his position. The Committee's decision would probably have been different had it been an official who had obtained promotion. He knew there was a scarcity of labour, but other undertakings were similarly situated. **COUN. LORD**, the chairman of the Committee, said the engineer was away when the Committee met, and the matter was really deferred so that he could be present to state his case. Several members asked if the position at Birmingham was still open, and the chairman replied in the negative. A member: Then he has lost his chance. The Council referred the minute back, **COUN. BROOKS** saying it amounted to a censure upon the Committee. **COUN. WHWELL** said the man could have applied to the Board of Munitions for a leaving certificate, but unfortunately he did not take that course.

After the War.—Speaking at the annual meeting of Messrs. J. Tylor & Sons, **MR. PHILIP BRIGHT** referred to the subject of Labour conditions after the war. As reported in the *Financial Times*, he said:—

"About two months ago we, in common with almost all other engineering firms, had a strike, which lasted more than a week and affected the month's output considerably. The causes were at the time obscure, but I have recently been investigating them, as one of the Commissioners appointed by the Government to look into the question of industrial unrest in the North-East area. Our report is now in the hands of the Government, and I hope that steps may be taken to remove any grievances which may have been found to exist. Personally, I am strongly of opinion that if the workman can be persuaded to increase his output and to utilise to the fullest extent every appliance which science, allied with capital, can provide, capital can and must afford him a more liberal reward in return for his labour and a reduction of working hours to permit him to enjoy the greater leisure and recreation which will be his due. The majority of employers and workmen are coming to regard conditions of employment from a more reasonable standpoint than they did in the past, and they ought to combine to influence the extremists of both classes who resist the introduction of methods which, if properly applied, must tend to improve the relations between Capital and Labour. Deliberate restriction of output, as now widely practised, is wholly indefensible, but it has been encouraged in the past by some employers who regarded large earnings on the part of workmen with suspicion and disapproval. In America wages are much higher than they are here, and the output per man is enormously greater, and it is in that direction that we must travel if the wealth which has been so wantonly destroyed during three years of war is to be restored. It is now generally recognised that all the pre-war conditions which existed in engineering workshops cannot be restored without a very serious loss of efficiency; indeed, such restoration would be as retrograde a step as the suppression of motor traction in favour of horses. We must, however, bear in mind that the Government is definitely pledged to such restoration, and we are in honour bound to see that Labour is in no way prejudiced if it loyally accepts—as I believe it will—a reasonable modification of that undertaking."

MR. ANDREW FISHER, High Commissioner for Australia, addressing businessmen in Belfast recently, said that after the war approximately two years would be occupied in returning to the Dominions the men who had come to fight the

enemy. That meant that a certain amount of shipping would be utilised, and that to a large extent the productive services of these men would be lost during that period, while all the time the Germans would be making goods for us unless we put up our hands now and told them that they could not come in. We had the men, the initiative, and the enterprise to found new businesses, but Government help must be guaranteed. He, for one, hoped that Free Trade as it was known before the war would never rear its head again.—*Daily Telegraph*.

Mr. J. L. Garvin, speaking to the United Workers, at Burlington House, said it was the sheerest moonshine madness to imagine that the problems of peace might be left till peace was declared, and that all our efforts should now be concentrated on the war. The nation which could demobilise most speedily would secure an enormous advantage which it would be difficult to overtake. Britain would have to demobilise by ships, and the Continental Powers, fighting on their own territories, by rail. Germany had perfected her railways, while we had torn our lines up. We had a diminished fleet, and must leave large numbers of our workers abroad while we carried to their homes the Colonial and American soldiers, and this with a sadly diminished fleet. We had to find work for 8,000,000 persons, and build, at the smallest computation, 150,000 houses with a lack of raw material for the purpose. France and Belgium could not wait for their rebuilding, but must take the first comers. It was the most imperative and urgent problem Great Britain ever had to face. The first desideratum was the compilation of a national register with a record of all the soldiers and munition workers and the available stock of machinery. Disaster would certainly come from Labour difficulties unless Capital and Labour could come to a common agreement for the production of a new industrial charter. A career must be offered to the worker, who should not be allowed to drift from employer to employer, and there must be some return to the older and more kindly social relations. Larger social ambitions must be excited and gratified for him.—*Daily Telegraph*.

Mr. George Lansbury, writing to the Stepney and Poplar Federation of the Church of England Men's Society on Labour problems after the war, said: "It is no use thinking of reorganisation merely for the purpose of more money-making. We must recognise the value of a thing not by its cost, but its utility. We have degraded Labour and ourselves by putting money value on all our services. Most of us have lived long enough to know that we cannot put a gold value on the things we most care for. Therefore, Labour and Capital must come together on a co-operative basis—Labour giving its industry, organised into industries or guilds, and Capital giving its brains, both as parts of the great business of co-operative production and distribution."—*Daily Telegraph*.

The *Times* reports a speech delivered by Lord Leverhulme at the Aldwych Club luncheon last week on after-the-war problems. We quote the following therefrom:—

"In what way, asked Lord Leverhulme, were we to make the best of our position? The present antagonism between Capital and Labour ought not to exist. Capital and Labour must be fused into one. Co-partnership was the one basis of commercialism; but it must not degenerate into charity or philanthropy. Its object must be increased efficiency and increased prosperity for all; and it must maintain supremacy of management, and Labour must be free to work out its own ideals; and there must be greater stability in the arrangement than a mere cash bonus. Further, the benefit must extend to wives and children—he attached the utmost importance to this—and a man must know that his share in co-partnership would on his death go to his widow during her widowhood. This benefit would elevate management and labour equally in the social scale, and would not be antagonistic to the legitimate rights of workers. Control must rest with those who found the cash capital. If we had co-partnership on these lines there would always be the underlying wages system. This must be maintained on the highest scale practicable to the industry concerned. The bulk of production was done by machinery, which was getting more and more complicated and costly every day. Would it not be better, instead of running it eight hours a day, to have two shifts of six hours each? With such a reduction in hours, and there would be an enormous national gain. The days lost through illness would be decreased by 25 per cent., and the breakdown of machinery would also be reduced. This was the outline of the vision he had of meeting the conditions that he thought would arise after the war. The greatest stimulus required was profit-sharing, which would humanise industry and make the working man no longer antagonistic to the capitalist, because he himself would be a capitalist."

Trade After the War.—Lord Balfour of Burleigh's Committee on the question of Trade After the War met at the House of Lords last week, when important evidence was taken.

Exemption Applications. At the Shoreditch Tribunal, Mr. J. Perg, aged 34 years, of 169, City Road, E.C., electrical engineer and scientific instrument maker, made a third application for exemption. He said he was carrying out a lot of electrical work for instruments in connection with the war.

He was a Russian Pole. The Tribunal granted one month, final.

At Maidstone, Mr. O. Jones, electrical engineer, appealed for E. Wicks (28) and W. H. Brown (37), employed on electrical plant at local works and institutions. Each was allowed three months.

Sheffield Tribunal has granted exemption until December 31st to C. West (37, Class C3), electrician, appealed for by the Lyceum Theatre, Ltd.

Hitchin Rural Tribunal has given six months' exemption to E. A. Bindell (22, Class B3), electrical engineer to Mr. Marlborough Pryor. He was discharged from the Household Cavalry in consequence of a dislocated knee.

At Bexhill-on-Sea, on the appeal of Mr. Baker, of Station Road, six months' conditional exemption was granted to E. W. Climpson (B1), electrician.

With the assent of the military, exemption whilst engaged in the same trade has been granted to A. T. Clarke (33, Class C3), electrician, Weymouth.

Hastings Tribunal has granted three months' exemption to J. P. Murray (31, B2), fitter's mate, and N. W. J. Bissenden (22, B3), wireman, appealed for by the Tramway Co.; six months to C. Gower (39, C2), tramway motorman; and conditional exemption without time limit to J. C. Sweatman (35, C3), electrician.

At Brierley Hill, Messrs. Holmes & Cartwright appealed for their electrical engineer and fitter (27, B1), said to be the only electrician left in the town. Three months were granted.

At Accrington Tribunal, application was made on behalf of six tram drivers for leave to bring their appeals before the Tribunal. The men ranged from 35 to 38 years of age. One half were Class A men and the other half were Class B. The Military Representative said he had gone into these cases along with the tramway manager, and they came to an agreement after making allowances for other men. It was too late in the day to re-open the cases. Mr. Britcliffe suggested that if the men had to go into the Army some of the tramcars would have to stop. The Tribunal refused to re-open the cases, with the exception of a B2 man, who could have a fresh examination. If, however, he was returned in the same category he would have to go with the rest into the Army.

BUSINESS NOTES.

Commercial Intelligence Work of the Board of Trade.

—At a meeting of the Advisory Committee of the Board of Trade on Commercial Intelligence on July 4th a report was presented for the quarter ended June 30th, 1917. According to the *Board of Trade Journal*, among the other matters considered by the Committee were the future organisation and scope of the British Industries Fair; co-operation of the Board of Trade with trade associations in the investigation of foreign markets; the revised instructions to Trade Commissioners; the commercial mission now in progress in Spain; and proposals for the formation of a Latin-American Association.

Japanese Electrical Exports to China.—According to a recent official report, Japanese electrical materials are being imported in considerable quantities into the Upper Yangtze district of China.

Book Notices.—*Farming by Motor.* London: Temple Press, Ltd. Price 1s. 6d. net.—This interesting booklet briefly summarises the leading particulars of about 20 types of farm tractors and motor ploughs, and illustrates and describes the work which they may be expected to perform. It is intended as an aid to the farmer in securing the machine best suited to his own conditions, and, needless to say, its sponsors, the *Motor and Commercial Motor*, have made the most of a pet subject in the limited space at their disposal. The book would be much increased in value by the addition of actual data as to cost of operating different machines under varying conditions of practical farm work; and the farmer would probably prefer to be warned of the possible defects of new implements rather than find them out by personal experience or trial. But if we admit certain shortcomings inherent in new appliances, the oil-driven farm implement is still one of the best means of labour-saving, and, as such, should be encouraged in every possible way.

"Technical Papers of the Bureau of Standards." No. 90. Structure of the Coating on Tinned Sheet Copper in Relation to a Specific Case of Corrosion. No. 91. Temperature Measurements in Bessemer and Open-hearth Practice. Washington: Bureau of Standards, Department of Commerce.

Catalogues and Lists.—BRITISH THOMSON-HOUSTON Co., LTD., Rugby. List No. 4,160 (20 pages) contains full description, with many illustrations, connection diagrams, and tabulated particulars, of the company's ironclad draw-out oil-break switch-gear (type O, forms J₁ and J₂).

THE KLAXON CO., LTD., 1, King Street, St. James', London, S.W. 1. Small booklet of 24 pages, giving illustrations of a few of the purposes for which their Klaxon warning signals are suitable.

Liquidation.—RURAL DISTRICTS ELECTRIC UNDERTAKINGS, LTD.—Winding-up voluntarily. Liquidator: G. W. Brown, 24, Martin's Lane, Cannon Street, London.

LIGHTING AND POWER NOTES.

Bradford.—B. OF T. ELECTRICAL SUPPLY COMMITTEE.

—The Corporation Electricity Committee has passed a resolution fully endorsing and supporting the action taken by the Hammersmith Electricity Committee in suggesting that Electricity Committees should combine to demand that the B. of T. Committee should be dissolved, and replaced by competent, unbiased persons not directly interested in electrical matters.

The Electricity Committee has decided to provide a special coal siding on the Midland Railway at Canal Road, and to install conveyors between the siding and the electricity works as soon as authority for the work can be obtained.

Bury St. Edmund's.—YEAR'S WORKING.

—The borough electrical engineer's report on the working of the electricity department for the year ended March 31st last, shows that the units sold amounted to 281,507, as compared with 302,680 in 1916. The total income was £1,875, and working expenses £3,828, leaving a gross profit of £1,046; after meeting interest and sinking fund charges and other expenses, there is a deficit on the year's working of £1,037. The cost per unit sold has risen from 234d. to 315d.

Canada.—ONTARIO POWER CO. PURCHASE.

—By the purchase of the generating plant of the Ontario Power Co., Niagara Falls, Ont., the Hydro-Electric Power Commission of Ontario have acquired the largest generating plant in Canada. The capacity of this plant is in the neighbourhood of 175,000 H.P.

The arrangement, briefly, amounts to the assumption by the Ontario Government of a bond of issue of \$14,699,000, the payment by 1 per cent. 40-year debentures at 80 per cent. of its par value for \$10,000,000 of capital stock, and the assumption of all Canadian and United States contracts. The financial obligation thus amounts to \$22,669,000, on the supposition that all the common stock is turned in, and the contracts include the Commission's own contract for 100,000 H.P., as well as a contract with the Ontario Transmission Co., which distributes throughout the Niagara Peninsula, for 60,000 H.P. There is also assumed a contract for the supply of 60,000 H.P. on the United States side of the line. It will thus be seen that the Ontario Power Co. held contracts for supplying up to 220,000 H.P., which necessitated the purchase of a considerable quantity of power. This, by an old agreement, is being obtained from the Electrical Development Co. The agreement for the supply of 60,000 H.P. to the United States terminates in 1950; the price received is \$12.50 per H.P. The United States company owns its own distribution system.

The Ontario Commission is, therefore, distributing at the present time in the neighbourhood of 300,000 H.P. This is made up chiefly of the 220,000 H.P. obligation assumed from the Ontario Power Co., 50,000 H.P. purchased from the Canadian Niagara Power Co., the generating plant at Eugenia, the Severn River plants, and the numerous developments recently taken over in Central Ontario from the Electric Power Co.—*Canadian Electrical News*.

The Shawinigan Water and Power Co. is constructing a 100,000-volt transmission across the St. Lawrence River. This will take the form of a 5,000-ft. span of three steel cables carried on towers 350 ft. high, which will rest on concrete piers in the river. The cable supports on the towers are on the same level but 50 ft. apart; the cables are to be brought down behind the towers and anchored. The spans will require to be insulated at either end, and the insulators will, in addition to the electrical stress, have to withstand a mechanical stress of above 150,000 lb. each.

Continental.—PORTUGAL.

—A Bill has recently been introduced into the Portuguese Chamber of Deputies, under which it is proposed to grant State assistance towards the establishment of new industries and the development of existing ones in the country. Among the undertakings which it is proposed shall come within the scheme are:—The utilisation of available water power and the manufacture of electrical material and electro-chemical products.

SPAIN.—Application has been made by Julian Hernandez, of Santa Cruz del Valle, for a concession to establish a generating station and erect transmission lines for the supply of electric energy to Santa Cruz del Valle, Soto Garganchon, and Valmala.

ITALY.—The Società Generale Italiana Edison di Elettricità has published the conditions of a prize competition for an electric kitchen to serve a family of five or six persons, which it has established. Ten thousand lire have been set apart for the prizes, up to three in number. Five judges have been nominated—namely, one member each from the Milan Royal Technical Institute, the Associazione Elettrotecnica Italiana, the Associazione Escenti Imprese Elettriche, the Lega Economica Nazionale, and the Società Edison.—*Elettrotecnica*.

Chippenham.

—The U.D.C. has decided to have the electric light installed at its offices.

Crosby.

—The P.C. has appointed a deputation to confer with the Scunthorpe U.D.C. relative to the latter's application for a prov. order for electric supply in the parish, and to which the Council is favourably disposed.

Darton.

—The U.D.C. has sanctioned the application of the Yorkshire Electric Power Co. to erect an overhead line from its power station at Barugh to Gawber.

Dover.

—The T.C. has decided to extend the mains so as to supply current to a local hospital. The Post Office having taken only 9,989 units instead of 12,000, the guaranteed minimum, the

T.C. has asked the department to pay 4½d. per unit for 10,000 units, instead of 4½d. and 4½d. per unit beyond, as originally agreed.

Exeter.—YEAR'S WORKING.

—The annual report of the city electrical engineer (Mr. H. D. Munro) states that the accounts of the undertaking for the twentieth completed year of working show a gross surplus of £9,789, as against £7,719 in the previous year, and a net surplus, after meeting interest, sinking fund, and income-tax charges, of £2,043. A total of 1,972,288 units were sold, a net increase of 207,065. The loss of revenue by reduced public lighting is made good by an increase in the tramway supply. Allowing for stock differences, the actual consumption of coal has been further reduced by 200 tons, in spite of the increased output, and the Committee has been able to effect economies in nearly every other item of the expenditure account. As a result, the overall cost of production per unit has been brought down by nearly 12 per cent., in spite of the enhanced cost of all materials. The number of consumers has increased by only 55 during the year, owing to the difficulty of obtaining cable for connections, but 15 of these were for power supply, of which an additional 110 H.P. has been connected.

Greasbro'.—PROV. ORDER.

—The U.D.C. has considered the notice dated June 8th, 1917, of the intention of the Rotherham Corporation to apply for a prov. order to supply electricity within the district, and has decided not to assent to the proposals. The Council intends to apply for a prov. order itself, and the Rotherham Corporation is to be asked for its terms for a bulk supply, so that the Council will be able to supply to consumers at rates not higher than those charged within the borough.

Halifax.

—Yesterday a new 6,000-KW. turbo-generator was to be officially started-up at the Corporation electricity works, Lady Rhondda having consented to perform the ceremony.

Hucknall Torkard.—PROVISIONAL ORDER.

—The U.D.C. is to oppose an application by the Nottingham T.C. for a provisional order for electric supply, as the Sherwood Colliery Co. has already offered a supply of current after the war.

Itchen (Hants).—PROPOSED BULK SUPPLY.

—The U.D.C. has appointed a Committee to discuss the question of obtaining electricity in bulk for distribution in the district.

Kirkby-in-Ashfield.—E.L. PROPOSALS.

—The U.D.C. has decided to call a special meeting to discuss the application of the Nottingham T.C. for a provisional order for electric supply.

Kirkcaldy.

—The T.C. having been refused permission to borrow £27,000 for extensions at the electricity works, has decided to apply for powers to borrow £7,000 for a high-pressure cable from the generating station to the Pathhead district.—*Glasgow Record*.

London.—L.C.C.

—The Finance Committee has, with the Council's sanction and with the approval of the Treasury, agreed to advance on loan £9,185 at 5½ per cent. to the Hackney B.C. for electricity purposes.

STOKE NEWINGTON.

—The Electric Lighting Committee reports that in view of the probable shortage of coal supplies during the coming winter, it has had under consideration the charges for domestic heating, which are at present 4½d. per unit for the first hour's daily use of the maximum demand, and 1d. per unit for all further consumption. As an alternative, the Committee recommends that a flat rate of 2d. per unit be offered for domestic heating, cooking, &c., to all lighting consumers.

SHOREDITCH.—WHISTON STREET EXTENSION.

—The revised estimate of the total cost of the proposed extension totals £51,500, as against £41,000 for which sanction has been obtained. The Electricity Committee recommends that application be made to the L.C.C. for sanction to a further loan of £10,500 necessary owing to the rise in prices consequent on war conditions since the original estimate was prepared; and that the L.C.C. be requested to consider the granting of the longest possible terms for the same and the lowest rate of interest.

HAMMERSMITH.

—The Electricity Committee has received a letter from the Controller of Coal Mines with reference to the proposed interconnection of the electricity stations at Battersea, Fulham, and Hammersmith, stating that in view of the urgent necessity of reducing the coal transport for the London area during the coming years, the Controller was anxious to assist in the fair apportionment of the total cost of carrying out the scheme which was approved in principle in June, 1915, and asking if the B.C. was willing to submit the matter to an arbitrator to be appointed by the B. of T., whose decision should be final. The Committee has approved the suggestion.

Rotherham.

—Mr. Garnham Roper, of the B. of T., has held an inquiry in London relative to an application by the Corporation for a prov. order to supply electricity in bulk to the Mexboro' and Swinton Tramway Co. The prov. order was granted, but was limited to the period of the war and 12 months after.

Sunderland.—PRICE REVISION.

—At a meeting of the T.C. on the 11th inst., the Electricity Committee submitted a report which (*inter alia*) recommended that the tariffs for the supply of electricity be revised. Mr. G. S. Marshall contended that it was unfair that the revision should only apply to the small consumer. Alderman Bruce said the large consumer was under a sealed contract, and that the small consumer had never contributed anything towards the increased cost of coal until last year, while the shipbuilders—the large consumers—had always paid for the increased cost of coal. Eventually the report was adopted.

Southport.—The Corporation Electricity Committee has given permission to the Birkdale & District Electric Supply Co. to charge an additional 5 per cent. to private consumers of electrical current in Birkdale, on condition that the increased profits on receipts shall not be taken into account in the event of the subsequent purchase of the undertaking by the Corporation, and on the condition that the increased charges do not exceed those charged by the Corporation.

Stoke-on-Trent.—PRICE INCREASE.—The T.C. has further advanced the price of current from the meter readings at the end of the September quarter by 8½ per unit, making a total increase since the war began of 33½ per cent.

Sutton-in-Ashfield.—PROPOSED E.L.—The Nottingham T.C. has informed the U.D.C. that application is to be made to the B. of T. for a provisional order for electric supply.

Taunton.—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking for the last year of operation show a gross profit of £5,167, of which £3,532 has been absorbed by loan charges, &c., and £521 transferred to the reserve account.

U.S.A.—According to the *Electrical World*, the Cincinnati Public Service Authorities intend to improve the lighting in 14 miles of streets, at an estimated cost of \$140,000. Some 913 new lamps are included, and 291 old arc lamps will be displaced. The new lamps will be of a 16-c.p. tungsten-filament nitrogen-filled type of 20-ampere 141-volt rating, placed 13 ft. 4 in. above the pavement, and operated through transformers in the base of the standards.

Worcester.—PROPOSED NEW PLANT.—After considerable discussion, the City Council has adopted the Electricity Committee's recommendation to purchase additional boiler and other plant, at a cost of £5,200. It was pointed out that the extension would facilitate the linking-up suggestions of the B. of T., and would also lead to economies in working—some £575 per annum—representing more than the capital charges on the new plant. An application for sanction to the additional plant has been made to the Government Department concerned, but so far without success.

TRAMWAY and RAILWAY NOTES.

Blackpool.—The Blackpool, St. Anne's, and Lytham tramway attained its majority on July 11th, the line having been opened on this date in 1896.

Canada.—The employees on the Toronto tramways recently struck work, demanding an increase of 5d. an hour, making 1s. 8d. an hour instead of 1s. 3d.

The strike was settled by the acceptance by the men of an offer of 3d. an hour increase in their wages.

Continental.—SPAIN.—The formation of a company for the construction and working of electric tramways and railways is, says *La Energia Electrica*, under consideration at Barcelona. The promoters are a Dresden firm, who, however, contemplate raising the capital by local subscriptions. Railway schemes immediately in view are a line from Almeria to Berja, and another from Coin and Ronda to Tolon (Balneario).

The Compania del Tranvia Electrico de Aviles has applied for a concession for the construction of electric tramways from Villalegre to Aviles and San Juan de Nieva.

SWITZERLAND.—A decision which the Administration of the Swiss Federal Railways has come to settles the question which has long hung fire. A water-power station is to be set up on the River Riton, on the southern slope of the Gothard range, providing a fall of over 800 metres. Three turbines will be installed at first, each of 12,000 h.p.—*L'Industrie Electrique*.

Halifax.—A tramway accident occurred at Ambler Thorne, Queensbury, on Sunday evening last, a Corporation car on the journey to Halifax getting out of control and leaving the rails and overturning; about 30 people were injured.

Heywood.—Alderman Ashworth, referring to the June receipts on the tramways, said if they were maintained at that level for the whole year, they would soon be paying, as they showed an average of 15.66d. per car-mile.

L. & Y. Railway Electrification.—A commencement has been made with the work of conversion of the Bury Holcombe Brook line of the Lancashire and Yorkshire Railway to the same system of electric traction as that in operation between Manchester and Bury, and it is expected that it will be completed at an early date.

London.—YEAR'S WORKING OF THE L.C.C. TRAMWAYS.—The annual accounts of the Council's tramways for the year ended March 31st last show total receipts amounting to £2,552,203 and working expenses, including war service allowances, of £1,817,691, leaving a gross surplus of £734,512. Interest, sinking fund, and other charges amount to £723,167, leaving a net surplus of £11,345, which has been transferred to the renewals fund, which stood on March 31st at £282,978. Previously to this year there have been no payments into this fund since the year 1912-13, except interest on investments and amounts received from the L.C.C. Tram-

ways, Ltd. The general reserve fund on March 31st last amounted to £72,390. During the year 586,127,976 passengers were carried and 49,478,973 car-miles run, these figures comparing with 515,429,397 passengers and 47,879,675 car-miles in 1915-16. The capital expenditure at March 31st amounted to £13,570,119, and the debt outstanding, less the sinking fund in hand and less £120,216 in respect of the value of surplus land, was £9,141,286. Capital expenditure on obsolete horse lines still to be provided for amounted to £943,710. The tramways system on March 31st, 1917, extended over a total length of 149 street miles, being 144½ miles of electric lines and 4½ miles of horse lines. The only horse tramway routes not yet electrified are those in Burdett Road and Grove Road, &c., and in Southwark Park Road, &c., and as the services on these tramways have been withdrawn, the system in operation consists entirely of electric tramways. During the year the only work of tramway construction undertaken was the doubling of certain portions of single line in Woolwich.

L.C.C. REVISED TRAMWAY ESTIMATES.—The following is a summary of the revised estimated results of the working of the tramways for 1917-18:—

Estimated gross surplus, £739,142; debt charges, &c., £730,811; leaving a net surplus of £8,598 instead of an estimated deficiency of £89,402. The estimates contain provision for £111,300 for war service allowances; but for this special charge, the results of working the tramways for the year would show an estimated surplus of approximately £123,000, notwithstanding the increasing working costs. The estimates contemplate £8,598 being available for addition to the renewals fund in 1917-18. The balance of the fund at March 31st, 1918, is estimated at £20,112, without taking account of the depreciation of investments; the estimated balance of the general reserve fund at March 31st, 1918, is £71,919 on the basis of investments being taken at cost price.

The Highways Committee recommends that application be made for an extension of the time allowed for the construction of certain tramways authorised, which will expire in August, 1918.

The Council has decided that 2d. workmen's tramway tickets shall no longer be available for the return journey or for a single journey by any car and on any route; also that workmen's return tickets shall only be available for return over the section for which they are issued for the first journey; and that workmen's tickets will not be issued to suburban termini by cars leaving the central termini after 7.30 a.m.

Manchester.—WAGES.—Sir George Askwith has decided to sit this week to hear the Corporation tramway employees' case for the revision of the recent wages award. Meantime, whilst the other Lancashire tramway authorities are protesting against the award being re-opened at all so soon, the Tramway and Vehicle Workers' Association, with which the Manchester employees are affiliated, takes the view that if the Manchester case is re-opened, those of the employees in the other districts must also be reconsidered, and the executive of the Association is demanding the re-opening of the whole award.

Northampton.—FARES.—The Tramways Committee is recommending the Council to increase the fares on the 1d. sections to 1½d., with a 1d. stage on each section. There was a loss of about £3,000 on the tramways last year, and unless the revenue is supplemented, there is a prospect of a considerably increased deficit on the current year. The institution of 1½d. fares for 1d. fares on one section has, on a three months' trial, led to an average increase of £30 per week in the takings on that section, and if this average is attained on the other sections, it is estimated that the revenue will be increased by £5,000 during the year.

TELEGRAPH and TELEPHONE NOTES.

A Long Telegraph Circuit.—New York maintains daily direct communication with Valparaiso, Chile, a distance of approximately 7,000 miles, over the cables of the Central and South American Telegraph Co. This is probably the longest regularly-worked circuit in the world.—*T. and T. Age*.

Brazil.—A decree has been issued declaring that the wireless telegraph and wireless telephone institutions in the country are exclusively the property of the Federal Government.

Foreign Languages on the Telephone.—The Postmaster-General, in a Parliamentary answer to Sir Henry Dalziel, states that conversations on the telephone in languages of enemy States are prohibited. The use of the languages of Allied countries is not, he thinks, open to objection, and it could not be forbidden without inconvenience to a large number of subjects of Allied States who, at present, are engaged on official work in this country.—*The Times*.

Recruiting at 3,000 Miles.—Lord Northcliffe, in a brief speech from New York to San Francisco, 3,000 miles away, over the long-distance telephone of the American Telephone and Telegraph Co., urged Californian Britishers "to do their bit" in the war. Conversations were held with many long-distance cities, and then the telephone officials switched on the wires which permitted the listeners to hear the Pacific surf at San Francisco and the Atlantic surf at Coney Island simultaneously.—*The Times*.

Wireless Telephony in the U.S. Navy.—A year ago, with the collaboration of the Bell Telephone Companies, a three-day test of communications as under war conditions was carried out by the United States Navy Department, in the course of which communication by wireless telephony was maintained between Washington and a battleship in the Atlantic Ocean. Since then the use of wireless telephony in the Naval Service has been further developed, and the system will be employed by the U.S. Navy in its war operations. Telephonic communication with aeroplanes, new wireless methods, and apparatus for detecting the presence of submarines have also been under investigation, and important progress has been made. — *T. and T. Age.*

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—**SYDNEY.**—August 22nd. N.S.W. Government Railways and Tramways. Thirty-six induction motors (Specification No. 488). September 19th.—One 225-H.P. synchronous motor (Specification No. 489). Particulars from Electrical Engineer's Office, 61, Hunter Street, Sydney.

Hford.—July 31st. Electricity Department. Two rotary or motor converters, 4,400 yards E.H.T. cable, 3,600 yards stoneware conduit. See "Official Notices" to-day.

Keighley.—August 3rd. 12,000 tons best slack and small slack coal for Electricity Department. Six-monthly and twelve-monthly period. Mr. H. Welber, Boro' Electrical Engineer.

London.—L.C.C.—The Highways Committee recommends that tenders be invited for 3,880 yards of electric cable for the Tramways Department.

I.L.M. OFFICE OF WORKS.—July 23rd. Six or twelve months' supply of conduit boxes. Controller of Supplies, King Charles Street, S.W. 1.

CLOSED.

London.—**SHOREDITCH.**—The Electricity Committee has received the following tenders for turbo-alternator plant at Whiston Street:—

British Thomson-Houston Co., Ltd.	£26,518
British Westinghouse Co., Ltd. (recommended)	26,538
Brush Electrical Engineering Co., Ltd.	30,250
Fraser & Chalmers, Ltd.	26,728
alternative	26,496
Howden & Co., Ltd.	27,193
Ateliers de Construction Oerlikon (Swiss)	31,815
Parsons & Co., Ltd.	25,900
Willans & Robinson, Ltd.	26,600

HAMMERSMITH.—The Electricity Committee has received the undermentioned tenders for E.H.T. cable:—

Pirelli-General Electric Co.	£176
Macintosh Cable Co. (recommended)	180
Callender's Cable & Construction Co.	204
Western Electric Co.	207
Henley's Telegraph Works.	209
British Insulated & Helsby Cables	234

The Baths Committee recommends the acceptance of the tender of Messrs. Rubery, Owen & Co. for a 20-H.P. motor, with circuit-breaker, starter, &c. for £125.

POPLAR.—The Electricity Committee recommends the acceptance of the following tenders:—

Switchgear.—British Westinghouse Co., Ltd.	£2,641.
Sub-station switchgear.—British Thomson-Houston Co., Ltd.	£1,621.
Cables.—Western Electric Co., Ltd., £1,782; Siemens Bros. & Co., Ltd., £2,081.	

Londonderry.—The Electricity Committee has accepted the tender of the Western Electric Co. at £2,080, for a new feeder cable.

Newport (Mon.).—Electricity Committee. Recommended tenders for plant for extensions:—

Induced-draught plant.—Musgrave & Co.	
Electrical equipment for induced-draught plant.—Brit. Westinghouse Co.	
Cooling towers.—Davenport Engineering Co.	

Swansea.—T.C. Messrs. Thomas & Evans, at £73 10s., for the installation of electric light in 27 Corporation houses on Trewyddfa Common.

NOTES.

Electric Light Switching.—The results of the fifth of the periodical Batch Exams, conducted in this subject by Messrs. A. P. Lundberg & Sons are given in our advertising pages, and are, to say the least, remarkable. It is only three months since the results of the previous Examination were given in this journal, and though the number of successful competitors then was very good for war time, the present list shows an increase of over 59 per cent. The average person would conclude that everyone who sent in a paper got a certificate. We are informed that this is by no means the case, 20 per cent. of the candidates having, in the present instance failed to satisfy the examiner. Those interested in the subject are advised to write to the firm at 477-489, Liverpool Road, London, E.C. 4, for particulars.

Foreign Trade.—**THE JUNE FIGURES.**—The official returns of imports and exports during last month contain the following electrical and machinery figures:—

	June, 1917.	Inc. or dec.	6 months, 1917. Inc. or dec.
IMPORTS.			
Electrical goods ...	81,272	— 69,610	— 110,772
Machinery ...	668,013	— 205,561	— 118,282
EXPORTS.			
Electrical goods ...	211,297	— 232,657	— 390,228
Machinery ...	1,618,121	— 153,757	+ 851,538

Volunteer Notes.—**COUNTY OF LONDON VOLUNTEER ENGINEERS (FIELD COMPANIES).** Headquarters, Balderton Street, Oxford Street, W.

Orders for the week, by Lieut.-Colonel C. B. Clay, V.D., commanding:—
Monday, July 23rd.—Technical instruction (searchlight) for No. 3 Company, Right Half Company, Regency Street. Drill, No. 3 Company, Left Half Company. Signalling Class. Recruits' Drill, 6.30.
Tuesday, July 24th.—Lecture, 6.30. Physical drill and bayonet fighting, 7.30.
Wednesday, July 25th.—Drill and elementary bridge construction No. 1 Company, Right Half Company.
Thursday, July 26th.—Drill and elementary bridge construction No. 2 Company, Right Half Company. Ambulance Class, 6.30. Signalling Class.
Friday, July 27th.—Technical instruction (searchlight) for No. 3 Company, Left Half Company, at Regency Street. Drill, No. 3 Company, Right Half Company. Recruits' Drill, 6.30.
Saturday, July 28th.—Commandant's Parade, 3 p.m. Uniform, for route-march. Fall in at Goddard's Green Station.

MACLEOD YEARSLY, Company Commander and Adjutant.

Iron Wire for Rural Transmission.—The Connecticut Public Utilities Commission has agreed to the Central Connecticut Power and Light Co. using galvanised iron wire for H.T. transmission on certain rural lines, on account of the high price of copper. It is proposed to use double-galvanised BB grade No. 6 iron wire, on poles spaced 250 ft. apart, sagging the wire to give a factor of safety of 2 with class B loading, viz., $\frac{1}{2}$ in. coating of sleet on the wire and a wind pressure equalling 8 lb. per sq. ft. of exposed surface of wire and sleet, at a temperature of 0° F. The iron wire is to be used where voltage drop will be inappreciable, and will be replaced with copper if it deteriorates so as to be unsafe.

The Fixation of Nitrogen.—Mr. Baker, U.S. Secretary for War, announces that plants for the production of nitrates from atmospheric nitrogen will be constructed immediately, at a cost of about four million dollars. He states that water power will not be utilised, the process to be used being "a modification of processes previously known."

Inquiries.—Makers of spare parts for "A.E.C." motors are asked for.

Hospital Installation.—The Duke of Portland has offered an electrical installation for the treatment of paralysis, rheumatism, and other suitable maladies to the Mansfield and District Hospital.

Marylebone Electricity Department and the Electrical Trades Union.—The Marylebone B.C. Electricity Committee reports having considered a communication from the London District Secretary, Electrical Trades Union, 70, Gray's Inn Road, E.C. 1, forwarding working rules for power and sub-station engineers, and asking whether the Council is willing to conform to them, and pay rates of wages and observe conditions of labour as appear therein; and stating that in the event of the Council refusing to agree to the rates of pay and conditions of labour laid down in the working rules, the Trade Union Committee will have to name the Council to appear before the Committee on Production to hear the claim of the Union to make their conditions apply to the men in the Council's employ. The Electricity Committee has informed the secretary of the Electrical Trades Union that it has recently increased the wages of the employees of the department, and has come to an agreement with the representatives of the men, and is not prepared to reopen the question.

Parliamentary.—**ROYAL ASSENT.**—The following Acts have received the Royal Assent:—

Trade Union Amalgamation Act, 1917.
Nottinghamshire and Derbyshire Tramways Act, 1917.
Lancashire Power Construction Co., Ltd., Act, 1917.

Holidays on the Clyde.—Shipyards, engineering shops, and other works in Glasgow and on Clydeside closed, on July 12th, for 10 days' holiday. — *Times.*

National Insurance (Unemployment) Acts, 1911 to 1916.—Contributions are payable in respect of:

2,352 X. Apprentices over 16 years of age employed wholly or mainly by way of manual labour elsewhere than in Scotland in trades set out in Schedule 1 of the National Insurance (Part II) (Munition Workers) Act, 1916, or in munitions work, and who are bound by agreements which are not under seal and which do not purport to have been sealed.

2,353. Apprentices over 16 years of age employed wholly or mainly by way of manual labour elsewhere than in Scotland in trades set out in Schedule 6 of the National Insurance Act, 1911 (Unemployment Insurance), and who are bound by agreements which are not under seal and which do not purport to have been sealed.

2,354 X. Workmen engaged in the manufacture of telephone switchboards for use in war.

2,357. Workmen engaged in the repair of accumulators used in connection with electrical machinery in buildings or ships, including cleaning sediment from the cells. (Application 196.)

B. of T. Coal Transport Reorganisation Scheme: Special Fuel.—In connection with the above scheme, the Controller of Coal Mines is considering the requirements of steam raisers in regard to supplies of special coal fuel. Forms have been sent out to steam raisers throughout the country asking for information in regard to the class of coal used, consumption, &c. A considerable number of the forms sent out have not been returned, and steam raisers who have received such forms should note that their requirements in the way of special fuels cannot be considered in the absence of the information called for by the forms, which should be filled in and dispatched to the Controller of Coal Mines immediately. In cases where steam raisers have not received forms, it is desirable that they should apply at once to the Controller of Coal Mines, 8, Richmond Terrace, Whitehall, London, S.W. 1.

Synchronous Signalling.—In a letter to *Nature* Prof. Joly, of Trinity College, Dublin, draws attention to a notice recently issued to mariners by the Board of Trade, in which the principle of synchronous signalling is applied for the first time to the determination of distance at sea. The notice states that on the Fire Island lightship, at the approach to New York Harbour, a combined radio and submerged sound signalling system has been installed, for use more especially in thick weather. The range of the apparatus is limited to that of the submarine bell receiving equipment, i.e., six or seven miles. The submarine bell strikes six strokes, pause, then eight strokes once every 38 seconds. Beginning shortly after the first stroke of the six, about $\frac{1}{2}$ second, the ship emits a series of radio signals. In order to determine the distance of a ship from the lightship it is necessary to count each of these radio dots until the first stroke of the six submarine signals is received. The number of dots thus determined gives the distance in half sea miles from the lightship. Example:—Eleven radio dots are received before the first stroke of the bell: the distance is $11\frac{1}{2}$ or $5\frac{1}{2}$ miles. The most convenient method of receiving these signals is to have one receiver connected to the radio and the other receiver connected to the submarine bell detector, thereby connecting one ear to radio signals and the other to submarine signals. The particular mode of applying synchronous signals above described, says Prof. Joly, enables the mariner to dispense with the use of stop-watch or chronometer. If a wireless and a submarine signal be started together, the latter lags $1\frac{1}{2}$ seconds for each mile travelled, or for each half mile the lag is $0\frac{1}{2}$ second. Hence if the instantaneous signal is repeated every $0\frac{1}{2}$ second, the first of these being emitted $0\frac{1}{2}$ second after the first submarine signal, the mariner at half-mile distance from the shore station gets both initial signals together. At one sea mile he gets the first submarine signal along with the second radio dot; at one and a half sea miles the third radio dot coincides with the first submarine bell stroke. Hence the rule: Divide by 2 to find the distance in sea miles.

The application of synchronous signalling to avoiding collision at sea is perfectly simple, and the step now taken should lead to its careful consideration and trial. In this case a vessel A, when overtaken by thick weather, emits synchronous signals, say, every two minutes. Another ship, B, hearing these, not only learns of the presence of A, but also gets her distance at once. B is also signalling, so that like information reaches A. Each ship now signals her course and speed. The navigating officers on A and B then read on an instrument of simple construction (1) the rate at which the ships will be hearing one another, and (2) the mutual bearings of the two ships—if collision is threatened. And now after two minutes each officer, on receiving the second synchronous signal of the other ship, is able to say whether danger threatens him or not. For if this second signal tells him that the ships have approached each other by a certain distance during the two minutes (a distance read directly on the "Collision Predictor") there is danger of collision. If the distance covered is less than this (it cannot be greater), there is safety. The third synchronous signal may be used to confirm the result.

Buyers—Beware!—Under this title the *Revue Générale de l'Electricité* prints a warning in connection with an advertisement appearing in the *E.T.Z.* as follows (translation):—

SWITZERLAND.

A Swiss electrical firm with large capital, having the best export connections, will resume after the war the export as well as the improvement [the *Revue* suggests "disguise"] of German electro-technical products. First class references will be supplied on request. Address inquiries to Alfred R. . . . Hamburg . . . (for obvious reasons we suppress the address).

Our contemporary remarks that we have amongst neutrals good and loyal friends, but there are also within their borders agents who will seize every opportunity to make money, though it be stained with the blood of thousands of human beings. We have been taught to be cautious, and we echo the warning after-war buyers, be on your guard!

The A.S.E.—For the post of assistant general secretary of the Amalgamated Society of Engineers, Mr. John E. Arthur, of Lambeth, has been elected. —*Daily Chronicle*.

Excess Profits Duty.—There was a lengthy discussion in the House of Commons on Monday, when the Finance Bill was under consideration. Mr. G. Terrill moved a new clause on behalf of manufacturers, most of which had come into existence since the outbreak of war, the object of the clause being to protect manufacturers so that when a tax is levied on profits it is real net profits that are taxed, and not something more than profits. All manu-

facturers should be allowed the depreciation which a prudent trader desirous of maintaining his trade or business in a high state of efficiency considered necessary. The Government should encourage manufacturers to equip their works in the most up-to-date fashion. The amendment was negatived after the Chancellor of the Exchequer had reminded the House of the protection which firms now had with regard to depreciation, and that they could go in every case with a direct appeal to the Referee if it was considered that a grievance existed. The proposed clause would have meant that the whole excess profits tax would end so far as manufacturers were concerned. Sir J. Harwood Banner moved a new clause with respect to the valuation of stocks, the effect of which, he said, would be to stereotype the basis of values of stocks during the period of excess profits duty. Throughout the country an enormous amount of stock held by manufacturers had been entered at cost: now the Government required the stock to be taken at market price, which would mean that they would have to pay on paper values which might never be realised. After some considerable discussion, Mr. Bonar Law announced that, in order to meet the views of members, the Government would put two years in the White Paper as the period to be allowed after the termination of the war in which to ascertain by actual realisation the value of the stock appearing in the account at the end of the last accounting period, and an allowance would be made from the profits of that period for any difference between the valuation and the sum realised. The period previously proposed was a fixed period of a year from the termination of the war, for all businesses. Sir J. Harwood Banner then withdrew his clause.

Electric Power Supply.—General Croft, in the House of Commons, on July 11th, asked the President of the Board of Trade whether, in view of his having promised to increase the representation of local authorities owning electricity undertakings on the Committee of Electric Supply, he would consider appointing a member to represent the provincial electric supply companies working under Provisional Orders and subject to purchase.

Sir Albert Stanley replied: I am of opinion that the Electric Power Supply Committee as now constituted is sufficiently representative of all bodies owning electricity undertakings, including those described, and I am not prepared to make any further additions to it.

Mr. Gilbert asked the President of the Board of Trade if he would state how many members of the Departmental Committee on Electric Power Supply were directors of electric power companies; and if he would state the qualifications of the last three members appointed to represent the interests of municipal electrical undertakings.

Sir Albert Stanley replied: There are three members of the Committee who are directors of electric power supply companies. Of the three members referred to in the latter part of my hon. friend's question, Mr. Harold Dickinson is the electrical engineer to the Corporation of Liverpool, and was nominated to serve on the Committee by the Association of Municipal Corporations. Mr. Vesey Knox, K.C., has acted as counsel for many urban district councils owning electricity undertakings, and was nominated by the Urban District Councils' Association. Mr. W. B. Smith is a member of the Glasgow Town Council, who own the largest municipal electricity undertaking in Scotland, and was nominated by my right hon. friend the Secretary for Scotland, on the recommendation of the Lord Provost of Glasgow.

Mr. Gilbert asked the President if he would be prepared to consider whether the London undertakings should also have a representative on the Committee.

Sir A. Stanley: I should like notice of that.—*Financial News*.

In the House of Commons, General Croft asked the President of the Board of Trade whether, having regard to the fact that the latest additions to the Board of Trade Departmental Committee on the Supply of Electricity were all representatives of municipal interests, he would reconsider his determination to exclude representatives of electric supply companies which were liable to purchase, and whether his attention had been called to the fact that these companies, subject to purchase, represented a capital of £25,000,000 sterling.

In a written reply, Mr. Roberts (Secretary) said: The Committee already includes representatives of the companies described, and the President does not see any reason to alter his decision not to make any further additions to the Committee.—*Financial Times*.

Report of the Electrical Trades Committee.—In the House of Commons, General Croft asked the President of the Board of Trade whether the reports recently made by the Electrical Trades Committee and the Coal Conservation Sub-Committee on Electric Supply had been published, and, if not, whether they would be published at an early date. Mr. Roberts said that the Government had decided that it is not desirable to publish at present the reports of Committees on the various aspects of industrial and commercial reconstruction. All the recommendations of these Committees were receiving earnest consideration.

Electrically-heated Moulding Presses.—The Westinghouse Electric and Manufacturing Co., of East Pittsburgh, Pa., has adopted electric heating for 23 presses used in the manufacture of moulded composition material. These presses were formerly heated by steam, but a trial of an electrically-heated press proved so satisfactory that the entire set of presses in the company's moulded-insulation department is now being modified for equipping with electric heaters.

A series of tests made on one of the presses shows that from one to $1\frac{1}{4}$ hours are required to heat the plates, starting cold, and that 1,800 watts are required to keep the press hot while in steady use for work requiring a temperature of 190°C .

Rats!—A City shop employé, fined 20s. for not properly shading lights in the premises, explained that they were properly switched off when the shop was closed for the night, and said that they must have been switched on again by a rat.—*The Times*.

Scientific Research.—The trustees of the Beit Fellowships for Scientific Research have recently elected Mr. Leslie Hartshorn to a Fellowship. He will carry out his research in the Imperial College at South Kensington.

Electricity Works Employes and Exemption.—The borough electrical engineer of Southend has reported to his Committee in regard to the applications made to the local Tribunal for the exemption of five men whose services the Committee had considered essential, that, subsequent to the applications being made, the system of exemption of men employed in undertakings certified under the Munitions of War Act (of which the electricity undertaking is one) had been revised, and that in accordance with the new system applications had been made to the Munitions Area Recruiting Officer by the men referred to, for protection certificates exempting them from military service so long as such certificates should remain in force, and that the certificates applied for had been granted. He further reported that one of the certificates had since been withdrawn. The town clerk was directed to communicate with the Munitions Area Recruiting Officer, with the object of arranging a conference between the chairman, the electrical engineer, the local Military Representative and the officer himself with respect to the men employed in the electricity undertaking whose services the Committee regards as essential to be retained.

Liberty Bonds.—Up to June 14th employes of the Central Group of Bell Telephone Companies subscribed for \$652,850 in Liberty Bonds. Chicago Telephone Co.'s employes took \$370,250, 5,891 subscriptions being for \$50. Commonwealth Edison Co. employes to the number of 6,043 subscribed for \$506,600.—*Elec. Rev. and Western Electrician*.

Engineering Wages: Further Advance.—An award has been issued by the Committee on Production giving a further advance of wages to all grades of workmen employed by members of the Engineering Employers' Federation. The award is given in pursuance of an agreement between the Federation and 46 Trade Unions connected with the engineering and foundry trades, under the terms of which the Committee on Production may be called upon at intervals of four months (*i.e.*, February, June, and October) to consider what alteration in wages is warranted by the abnormal conditions due to the war. The awards now issued give a further advance of 3s. per week, making the aggregate increase on pre-war rates 15s. per week. An advance of 1s. 6d. per week is given to boys and youths.

Scottish Electricians' Wages.—Mr. James M. Davies, jun., secretary of the Electrical Contractors' Association of Scotland, states that the general effect of the wages award is that the employes in the Glasgow district receive an advance of 1½d. per hour as from the beginning of June. The employes have already received more than the 7s. minimum advance, in two advances of 1d. and ½d. respectively (making for the 54 hours' week, 7s. 10½d.).

Higher Education.—The Society of Chemical Industry held its annual meeting, in Birmingham, on Wednesday and Thursday, concluding to-day, and we will refer to a number of matters of electrical interest in our next issue. In his presidential address, on Wednesday, Dr. Charles Carpenter referred to the necessity for bringing our governing classes more into contact with the working classes—which make up the bulk of the population—in early training, if they were thoroughly to understand their outlook on life. In coming into contact with men holding important positions, he had been struck by the remarkable fact that, although they had been fully qualified to deal with big businesses and organisations, they had not the least idea how to manage and deal with workers. The reason was that their early training gave no opportunity for getting into close and personal contact with them.

He suggested that a boy, on reaching the age of 16, should commence, either at the desk or in the factory, with compulsory attendance at continuation schools. After two or three years he would, if showing himself to possess the necessary ability, be fit for entrance to the university. At the same time, it should not be left to chance to determine the path which the boy followed after leaving school. If the teaching authority had properly looked after him, it should be easy to divine the pupil's leanings, and direct his course in accordance with them. As a preliminary step towards this, the first principles of experimental science should be taught compulsorily at the primary schools. In this matter, the community required, and was entitled to have, the assistance of the State. Our educational system needed alteration at the foundation. In his opinion, a boy was old enough to learn science when he was old enough to learn history and geography. Incidentally, Dr. Carpenter urged the importance of the interdependence of the engineer and the chemist, and regarded it as imperative that they should get into double harness as soon as possible.

Prohibited Exports.—The Supplement to the *Board of Trade Journal* of July 19th contains complete lists of articles which, according to the latest information received by the Board of Trade, are prohibited to be exported from British India, Australia, Canada, New Zealand, South Africa, Newfoundland, Egypt, Cyprus, and Ceylon.

Appointments Vacant.—Engineer-in-charge (55s.) and senior switchboard attendant (10s.), for the Darlington Corporation Electricity Department; shift engineer (£115) and engine fitter and turner, for the Dover Corporation Electricity Works. See our advertisement pages to-day.

Russian Electro-Technical Institute.—The Ministry of Trade and Industry has prepared a project for the transfer of the Electro-Technical Institute from the control of the Ministry of the Interior to that of the Ministry of Trade and Industry. The Department proposes the reform of the basis of the professional educational side of the Institute, in order to fit it better to meet the greater demands on it, and the requirements of the electro-technical industry. The Minister of Posts and Telegraphs protests against the move, as the original home of the Institute was in this Department.

Steel-cored Aluminium Wire.—The employment of this material is described in an article on the supply of electricity to Pomona, a "small town" of 600 inhabitants, or what we should call a village, in the *Electrical World* of May 5th. Power is transmitted from a station at Ottawa (Kan.), 11 miles (17.7 km.) distant; lattice steel poles are used, carrying No. 1 B. and S. stranded steel-cored aluminium wire, with a sag of 17 in. (432 mm.) at 70° F. The pressure is 6,600 volts, single-phase, reduced to 220–110 volts for distribution, the total power provided for being 15 kw. The transmission-line poles are 250 ft. (76.2 m.) apart; on the distribution lines, consisting of Nos. 0, 2, 4, and 6 B. and S. gauge wires, about half this spacing was adopted. The installation cost in all \$12,252, and the consumers number 110. The price is 6d. per kw.-hour, and energy is purchased from the generating station at Ottawa at 1½d. per kw.-hour. The average supply is 2,089 kw.-hours per month, costing in all \$62.68.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station and Tramway Officials.—The Bradford Corporation Tramways Committee has increased the salary of Mr. J. W. DAWSON, assistant electrical engineer in the tramway department, from £295 to £325 per annum.

Gravesend T.C. has disagreed with a motion to grant a war bonus of £50 a year to the electrical engineer, Mr. McINNES, and has passed an amendment asking Mr. McInnes not to press for any increase until after the war.

Colechester T.C. has, having regard to the special services rendered during the past two and a half years, increased the salary of the electrical engineer, Mr. FRISBY, by £50 a year as from June 1st.

Mr. D. H. C. LAE, who served his articles at the Folkestone electricity supply works, has been granted a commission in the R.F.C.

General.—The wedding took place on July 5th, at Holy Trinity Church, Houghton, of Lieutenant EGERTON JOHN WARD, A.M.I.E.E., The Royal Irish Regiment, to Olive Mary Langton, second daughter of the Rev. T. L. Webster and Mrs. Webster, of Houghton Vicarage, Preston, Lancs.

Mr. LORENZO W. MIGOTTI, who for the past nine years has been electrical engineer to the Bahia Blanca North-Western Railway, and manager of the South American Light and Power Co., and who was formerly with the Underground Railways of London, has accepted the post of chief engineer to the Electric Supply Co., of Rosario de Santa Fé, Argentine Republic.

The Hon. GILBERT JOHNSTONE having resigned from the L.C.C. Special Committee on London Electricity Committee, the Committee recommends that Mr. F. C. HARRISON be appointed to fill the vacancy.

In commemoration of the completion of the 21st year of the working of the County of London Electric Supply Co., Ltd., the company presented silver match-boxes to members of the staff, and gold medallions to the chief officers. These were inscribed as follows:—"To commemorate the 21st year of working 5,000 kw. per annum in applications, and 1,000,000 units sold per week, 1916." The directors and chief officers of the company also presented to the chairman, Mr. J. B. BRAITHWAITE, a rose bowl and salver in commemoration of the above and of his association with the company since its formation.

On Monday last, at a meeting of the Manchester Education Committee, Mr. GEORGE GERALD STONEY, B.A., F.R.S., &c., was recommended for appointment as Professor of Mechanical Engineering in the Manchester School of Technology.

Our Chicago namesake says that Mr. SAMUEL INSTILL, president of the Commonwealth Edison Co., Chicago, Ill., has been given the degree of Doctor of Science by the Union College, of Schenectady, N.Y., in recognition of labours in the development of electrical science.

Roll of Honour.—Lieutenant CYRIL STREET, R.F.C., killed in action, was trained as an electrical engineer at Broadbeath, Manchester.

Sergeant F. C. PLATT, R.E., who has been awarded the Military Medal for bravery in the field, was employed as an electrical engineer by the Wolverhampton Corporation.

Mr. A. J. COLLINS, of Scorton, a wireless telegraphist on one of H.M. ships, has been killed at sea, his vessel being torpedoed or mined. He was 30 years of age, and was recently awarded the Distinguished Service Medal.

Lieutenant FRANK S. SCARR, Australian Engineers, who has fallen in action near Bullecourt, was formerly on the staff at Enfield, N., of the Ediswan Co. He was 38 years of age, joined the ranks, and saw service in Gallipoli. For his services in that theatre of the war he was complimented by Sir Ian Hamilton, and was given his commission on the field.

Able Seaman D. COLMAR, R.N., who has died at Haslar Hospital at the age of 37 years, was prior to the war manager's assistant at the Totnes electric light works.

Private ARTHUR HOLGATE, York and Lancaster Regiment, killed in action, enlisted from the Doncaster Corporation tramway staff.

ALBERT WOODCOCK, S.P.O. Torpedo Boat Service, reported killed, was formerly employed at the Bradford Corporation electricity works.

Private J. T. HALL, who was in the turbine department at Wheatley Hill Colliery (Co. Durham) has been killed in action.

Private J. CHARNOCK, King's (Liverpool Regiment), formerly reported missing, and now officially reported killed, was employed by Messrs. Dick, Kerr & Co., Ltd., Preston. Lance-Corporal HESKETH, Loyal North Lancashire Regiment, killed in action, was also employed by the same firm.

We desire to tender to Dr. and Mrs. Ferranti on our own behalf, and we are sure also on behalf of a host of sympathisers in the electrical profession, our sincere condolences with them on the death of their eldest son, Major BASIL DE FERRANTI, M.C., R.G.A., from wounds received in action on July 12th. That Major Ferranti was wounded was announced in our last issue, but we regret that he has now to be reckoned among the increasing number of electrical men to whom it has fallen to make the supreme sacrifice.

J. W. WOOD, an employé of the Marylebone electricity department, at present serving as a sergeant in the R.A.M.C. in France, who was awarded the D.C.M. for services in the field last year, has now been awarded the Croix de Guerre by the French Government in recognition of work done during the past 12 months.

Lance-Corporal JOHN ARMSTRONG, R.E., who has been killed in action, was engaged in the electrical department of the Calico Printers' Association, Ltd., Manchester.

Bombardier E. WADE, R.G.A., wounded and in hospital abroad, was engaged in the British Westinghouse Works at Trafford Park.

Private ALLWAY, Gloucester Regiment (T.F.), who has died from wounds, was employed at the Bristol Corporation electricity works.

Obituary.—MR. FRANK PATCHETT.—We regret to record the death of Mr. Frank Patchett, J.P., of Halifax, at the age of 69 years. He was the owner of the business conducted as George Patchett & Sons, wire manufacturers, with which firm was incorporated several years ago the Northern Electric Wire & Cable Manufacturing Co. He was one of the oldest magistrates for Halifax.

CITY NOTES.

General Electric Co., Ltd.

Presiding at the annual meeting, on Tuesday, Mr. H. HIRST said that the total net profit had increased by about £70,000—£30,000 on trading account and £40,000 revenue from investments. The investment account, which had shown a steady yield of about 10 per cent., had increased by, roughly, £350,000, and the net revenue from this source had grown correspondingly. This was mainly due to the acquisition of shares in the Osram Robertson Lamp Works, Ltd., of which they were only part owners in the past, although they always managed the factory, and absorbed its entire output. The scarcity of raw materials and skilled labour, and the uncertainty of the patent situation, as well as certain war work, which interfered with the standard output, made it more than likely that the revenue from this investment might not be quite up to this year's level in the near future. They had, however, planned extensions, acquired improved methods of manufacture, and made arrangements for the starting of a research laboratory, so that as soon as they could go full-speed ahead they would again reap the fullest benefit from this bold venture. It was desirable that they should have plenty of cash at disposal. Raw material prices were still soaring at a great height. To-day the same amount of business as in pre-war time necessitated the employment of nearly double the amount of money; on the other hand, credit was considerably shorter, purchasing was more irregular through difficulties of transport, and funds must therefore be at disposal at a moment's notice in order to secure materials when they were to be had. This was sufficient explanation of the

bank loan. With reference to the additions to reserve, they had always striven to strengthen and develop the company so as to make it one of the strongest electrical concerns in the country. They had therefore put to a contingency account every year a certain sum which should, approximately, cover any possible losses. By that means the investments were always kept at par value. In the course of time, however, the allied and subsidiary companies developed and made profits, which were used in the first instance to wipe out previous losses or establishment charges, and as soon as this was accomplished the reserves originally allotted to them became free. The £100,000 transferred was an amount freed from such accounts, and also from contingencies in connection with contracts, which fortunately did not arise. In making this transfer they had not departed from their usual conservative policy. He hoped that the ordinary shareholders would approve their refunding this year the income-tax to preference shareholders by way of a special bonus. The ordinary shareholders were reaping the full benefit of the prosperity of the company, not only by an increased dividend, but also by the appreciation of the value of their shares. The directors felt that they had been just to the demands of labour and employes, and thus the only class suffering under present conditions was the preference shareholder, who had a fixed rate of income, with an increasing rate of income-tax. The preference shareholders numbered about 3,000, mostly small investors, many of whom probably felt the stress of the times very much. Some ordinary shareholders thought that the results of the year warranted a bigger dividend. He appealed to them to be satisfied with their proposal. The present war would change many things—perhaps everything. Nothing would be quite as it was before the war, but of all the changes that would alter industry in this country, the electrical industry would undergo the most drastic transformation. Electrical plant in the country at the present moment was run at high pressure to a premature death. Under present conditions none but the most important plant could be replaced, and the replacement and re-organisation necessary after the war would be a tremendous task for the existing electrical companies, which had yet to make good a deficiency in output to cover the demand, which in pre-war time was supplied by importation. War had taught this country the necessity of home production. Many industries on which this country relied would have to modernise their methods and rejuvenate themselves. Electric power, heat and light were primary essentials in the carrying out of such a programme. The depletion of rolling stock in the country would have to be made good, and railway electrification on a large scale had suddenly appeared within the realm of immediate practical politics, for which many of them must prepare. Greater efficiency and economy throughout this country occupied the mind, not only of industrialists, but also of Government departments. They heard much nowadays of barbaric waste of coal, and only the other day the Controller of Coal Mines had to issue an Order to save labour, transport, and rolling stock, which divided the country into areas within which coal from certain districts could only be circulated and used. He was convinced that the extraction of by-products from coal would have to be treated from a national point of view. He was convinced of the necessity for the creation of large generating stations in some 15 to 20 centres throughout the Kingdom, so that instead of coal being transported to big power units, big power units would be transported to the coalfields, and, after the extraction of by-products, electric current or gas, or both, would be transmitted to towns and industrial undertakings to supply power, light, and heat through cables and pipes, and the necessity for the conveyance of coal by rolling stock would be reduced to a small proportion. Many industries, especially certain chemical industries, above all the production of fertilisers, would thus become practicable in this country, whereas in the past they were relegated only to countries where water-power was available. Power, the foundation of all modern industry, would then, thanks to our natural resources, be produced in this country as cheaply, if not more cheaply, than in any other part of the globe. He had said nothing of the electrical requirements of the overseas dominions, and of poor Belgium and many of the Allies, whose wants in the past had been largely supplied by enemy countries. He had, however, said sufficient to indicate a few aspects of the big task expected from the electrical industry, and the "G.E.C." meant to take its proper part in this evolution and in these developments. It was for that reason that they were not at present suggesting a higher dividend, but preferred that the company should be strong enough to command any capital required, and to run certain risks connected with such new enterprises without prejudice to its future prosperity. Income-tax and excess profits must be paid, and the directors could only appeal to the ordinary shareholders for an altruistic policy to attain these great ends. He was convinced that some day, perhaps not too distant, they would reap very tangible results from this present self-denial. Their capital, and the skill of the directors and staff would, however, not alone bring about these changes, which were so essential for the national benefit. They must above all have the co-operation of labour. The relationship between the management of their company and labour throughout their history had been good—as good as that of any concern in the country. Yet there had been in the past occasional periods of tension

and stress which, in spite of goodwill on both sides, had been difficult to overcome. Present conditions had brought about better vision. The conditions of the country, and more particularly the outlook after the war, had made it clear to all that mutual understanding was essential in the national interests. The leaders of Industry and Labour had at last met to exchange views; they were comparing notes and formulating ideas, even programmes, which should go far to remove a great many of the past difficulties. Let them hope before the war was finished a means or machinery might be found which would solve any future difficulties which were bound to crop up from time to time without resort to strife. From personal experience gained during the past year, he knew that the desire for harmonious working existed, and had been fostered by genuine patriotism on the part of both employers and employes. Much patience was, however, still required to make these ideas effective and to bring them to fruition. For two or three generations, both classes had been set against each other, mistrust and prejudice had been preached, and it required not only goodwill and intention, but also a period of probation and experiment of the most varied kind to bring home to each side a conviction of the sincerity of the other. He was sorry to say that the list of those of their staff and workpeople who had given their lives in the great cause had grown to 119; 209 had been wounded, six were prisoners of war, and 40 were missing. Amongst the honours awarded to their men were two Military Crosses, two Distinguished Conduct Medals, eight Military Medals, and two Meritorious Service Medals.

The report for 1916 shows that after deducting general and legal expenses, administration charges and interest, £341,850, there is left \$5,674,612. Dividends on the preference and ordinary shares absorbed \$4,851,488, leaving \$823,151. The reduction in the surplus of net revenue for the last two years, attributable to the decline in exchange from the rates prevailing for several years before the war, is approximately \$3,000,000 for 1915 and \$3,300,000 in 1916. Since the middle of April the exchange value of the milreis has advanced from 12d. to 13½d. on June 13th. If this rate is maintained the net revenue should show a very substantial increase. The surplus profits of the subsidiary companies and the Brazilian Traction since their incorporation, which at December 31st, 1915, remained undistributed in dividends, amounted to \$14,773,244. Of this \$4,600,000 has been allocated to special reserve accounts for renewals, contingencies, &c. A further sum of \$1,500,000 has been applied for payment of the sinking fund instalments of the first mortgage bonds of the Rio de Janeiro Tramway, Light & Power Co., leaving \$8,613,244 unappropriated on the books of the companies, which sum has been invested in the development of the enterprises of the subsidiary companies. Out of this surplus the total amount allocated to special funds is \$4,600,000.

The trading profit of the Lancashire Electric Power Co. for 1916 was £38,710, plus £1,128 interest on hire-purchase plants, &c., making £39,839, as against £32,843 for 1915. £2,061 brought forward is added. Debenture interest has required £1,500, there has been put to reserve £15,000, a dividend of 3 per cent. on the shares absorbs £14,700, and £7,703 is to be carried forward. The following figures show the development of the Parliamentary company's business for the past three years:—

	1914.	1915.	1916.
Units generated	32,157,185	35,768,064	40,842,652
Max. load in kw.	10,210	10,740	11,900
H.P. connected	27,018	29,000	30,600
Receipts	£65,433	£72,395	£97,964
Expenditure	£35,472	£40,160	£59,254
Profit on trading	£29,961	£32,235	£38,710

The revenue account of the Lancashire Power Construction Co., Ltd., shows that the total interest, dividend, and other receipts for the year amounted to £19,205, and after deducting therefrom debenture interest, trustees' fees, and general charges payable, £15,468, the available balance is £3,735, which is to be carried to reserve. A Bill to re-arrange the capital of the company and for other purposes, has received the Royal Assent, and the re-arrangement will now be proceeded with. Annual meeting: July 26th.

New Issue.—The "Manchester Guardian" states that, in order to complete extensions at their works at Middlesbich, the Electro-Blench & By-products Co. are issuing the balance of their authorised share capital at par—namely, 7,356 preference and 8,000 ordinary shares. Treasury sanction has been obtained. The company, which took over the properties of the old Electrolytic Alkali Co., began manufacturing in January, 1915, and in consequence of the demands on the chemical industry have been very busy since. For 1915 the dividend was at the rate of 7 per cent., the profit being £25,571, and out of this £4,000 was placed to reserve. Owing to the pressure on the Ministry of Munitions and the consequent delay in adjusting the duties payable by the company as explained at the annual meeting last month, the accounts for 1916 have not yet been published, and the directors have repeated the 7 per cent. dividend.

British Thomson-Houston Co., Ltd.—Profit for 1916, after deducting expenses other than interest, £359,361, plus £73,359 brought forward, less £70,000 for excess profit duty and increased depreciation for 1915. Reserve re raw materials at December, 1915, not required and written back £25,000. Interest on loans and debentures £70,000, appropriated for depreciations £153,700, leaving £163,923 to carry forward, subject to deduction of munitions levy for 1916. Mr. E. Thurmauer retires from the board.

Mather & Platt, Ltd.—Interim dividend on the ordinary shares, 5 per cent. for the half-year, less income tax.

St. James' & Pall Mall Electric Light Co., Ltd.—Interim dividend at the rate of 7 per cent. per annum on the ordinary shares.

Sao Paulo Tramway, Light & Power Co.—Dividend 10 per cent., to reserve \$1,350,000, to depreciation and renewals \$250,000, carry forward \$32,757.

Rio de Janeiro Tramway, Light & Power Co.—Dividends 5 per cent., to general reserve \$1,750,000, to depreciation and renewals \$750,000, carry forward \$56,512.

Kaministiquia Power Co.—Quarterly dividend \$1½ per share (7 per cent. per annum).

West African Telegraph Co., Ltd.—The accounts show £12,720 available, as compared with £25,317 for 1915. £2,000 (against £13,000 has been transferred to reserve, and a further dividend of 2 per cent. has been paid, making the usual distribution of 4 per cent. for the year, free of tax.

W. & T. Avery, Ltd.—Further dividend, 10 per cent., less tax, making a total of 12½ per cent. for the year, placing £13,000 to reserve, and carrying forward £12,564.

Hadfields, Ltd.—Interim dividend, 1s. per share, free of tax, on the ordinary shares.

Metropolitan Electric Supply Co., Ltd.—Interim dividend, 2 per cent. per annum (1s. per share) on ordinary shares.

Lima Light, Power & Tramways Co.—Dividend, 1 per cent.

Nairobi Electric Power & Lighting Co., Ltd.—Interim dividend at the rate of 6 per cent. per annum for the half-year ended June, 1917.

Singapore Electric Tramways Co., Ltd.—Interim dividend, 5 per cent.

STOCKS AND SHARES.*

TUESDAY EVENING.

RISEING Consols are as clear an index as can be desired of the investor's frame of mind, and Consols just now are what the Stock Exchange calls a good market. The strength of the stock finds apt reflection in the other investment departments, and sound industrials are particularly in favour. Stock Exchange jobbers have become very cautious in selling shares they have not got, because time after time their expectations of buying back the shares have been disappointed, holders declining to sell at prices they would have deemed tempting six months ago.

Therefore quotations respond with alacrity to the growing pressure to buy. Metropolitan Electric preference are ½ up. The company has this week declared an interim dividend of 2 per cent. on its ordinary shares, the same rate as last July's. Other interim dividends will probably follow the same sort of line, and repeat their last year's interim declarations. City Lights are ¾ up at 12½, and County ordinary hardened to 11. General Electric ordinary at 16½ are the fraction to the good. British Westinghouse preference show strength at 2 9/16, this being 3/16 up. Edmundsons at 2½ are ½ better on the report; the preference dividend is secured, though net profits at £12,300 are about a thousand pounds down compared with 1915-1916.

County of Durham Electric 5 per cent. debenture stock has been removed from the pages of the Stock Exchange Official List by reason of the infrequency of dealings, the last recorded bargain having been at 9½ on October 17th, 1910.

The Home Railway dividend season begins this week, and there is mild curiosity as to how the companies will show up. It is taken more or less for granted, however, that the forthcoming interim dividends will be, like those of the electric lighting companies, the same as the 1916 levels. Most of the prices fairly well maintain their recent spurts, but Districts and Metropolitan have both lost ¼, and the price of the latter looks high enough, in the light of its one per cent. dividend. Districts, on the other hand, having received no distribution for the past 31 years, are not handicapped in the same way, their vogue being due to "possibilities"—always more attractive than a meagre dividend. Underground comes at 84 are ½ better on the week.

Mexican news is said to be much more favourable, and while the industrials have not moved, Mexican Government and Railway issues are up, this usually being precursory to a stiffening of the others. A substantial rise in Brazilians

followed upon the resumption of cash payments of the Republic's coupons due this week. Brazilian Tractions have sympathised with a rise of 2 points, and Rio Trains bonds are wanted at the improved levels of 87 for the Firsts and 76½ for the Seconds. British Columbia Electric Railway stocks have been little affected by the issue of a preliminary circular to proprietors, who are now officially informed of the municipal competition with which the company is threatened. They are promised further information in due course. Oddly enough, the 1½ per cent. debenture stock has risen 2 points, from which it might appear that the market takes the view that the prior-charge is safer than before. The yield, of course, is good, being nearly 7½ per cent. allowing for accrued interest in the price. Canadian General Electric at 119 are 2½ higher.

Cable prices mount day by day. The investor is keen upon getting any of the good-class descriptions, and, of the more speculative, West India and Panama continue their giddy advance, at 32s. 6d. showing another jump of 3s. 9d. The First Preference are 5s. up at 8, and the Seconds are equally better at 7. Globe ordinary and preference have recovered more than their dividends. Both Eastern and Western groups have hardened. The same story is repeated amongst manufacturing shares. Telegraph Constructions are £1 up, plus the dividend deducted last week. Callenders have put on another 5s. Those stocks which show no notable changes are really stronger, because there are many buyers and hardly any sellers. Marconis are quiet, though the Marines at 18s. 9d. have improved a little.

Rubber shares remain firm, and base-metal issues are very steady. Armaments have slightly risen. Iron, coal, and steel issues are amongst the industrials for which there is active demand.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.					
	Dividend	Price	Rise or fall	Yield	
	1916. 1916.	July 17, 1917.	this week.	p.c.	
Brompton Ordinary	10 9	6½	—	£6 18 8	
Charing Cross Ordinary ..	5 5	8½	—	7 2 10	
do. do. do. 4½ Pref. ..	4½ 4½	8½	—	6 18 6	
Chelsea	4 8	2½	—	5 4 4	
City of London	8 8	12½	+ ½	6 8 0	
do. do. 6 per cent. Pref. ..	8 6	10	—	6 0 0	
County of London	7 7	11	+ ½	6 7 3	
do. do. 6 per cent. Pref. ..	6 6	10	—	6 0 0	
Kensington Ordinary	7 10	5½	—	6 11 7	
London Electric	8 8	1	—	Nil	
do. do. 6 per cent. Pref. ..	6 4	8½	—	6 6 8	
Metropolitan	8 8	2½	—	6 0 0	
do. do. 4½ per cent. Pref. ..	4½ 4½	8½	+ ½	7 4 0	
St. James' and Pall Mall ..	8 8	6½	—	6 3 1	
South London	5 5	2½	—	7 5 6	
South Metropolitan Pref. ..	7 7	20½	—	7 0 0	
Westminster Ordinary	7 7	6½	—	6 1 8	

TELEGRAPHS AND TELEPHONES.					
	Dividend	Price	Rise or fall	Yield	
	1916. 1916.	July 17, 1917.	this week.	p.c.	
Anglo-Am. Tel. Pref.	6 6	99	+1	8 1 0	
do. do. Def.	83½ 83½	27½	—	6 16 4	
Chile Telephone	8 8	7	—	6 14 4	
Cuba Sub. Ord.	6 5	8½	—	6 17 8	
Eastern Extension	8 8	14½d	+ ½	*6 14 6	
Eastern Tel. Ord.	8 8	140½d	+ ½	*5 14 6	
Globe Tel. and T. Ord. ..	7 7	12½x1	+ ½	*5 9 0	
do. do. Pref.	6 6	104½d	+ ½	5 17 1	
Great Northern Tel.	22 24	86	—	6 13 4	
Indo-European	13 13	51	—	6 7 5	
Marconi	10 10	31½	— ½	3 1 6	
New York Tel. 4½	4½ 4½	99	—	4 11 0	
Oriental Telephone Ord. ..	10 10	23	+ ½	3 12 9	
United R. Plate Tel.	8 8	5½	—	*5 18 6	
West India and Pan.	6d. 6d.	1½	+ ½	1 10 9	
Western Telegraph	8 8	14½	+ ½	*6 13 4	

HOME RAILS.					
	Dividend	Price	Rise or fall	Yield	
	1916. 1916.	July 17, 1917.	this week.	p.c.	
Central London, Ord. Assented	4 4	60½	—	6 8 0	
Metropolitan	Nil Nil	24	— ½	4 3 4	
do. do. District	Nil Nil	16	— ½	Nil	
Underground Electric Ordinary	Nil Nil	14½	—	Nil	
do. do. "A"	Nil Nil	69	—	Nil	
do. do. Income	6 6	84	+ ½	*6 19 1	

FOREIGN TRAMS, &c.					
	Dividend	Price	Rise or fall	Yield	
	1916. 1916.	July 17, 1917.	this week.	p.c.	
Adelaide Sup. 6 per cent. Pref.	6 6	5	—	6 0 0	
Anglo-Arg. Trams, First Pref.	5½ 5½	21½	—	7 16 6	
do. do. 2nd Pref. ..	5½ —	2½	— ½	—	
do. do. 5 Deh.	5 5	68	— ½	7 8 6	
Brazil Tractions	4 4	50	+2	—	
Bombay Electric Pref.	6 6	10	—	6 0 0	
British Columbia Elec. Rly. Pice.	5 5	56½xd	—	8 17 0	
do. do. Preferred Nil Nil	Nil Nil	82½	—	Nil	
do. do. Deferred Nil Nil	Nil Nil	27½	—	Nil	
do. do. Deh.	4½ 4½	69½	+2	7 3 6	
Mexico Trams 5 per cent. Bonds	Nil Nil	37	—	Nil	
do. do. 6 per cent. Bonds	Nil Nil	30	—	Nil	
Mexican Light Common	Nil Nil	14½	—	Nil	
do. do. Prof.	Nil Nil	22½	—	Nil	
do. do. 1st Bonds	Nil Nil	89½	—	—	

MANUFACTURING COMPANIES.					
	Dividend	Price	Rise or fall	Yield	
	1916. 1916.	July 17, 1917.	this week.	p.c.	
Babcock & Wilcox	15 15	23½xd	—1½	5 1 0	
British Aluminium Ord. ..	7 10	29½	+3½	6 18 0	
British Insulated Ord.	17½ 20	12½	—	7 16 0	
British Westinghouse Pref. ..	7½ 7½	2½	+½	5 17 2	
Callenders	20 20	13½	+ ½	7 5 6	
do. do. 5 Pref.	5 5	4½	+ ½	5 17 8	
Castner-Kellner	22 22	8½	—	6 10 2	
Edison Swan, fully paid ..	— —	1½	—	Nil	
do. do. 4 per cent. Deb. ..	4 4	70½	—	5 13 6	
Electric Construction	7½ 7½	1½	—	8 0 0	
Gen. Elec. Pref.	6 6	10	—	6 0 0	
do. do. Ord.	10 10	16½	+ ½	6 1 3	
Honley	25 25	18	—	7 16 8	
do. do. 4½ Pref.	4½ 4½	4	—	5 12 8	
India-Rubber	10 10	12½	—	*8 5 0	
Telegraph Coc.	20 20	35½xd	+1½	*6 6 2	

*Dividends paid free of income-tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, July 18th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/6	..
a Ammoniac Sal	per ton	£75	..
a Ammonia, Murate (large crystal)	..	£54	..
a Bisulphide of Carbon .. ..	..	£23	..
a Borax .. ..	..	£39	..
a Copper Sulphate .. ..	..	£61 10	..
a Potash, Chlorate	per lb.	2/6	..
a " Perchlorate .. ..	..	2/	..
a Shellac	per cwt.	206½	10½ dec.
a Sulphate of Magnesia	per ton	£16	..
a Sulphur, Sublimed Flowers .. ..	..	£35	..
a " Lump .. ..	..	£25	..
a Soda, Chlorate	per lb.	10½d.	..
a " Crystals	per ton	120½	..
a Sodium Bichromate, cakes ..	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2" to 12" basis)	per lb.	..	..
c " Tubes (solid drawn) .. ..	..	..	..
c " Wire, basis .. ..	..	..	..
c Copper Tubes (solid drawn) ..	..	1/8½ to 1/8½	..
g " Bars (best selected)	per ton	£166	..
g " Sheet .. ..	..	£165	..
g " Rod .. ..	..	£165	..
d " (Electrolytic) Bars .. ..	..	£142	..
d " " Sheets .. ..	..	£167	..
d " " Wire Rods .. ..	..	£150	..
d " " H.C. Wire	per lb.	1/5½	..
f Ebonite Rod .. ..	..	3/	..
f " Sheet .. ..	..	2/6	..
f German Silver Wire .. ..	..	2/3	..
n Gutta-percha, fine .. ..	..	6/10	..
h India-rubber, Para fine .. ..	..	3/2	2d. inc.
i Iron Pig (Cleveland warrants) ..	per ton	Nom.	..
i " Wire, galv. No. 8, P.O. qual.	..	£42	..
l Lead, English Pig .. ..	..	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small ..	per lb.	6d. to 3/	..
e " " medium .. ..	..	3/6 to 6/	..
e " " large .. ..	..	7/6 to 14/ & up.	..
e Silicon Bronze Wire	per lb.	1/9½	..
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English) .. ..	..	..	..
n " Wire, Nos. 1 to 16	per lb.	3/6	..

Quotations supplied by—	
a G. Boor & Co.	g James & Shakespeare.
c Thos. Bolton & Sons, Ltd.	h Edward Till & Co.
d Frederick Smith & Co.	i Bolling & Lowe.
e F. Wiggins & Sons.	j Richard Johnson & Nephew, Ltd.
f India-Rubber, Gutta-Percha and	k P. Ormiston & Sons.
Telegraph Works Co., Ltd.	l W. F. Dennis & Co.

The British Association.—With further reference to the B.A. arrangements for this year and next, we read in *Nature* that in view of the cancellation of the annual meeting of the British Association, it has been necessary to make special arrangements for carrying on the Association's current work. Meetings of the Organising Committees of the various Sections, the delegates of corresponding Societies, the Committee of Recommendations, and the General Committee have, therefore, been held. It has been decided to continue Sir Arthur Evans in the presidency for another year, while the Hon. Sir C. A. Parsons, who would have presided over this year's meeting, will do so at the meeting which, it is hoped, will take place as arranged at Cardiff next year. Bournemouth has repeated its invitation, which has been accepted for 1919. Grants amounting to £286 were made in aid of such researches as it was considered essential to carry on, having regard to present conditions.

Resuscitation after Electric Shock.—In the *Electrical World* of May 5th, Mr. W. P. Strickland cites another case in which a man who had received a shock on a 2,200-volt circuit was brought back to consciousness without special apparatus with the aid of mechanical shocks. The man was on the top of a pole when he received the shock; the lines were cut, and the victim was lowered to the ground, being purposely allowed to drop the last 3 ft. His body was then lifted by the heels (his head resting on the ground) and dropped. While his clothes were being loosened and his tongue drawn forward, the soles of his feet were struck vigorously with anything that came handy, and this treatment was continued during the application of the Schaeffer method of artificial respiration. Recovery was complete. In another case a man was restored to consciousness by falling from a pole.

Canada's Coal Supply.—The Canadian Fuel Controller has been given authority to investigate the amount of fuel stocks on hand, and to arrange for an equitable distribution of the supply. Coal production will be stimulated, and an effort made to establish large stocks inland before water transportation closes for the season.—*Times*.

A Cynical Conundrum.—A "Victim of Many Reconstructions" propounds the following:—"What's the difference between reconstruction and liquidation?" His suggested reply is: "Well, you sometimes get something out of the latter!"—*Financial Times*.

THE PSYCHOLOGY OF POWER-HOUSE SHIFT WORK: AN EX-SHIFTMAN'S REFLECTIONS.

By A. ARNOLD.

MUCH attention has been given at sundry times to the conditions under which men are capable of producing maximum useful work, particularly in the case of manual labour, but little note seems to have been taken of the modifications necessarily involved when provision must be made for continuous running, and hence relays of labour.

The economic results accruing from semi-"Taylorism," applied with discretion to manual and repetitive work are, doubtless, considerable; but in the average generating station—with which the writer is now concerned—there is little scope for such application, except, perhaps, to a limited extent in connection with coal and ash handling. "Taylorism," or scientific management, does not appear to have been intended for use with skilled workers, nor, indeed, is it applicable to duties involving the exercise of judgment and initiative, although the principle (of avoiding circumlocution and needless expenditure of energy, by direct methods) might well form the foundation of a course of mental training for such workers, and this would doubtless result in quicker and sounder decisions.

Power-station work is often jeered at by persons of restricted experience as being "too dull for words," a job comprised of starting up and shutting down sets and boilers to meet the requirements of the load and otherwise simply watching the clock go round—wholly mechanical, methodical, and prosaic, lacking variety, interest, or scope. Under some conditions, portions of this indictment may be substantiated, but few engineers with station experience would admit that it exhibits anything like a true picture as a whole. Practically all posts in a central station—from greaser to manager—call for more or less display of initiative and judgment, unlike factory work in general; there, quickness and manual dexterity count for more than brains, except in the higher positions. Further, the staff of a power house is necessarily on shift work, again excluding the management and higher officials, and its treatment should also be modified in view of that fact. It is fallacious to imagine that because any given person on shift work averages only a number of hours on duty similar to the total of a day-working artisan, he is therefore on an equality with the latter in respect of energy-output value, even if the actual work done in the two cases be identical.

It has been often demonstrated that "seven-days-a-week" labour is inefficient, in the sense that it involves expenditure of energy out of proportion to the increased work performed, and similarly the psychological tendency of night work is to decrease one's personal energy-output value. This is also the case in regard to long spells of duty, and is cumulative; it is usually noticeable even in ordinary day work after about six hours' duty without distinct relaxation of both mental and physical stress. At night this depreciation becomes marked in normal persons after about four hours' application, even when the "previous history" of the observed individuals is known to be good, with respect to reasonable rest and sleep; hence the interests of the undertaking, no less than those of the watch-keepers themselves, require that the duties of night shift should be kept down to the essential minimum. The policy of a few managers to set aside many detail jobs for the night staff is a short-sighted one under the present system, and is as fallacious as the execution of the innocent Admiral "pour encourager les autres."

The psychological and physiological effects due to the periodic change of shift at week-ends are frequently ignored, but their reality is unquestionable. From social and humanitarian points of view such periodic changes are imperative; also the utilitarian advantage of giving experience in all duties to each individual demands it, in order to produce a strong staff and one able to meet possible depletion by illness or disaffection. Nevertheless, physiologically these changes do harm; they disturb the health, and hence

deteriorate the coolness and emergency value of everyone affected by them. The psychological effect is not so simple. Changes are beneficial, in so far as they prevent stagnation (or more properly, "vegetation," to pervert a word), and they promote interest and concentration, and sometimes competition and emulation; in so far, however, as there is usually a favourite and also a very strongly disliked shift, the anticipation of the approach of the latter, and the reflexive, but probably unconscious relaxation of effort when it arrives, is only partly off-set by the good effects of the expectation of the better shift to come.

Power station shift systems vary but slightly in the British Isles, and the variations are usually of local origin. Anyone who has attempted to alter a shift list (or "watch-bill," in sea parlance) so as to obtain improved conditions without bringing in extra assistance, knows that inevitably the existing scheme is found to be the best under the prevailing conditions, except possibly in some very minor detail: this is only to be expected, as the present system is a product of gradual evolution. No further big improvement can be expected without very drastic alterations, but probably the time is now ripe for such.

A semi-ideal system of shifts might be similar to that in vogue at sea—a short watch of, say, four hours, followed by an interval of at least eight hours and preferably longer; but the interim should be entirely free, and not, as is usual, partly occupied by concern for some specialised department. This system, with, say, a 48-hour break every fortnight, would be physiologically as nearly healthy as possible, having regard to the necessity for a periodic change of shift. It would be, however, quite impossible ashore, on account of the time taken in the journey to and from the works, which would, in effect, be just doubled as compared with the existing eight-hour shifts, and, further, it would lead to times of starting and leaving work which would not fit in at all with the general conventional scheme of things.

The system at present in operation suffers from obvious disadvantages. Night shift is longer than is physiologically desirable or even economically defensible, particularly as in most cases the preparation for, and the picking up of, the morning load comes upon the latter end of this shift, just when vitality and energy are at their minimum. Further, as watch-keepers are but human, it must not be supposed that the beginning of this shift coincides with the commencement of the individual's day: it seldom or never does. All the world takes its pleasure and social recreation in the evening hours, and so the increased activities demanded in the latter hours of the night shift find the *personnel* more fit for bed than for a display of the brilliance to be expected of "the embodiment of all that is best in British engineering manhood."

The week-end system is also faulty. It is recognised even by the worst type of official that a regular break, say every three weeks or a month, is essential to every individual, that he may maintain his sanity, fulfil social obligations, and obtain necessary change and rest. In probably 95 per cent. of British power stations there are no reliefs in regular routine—a state of affairs which can only be excused during war time, but which is now only a little worse than prior to it. As a consequence, for a person to obtain this minimum recreative opportunity he must pay for it (in hours worked) during subsequent week ends, while his colleagues enjoy by rotation their respite, also duly paid for. Now, in all engineering works there are repair jobs and alterations which can only be carried out at times of light load: these are done at week-ends, and are accomplished by, or under the direct supervision and responsibility of, an engineer who is working 12-hour or longer shifts after a normally fatiguing week—not a very fair arrangement, either to him or his work. This applies more particularly to the engineers-in-charge of shifts: but in a general way, long hours are also demoralising to all engaged in week-end work, for they give some foundation for the "long-suffering martyr" feeling so easily aroused amongst those working unusual hours.

In cases of illness it is usual under the present system for the two remaining men of the affected grade to work 12-hour shifts. Only a few longer-sighted engineers have arranged their staffs so that reliefs can be found, and still

fewer have carried out the scheme in its entirety, so as to include chargemen as well as stokers. Twelve-hour shifts under modern conditions are demoralising—physiologically, psychologically, and economically; the undertaking which allows them is laying up big possibilities of trouble. Practically all preventible accidents are the result of overstrained physique or mentality, both of which are indubitably brought about by long shifts amongst other causes, hence the danger. It is beginning to be realised, too, that men are not mere machines, and, further, that to obtain the best results, employers must be at least as solicitous for their welfare and decent treatment as they are as to the precise minimum remuneration which can be offered. In another decade it is possible that an employer permitting 12-hour shifts will be liable to salutary penalties.

In view of these matters, it is obvious that at least four men of each grade should be employed, except where it may be possible to provide "double-utility" relief men. The latter, however, although usually only the most intelligent qualify, are often very averse to being employed thus, and, in the lower ratings at least, their colleagues are apt to resent it also. Whether this is but a passing phase remains to be seen.

The question of expense will, of course, be raised in opposition to this suggested increase of staff. Yet, if the extra wage bill were translated into terms of pence per unit generated or percentage decrease in available profits, it would be seen to be almost infinitesimally small as compared with the increased efficiency of the staff employed and their consequently enhanced value.

It is difficult to foresee at all clearly the position of electrical undertakings, after the conclusion of peace, with regard to staff. The relaxation of military authority, and the apparent cessation of the necessity for self-discipline, will greatly affect the labour market. Skilled men will only be available on their own terms, and they will not willingly enter shift work. Although the present staffs of stations throughout the country have shown splendid loyalty both to their employers and their country, by sticking to their posts when khaki was immeasurably more popular, they are now thoroughly unsettled, and a "General Post" is quite certain when the present restrictions as to movements are withdrawn. Their loyalty to their employers deserves emphasis, in the writer's opinion, and was well shown by the apparent collapse of the A.E.S.E. when that body began to meditate militant tactics.

Now, therefore, is the employers' opportunity to formulate and publish schemes whereby the present anomalies of the shift system may be smoothed out—eradicating they can never be. In the long run, the employers will be gainers by taking the initiative in this matter, and they will attract the better type of men, and form stable, loyal staffs.

The future commercial greatness of this country will be greatly aided by adequate, cheap and reliable supplies of electrical power, and the reliability depends very largely upon the staff engaged and their conditions of employment, having in view their peculiarly trying hours and the onerous duties and responsibilities devolving upon them.

TRADE STATISTICS OF SOUTH AFRICA.

THE following statement, showing the imports of electrical and similar goods into the Union of South Africa during the year 1916, has been taken from the recently-issued official trade statistics. The figures for 1915 are added for purposes of comparison, and notes of any increases or decreases are given:—

	1915.	1916.	Inc. or dec.
	£	£	£
<i>Brass manufactures.—</i>			
From Great Britain ...	19,000	24,000	+
" United States ...	—	2,000	+
" Other countries ...	2,000	2,000*	—
Total ...	21,000	26,000	+

*Mainly India.

Copper, plate and sheet.—

From Great Britain ...	4,000	4,000	—
------------------------	-------	-------	---

	1915.	1916.	Inc. or dec.
	£	£	£
<i>Copper manufactures.—</i>			
From Great Britain ...	3,000	3,000	—
" United States ...	—	1,000	+
Total ...	3,000	4,000	+

Electrical cable and wire.—

From Great Britain ...	102,000	228,000	+
" Italy ...	1,000	1,000	—
" United States ...	8,000	5,000	—
" Other countries ...	1,000	3,000*	+
Total ...	112,000	237,000	+

*Holland £3,000.

Electrical fittings, including posts.—

From Great Britain ...	125,000	200,000	+
" Germany ...	3,000	—	—
" Holland ...	11,000	22,000	+
" United States ...	37,000	62,000	+
" Other countries ...	6,000	14,000*	+
Total ...	182,000	298,000	+

*Denmark £4,000.

Lamps and lampware.—

From Great Britain ...	15,000	28,000	+
" Germany ...	1,000	—	—
" United States ...	12,000	19,000	+
" Sweden ...	3,000	17,000	+
" Other countries ...	1,000	2,000	+
Total ...	32,000	66,000	+

Electrical machinery.—

From Great Britain ...	110,000	112,000	+
" Germany ...	4,000	—	—
" United States ...	59,000	63,000	+
" Other countries ...	5,000	5,000*	—
Total ...	178,000	180,000	+

*Mainly Sweden.

Cranes, elevators, and lifts.—

From Great Britain ...	18,000	17,000	—
" United States ...	2,000	2,000	—
Total ...	20,000	19,000	—

Mining machinery.—

From Great Britain ...	368,000	473,000	+
" Germany ...	2,000	—	—
" United States ...	240,000	253,000	+
" Other countries ...	3,000	3,000*	—
Total ...	613,000	729,000	+

*Sweden £2,000.

Machinery not specially mentioned (other than agricultural, manufacturing, &c.).—

From Great Britain ...	201,000	256,000	+
" Germany ...	5,000	2,000	—
" United States ...	43,000	59,000	+
" Canada ...	3,000	6,000	+
" Other countries ...	3,000	5,000	+
Total ...	255,000	328,000	+

Telegraph and telephone material.—

From Great Britain ...	8,000	8,000	—
" Sweden ...	2,000	2,000	—
" United States ...	1,000	—	—
" Other countries ...	—	1,000	+
Total ...	11,000	11,000	—

Tramway rolling-stock.—

From Great Britain ...	21,000	10,000	—
" United States ...	4,000	2,000	—
" Other countries ...	—	1,000	+
Total ...	25,000	13,000	—

Other tramway materials.—

From Great Britain ...	5,000	2,000	—
" United States ...	2,000	2,000	—
" Other countries ...	1,000	1,000	—
Total ...	8,000	5,000	—

In addition to the above the following goods were imported as "Government Stores":—

Brassware.—

From United Kingdom ...	1,500	4,000	+
-------------------------	-------	-------	---

Copper, plate and sheet.—

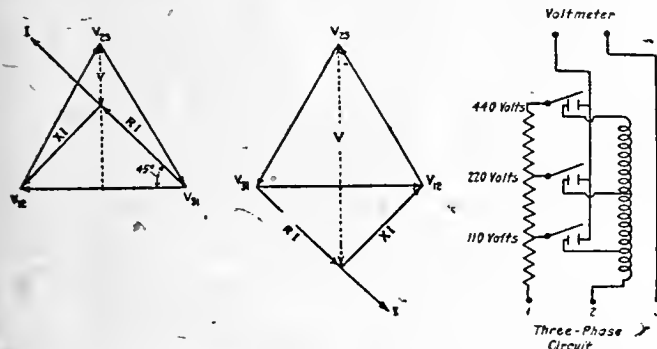
From United Kingdom ...	14,000	6,000	—
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	1915. £	1916. £	Inc. or dec. £
Electrical cable and wire. —			
From United Kingdom ...	18,000	22,000	+ 4,000
„ United States ...	1,000	—	— 1,000
Total ...	19,000	22,000	+ 3,000
Electric fittings. —			
From United Kingdom ...	14,000	13,000	— 1,000
„ Other countries ...	1,000	1,000	—
Total ...	15,000	14,000	— 1,000
Lampware. —			
From United Kingdom ...	1,000	2,000	+ 1,000
Cranes and elevators. —			
From United Kingdom ...	8,000	—	— 8,000
Electrical machinery. —			
From United Kingdom ...	3,000	5,000	+ 2,000
Other machinery. —			
From United Kingdom ...	20,000	7,500	— 12,500
„ Other countries ...	1,000	4,500*	+ 3,500
Total ...	21,000	12,000	— 9,000
*United States mainly.			
Telegraph and telephone material. —			
From United Kingdom ...	30,000	21,000	— 9,000
„ Sweden ...	5,000	5,000	—
„ Other countries ...	1,000	—	— 1,000
Total ...	36,000	26,000	— 10,000

DETERMINING PHASE ROTATION.*

By W. V. LYON.

FOR determining the phase rotation in a three-phase circuit, that is, to ascertain whether or not the line voltage between mains 1 and 2 leads or lags the voltage between mains 2 and 3, the writer has found the scheme shown in the accompanying illustrations useful and convenient. It consists of a non-inductive resistor and a low-resistance reactor of the same ohm value connected in series between two of the mains. The magnitude of the voltage between the third main and the junction of these two units indicates the phase rotation. Mark the mains 1, 2, and 3 as in fig. 3. Connect the free terminal of the resistor to main 1 and the free terminal of the reactor to main 2. Measure the voltage from their junction to main 3.



FIGS. 1 AND 2.—VECTOR RELATIONS OF VOLTAGE FOR LEADING AND LAGGING CONDITIONS.

FIG. 3.—CONNECTIONS OF RESISTOR, REACTOR AND VOLTMETER.

If this voltage is approximately 37 per cent. of the line voltage, the voltage between mains 1 and 2 leads the voltage between mains 2 and 3. If the voltage is approximately 137 per cent. of the line voltage, however, the voltage between mains 1 and 2 lags the voltage between mains 2 and 3.

The proof of this fact is simple. Refer to figs. 1 and 2. Assume that the line voltages are equal. The interior angles of the voltage triangles are then 60°. Any ordinary unbalancing of the line voltages would affect the voltmeter reading but little. The current should be at least ten times as much as the voltmeter takes on full scale deflection. If this be the case the voltmeter will read not more than 2 per cent. less than the stated values. In the proof it is assumed that the voltmeter current is negligibly small.

Let V_{12} lead V_{23} as shown in fig. 1. If the resistor and reactor have the same resistance value in ohms, the current will lag the voltage from 1 to 2 by 45°. The voltmeter reading, v , will be—

$$v = (0.866 - 0.50) \times \text{line voltage} \\ = 0.37 \times \text{line voltage}.$$

* From the *Electrical World*.

If V_{12} lags V_{23} as shown in fig. 2, the voltmeter reading is—

$$v = (0.866 + 0.50) \times \text{line voltage} \\ = 1.37 \times \text{line voltage}.$$

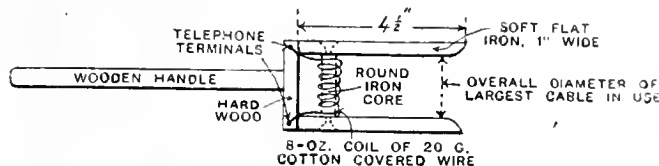
In order that the device may be used on circuits of different voltages switches should be provided as shown in fig. 3. For example, when it is to be used on a 220-volt circuit the switch marked 220 volts should be closed and the other two left open. By properly choosing the ohm values of the units, the current may be kept constant and the same accuracy obtained at the different voltages without excessive heating loss.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Induction Methods of Fault Localisation.

With reference to the letter from "North Staffs." in your last issue, to pick out a faulty cable at draw boxes, the triangle is more conveniently replaced with a fork, in accordance with the accompanying sketch.



A switch in the telephone circuit, by making and breaking the current to the receiver, more readily distinguishes the sound produced by the induction coil from any extraneous noises.

H. E. Blake.

Eastbourne, July 7th, 1917.

A Revelation Concerning the Ways of Reviewers.

In a recent review of a book in an electrical journal that shall be nameless, the reviewer apologises for the tardiness thereof with the plea that "he got interested in it, so that instead of reading merely the introduction and contents pages and basing his review on these, he read it through and forgot he was a mere reviewer."

These remarks, quite obviously made in all seriousness, will be received with mixed feelings by those whose misfortune it is to be authors, by publishers, and by a large body of readers who look for enlightenment and guidance in reviews.

Comment seems hopeless, unless other people will take up the cudgels.

W. Perren Maycock.

West Norwood, S.E. 27, July 14th, 1917.

[We fear our correspondent's sense of humour has been caught napping in this instance. The remarks in question, to our mind, we "quite obviously" facetious, and the reviewer happens to our knowledge to be conscientious to the last degree, one who is more likely to read the chapter headings, index, and advertisements in addition to the text than to follow the practice to which he playfully alludes. Moreover, he has made a special study of the subject of the work in question—that is why he was asked to review it.—EDS. ELEC. REV.]

Water-Power Proposals.

Your remarks on the development of water power in your issue of the 6th inst. are most opportune, and I trust now that the matter has been raised that the existence of available power will be realised by an authority that will be competent to carry out the necessary schemes for its development.

I am a native of North Wales, and am acquainted with many suitable sites which deserve attention. My playmate when a child was a stream that ran through my father's farm, and a noisy Scotch turbine provided daily enjoyment to me as it operated the barn and dairy machinery. The hero of those days to me was the man who had charge of that rough but serviceable plant.

In later years my father moved to a larger farm—a noted dry one. I was at that time but a youngster, but great was my joy when I realised that one of his first objects was to provide an irrigation system for the whole farm, together with two turbines for power purposes. To go with him on levelling and surveying expeditions, and laying out water courses, was the greatest pleasure that could be experienced. Never shall I forget the day when the water was turned on to the turbine for the first time.

Unfortunately, my father did not combine his knowledge of engineering and hydraulics with that of the law, the result being that he was legally involved over the question of riparian rights. He lost his case from the legal point of view, but his engineering abilities came to his aid, and he has been able

to maintain the supply to the present day. The installation to-day, after 27 years' use, stands as an example of practical engineering and a monument to the properties of the laws of this country.

For the last 15 years one of the turbines has been coupled to a generator, this being the first electric lighting plant installed in the district.

Since that time I have been interested in several small hydro-electric plants, having made a hobby of that branch of engineering, and devoting my yearly vacations to exploring possible power schemes for farm and village supply.

I consider Mr. Britton's opportunity a magnificent one, and I sincerely hope he will be able to carry his ideas to a successful issue.

The Dee, to which he intends devoting special attention, is but one instance. The Clwyd and Conway in their upper reaches have scores of localities where plants of from 20 to 200 kw. could be installed. The rivers of Snowdonia, with their high falls, are rich in possibilities. Blaenau Ffestiniog is an instance of wasted power; in fact, the waste is to be seen on every hand throughout the Principality.

A source of power which has appealed to me is that of relief stations on the pipe lines of our town supplies, and the surplus waters at our reservoirs. The Vyrnwy and Rhayadr works are instances. At both these reservoirs a considerable quantity of compensation water is allowed to flow, and very large volumes flow over the sills during the winter months. Instead of allowing this to run to waste, why not allow it to flow along the pipe line to the utmost capacity, and at its highest load factor, and utilise it at suitable points along the route? Why not allow Mr. Britton, for instance, to tap the Vyrnwy line at a point near Chester, utilising surplus water at that point, and at the same time augmenting the supply to his existing station lower down? In the case of the Rhayadr works the same applies, the supply being given to small towns and villages *en route*.

Another instance is the new Birkenhead waterworks. In this case turbines could be fixed at such places as Llanfihangel, Clawdd Newydd, and Ruthin. Again, after crossing the Clwydian Range, if any further supply is available it could be utilised on either side of the Dee, as found necessary.

The question arises as to how these developments are to be carried out. I doubt if a private company can be formed to undertake the work, owing to the hostility of riparian owners and holders of sporting rights. The alternative is for the Government to form a Department of National Power Supply to take charge of all our water power, and to control its development. This could be extended to the smallest plants, even where electricity is not generated. Small installations could be installed on hire-purchase systems, and in the case of larger ones licences could be granted to companies and local authorities to develop them under national control.

In this way encouragement would be given to farmers to extend the use of power on their farms, it would lessen the drudgery of farm work, and generally increase the yield of our land. Our villages would be brightened, not only from the illumination point of view, but from a social standpoint. Industries requiring small power would be established along our countryside, and the cry of "back to the land" would at last become practical.

The North Wales Power Co. has done pioneer work in this direction, but its progress has not been very marked. I am not acquainted with the conditions responsible for its apparent failure to compete with the steam stations at Carnarvon and along the North Wales coast, but it most probably can be accounted for by wayleave and other difficulties, together with, most probably, a certain amount of parochial jealousy.

All these difficulties would be overcome by a national system possessing compulsory powers of expropriation.

Thomas Smith.

Wolverhampton, July 10th, 1917.

The Salaries of Central-Station Officials.

The table of average salaries of central-station officials given in this week's REVIEW is particularly interesting in the poor comparison they make with the salaries of leading officials in other professions. In nearly all municipalities the town clerk receives quite twice the salary of the electrical engineer. In these days this is surely absurd. In the Army the engineers have long been the most highly paid branch, and in the majority of circumstances the R.E. officer takes command. In these days, when cheap and reliable power is the life-blood of a nation, it is surely time that the electrical engineer topped the lawyer in salary. The achievement of this is also, I should like to suggest, an engineering problem (in an introductory note by Dr. Thurston to Rowan's "Practical Physics of the Steam Boiler," the following passage occurs: "The engineer, it will be seen, is also a high order of financier"). I wonder if it is high finance to suggest that, as the chief's salary must always bear a certain ratio to his assistants', his own may be automatically "boosted" by boosting his assistants'?

Assistant.

[We cannot make use of the information forwarded by "Rex" unless he sends us his name and address.—Eds.]

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

- 9,501. "Sparkling plugs for internal-combustion engines, and method of manufacture." R. HOWARTH. July 3rd.
- 9,521. "Means for connecting high-tension leads to sparking plugs." V. PERRETT. July 3rd.
- 9,532. "Electric accumulators." H. HARROP. July 3rd.
- 9,533. "Active material in accumulator plates." H. LEITNER. July 3rd.
- 9,554. "Supports for accumulator plates." H. LEITNER. July 3rd.
- 9,558. "Electrically-operated riveting, pressing, stamping, &c., machines." E. ADAMSON. July 3rd.
- 9,573. "Separators or non-conducting supports for accumulator plates." H. LEITNER. July 3rd.
- 9,579. "Electric lanterns for hand signalling." H. BURGE & S. D. WHITE. July 3rd.
- 9,584. "Electric furnaces and method of working same." CRITTALL MANUFACTURING CO. & H. S. PRIMROSE. July 3rd.
- 9,585. "Interrupters." MARCONI'S WIRELESS TELEGRAPH CO. & W. PLATT. July 3rd.
- 9,587. "Electric condensers." F. R. SIMMS & SIMMS MOTOR UNITS, LTD. July 3rd.
- 9,595. "Electro-magnetic apparatus." M. LATOUR. July 3rd.
- 9,631. "Electrolytic electricity meters." BASTIAN METER CO. & A. E. SALISBURY. July 4th.
- 9,675. "Dynamo-electric machines." H. F. BROWN & VICKERS, LTD. July 4th.
- 9,724. "Voltage regulators." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). July 5th.
- 9,747. "Electric fuses." E. S. CONRAD & L. NEWITT. July 5th.
- 9,781. "Field telegraph signalling, &c., apparatus." F. FITTON. July 6th.
- 9,784. "Telephones." E. A. PETTIBURY. July 6th.
- 9,801. "Electric switches." H. H. BERRY & W. J. MARKHAM. July 6th.
- 9,811, 9,816. "Multipolar magnetos for electric ignition systems." BOSCH MAGNETO CO. & W. J. MELLERSH JACKSON. July 6th.
- 9,855. "Spark discharges producing impulse excitation and high-frequency sparks." A. KOWALSKI. July 7th. (Switzerland, July 25th, 1916.)

PUBLISHED SPECIFICATIONS.

1916.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

- 5,447. PHOTOGRAPHIC METHOD OF PRODUCING SOUND RECORDS AND MEANS FOR UTILISING SAME FOR PRODUCTION OF MAGNETIC RECORDS. H. C. BULLIS. April 13th, 1916. (107,025.)
- 8,056. ELECTRICAL WATER HEATERS. J. F. BARR. June 7th, 1916. (Cognate application, 13,564/16.) (107,038.)
- 8,178. TELEPHONY. Relay Automatic Telephone Co. & H. J. Herink. June 9th, 1916. (107,041.)
- 8,179. TELEPHONE SYSTEMS. Relay Automatic Telephone Co. & H. J. Herink. June 9th, 1916. (107,042.)
- 8,245. ELECTRIC IGNITION OR SPARKING ARRANGEMENTS. Siemens Bros. and Co. & H. W. F. Ireland. June 10th, 1916. (107,045.)
- 8,305. TELEPHONE TRANSMITTER. S. C. PORTER. June 12th, 1915. (100,680.)
- 8,457. MAGNETO ELECTRIC MACHINES. A. E. BENNETT. June 15th, 1916. (107,062.)
- 8,474. STEAM-POWER PLANTS, PARTICULARLY FOR USE IN ELECTRIC GENERATING SYSTEMS. J. C. RUTHS. June 14th, 1915. (100,693.)
- 8,733. ELECTRIC CABLES. C. J. BEAVER & E. A. CLAREMONT. June 21st, 1916. (107,073.)
- 8,810. MINERS' ELECTRIC SAFETY LAMPS. O. Oldham. June 22nd, 1916. (107,074.)
- 8,811. ELECTRIC BATTERY LAMPS. N. Kribs. June 22nd, 1916. (107,075.)
- 9,766. REGULATORS FOR POLYPHASE TRANSMISSION SYSTEMS. British Thomson-Houston Co. (General Electric Co., U.S.A.). July 11th, 1916. (Cognate application, 9,812/16.) (107,093.)
- 10,182. MEANS FOR DIFFERENTIALLY METERING ELECTRICITY FOR LIGHTING AND HEATING PURPOSES. L. Birks & J. R. Templin. March 2nd, 1916. (104,498.)
- 11,043. ELECTRIC MOTOR CONTROL. British Thomson-Houston Co. (General Electric Co., U.S.A.). August 4th, 1916. (107,106.)
- 12,685. ELECTRIC INSULATING MATERIAL RESEMBLING VULCANITE. T. S. Chivers and C. Marter. September 7th, 1916. (107,122.)
- 16,514. TIMING IN IGNITION DYNAMOS. C. T. Mason. June 19th, 1915. (102,267.)
- 18,194. IGNITION MAGNETOS FOR INTERNAL-COMBUSTION ENGINES. Abingdon-Ecco, Ltd., & G. B. Bianco. December 19th, 1916. (106,954.)
- 18,374. ELECTRO-PNEUMATIC BRAKES FOR RAILWAY VEHICLES. E. H. Dewson. June 1st, 1916. (106,813.)

1917.

- 1,279. AUTOMATIC SWITCHING DEVICES FOR THERMIC TELEPHONES. B. E. D. Kilburn (Naamloze Vennootschap de Nederlandsche Thermo-Telefoon Maatschappij). January 25th, 1917. (106,962.)
- 2,191. AUTOMATIC ELECTRIC CIRCUIT BREAKERS. Switchgear & Cowans and E. D. Rowley. February 14th, 1917. (106,971.)
- 2,912. MERCURY RECTIFIER DISTRIBUTING SYSTEMS. British Westinghouse Electric & Manufacturing Co. (Westinghouse Electric Manufacturing Co., U.S.A.). February 27th, 1917. (106,973.)
- 5,401. TRANSFORMERS FOR ALTERNATING ELECTRIC CURRENTS. O. Loras. June 9th, 1916. (106,986.)

Accident.—On Friday at the Yorkshire Electric Power Co.'s works at Thornhill, two workmen aged 61 and 59 respectively, in the employ of Messrs. Firth & Co., of Burton-on-Trent, who are engaged upon the contractor's work in connection with the extension scheme at the power station, came into contact with a live wire and received a shock while working at a crane. Both were in a critical condition, suffering from burns on the feet and hands.

THE ELECTRICAL REVIEW.

VOL. LXXXI.

JULY 27, 1917.

No. 2,070

ELECTRICAL REVIEW.

INDUSTRIAL MISTRUST.

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It is common with all peoples at all times, we are prone to assume that our own problems of the moment are original in their character, and more far-reaching in their significance than those of any other times or other peoples. We hear much of industrial unrest and of class antagonisms, and the gravity of such unrest at the present time, as well as the importance of its removal, deserves the closest attention of all who are desirous for the welfare of the State. The Parliamentary Secretary of the Board of Trade, Mr. G. H. Roberts, M.P., has expressed the view that: "If the old disputations remain, if employers and employed are ranged in conflicting camps, the ravages of war will not be repaired, reconstruction will be impossible, and, as sure as morn follows night, so will the decline and fall of the British Empire set in."

Now, the disputations of Capital and Labour have always existed, and, unhappily, the idea of antagonism of interests, though early combated, has not been eradicated. Harrington says in his "Oceana," which was first printed in 1656: "It will be convenient in this place to speak a word to such as go about to insinuate to the nobility or gentry a fear of the people, or to the people a fear of the nobility or gentry, as if their interests were destructive to each other." He indicates that they are mutually dependent. The intervening centuries have not succeeded in eradicating the idea that employer and employed must needs be in opposition, that their interests are, in fact, "destructive to each other."

It is the more interesting, then, to hear Mr. Roberts on this point:—"I have no illusions. The interests of employer and employed will never be identical any more than the principle of nationality or the interests of buyer and seller will be identical, but up to a certain point there is a community of interest."

Setting aside any philosophical or argumentative discussion as to the point where the community of interest begins or ends, there are few who will be ready to question that, for practical purposes, Mr. Roberts's statement is sufficiently accurate. And the problem of the moment is how to obtain a fair settlement where interests differ, and a recognition of points where interests are identical.

The differences of opinion are generally to be found in regard to the division of the cake to the exclusion of a recognition of the mutual advantage of producing as large a cake as possible. The disputations have centred about the former with, too often, an acrimonious attribute which has prevented a recognition of the utility of the latter.

How, then, can a new frame of mind be brought about whereby either side may approach the problems with knowledge of and sympathy with the other's case? Clearly, as we have said many times, the most effective means is to "get together." And it has happily occurred to some practical minds to form an "Industrial League for the Improvement of Relations between Employers and Employed." It was at a meeting of this League that Mr. Roberts made the remarks we have quoted. He also said:—"The working classes are very nervous and suspicious. When you tell them of a movement such as ours they say it is only another capitalistic dodge, another device

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

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The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 8d.; Canada, £1 8s. 10d. (\$5.80). To all other countries, £1 10s.

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AUCKLAND N.Z.: Gordon & Gotch, Albert Street; The Mining and Engineering Review, 31A, Strand Arcade, Queen Street.

BRISBANE: Gordon & Gotch, Queen St.

CHRISTCHURCH, N.Z.: Gordon & Gotch, Manchester Street.

DUNEDIN, N.Z.: Gordon & Gotch, Princes Street.

JOHANNESBURG, CAPE TOWN, BLOEMFONTEIN, DURBAN, PORT ELIZABETH, &c.: Central News Agency, Ltd.

LANCASHIRE: Gordon & Gotch, Cimitiere Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

MELBOURNE: The Mining & Engineering Review, 90, William Street; Gordon & Gotch, Queen Street.

MILAN: Fratelli Treves.

NEW YORK: D. Van Nostrand, 25, Park Place.

PARIS: Boyveau & Chevillet, 22, Rue de la Banque.

PERTH, W.A.: Gordon & Gotch, William Street.

ROME: Loescher & Co., Corso Umberto I° 307.

SYDNEY: The Mining & Engineering Review, 273, George Street; Gordon & Gotch, Pitt Street.

TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon & Gotch, 132, Bay Street.

WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

THE "ELECTRICAL REVIEW'S"

ELECTRICAL & ALLIED TRADES DIRECTORY (THE RED BOOK),

1917 EDITION

NOW READY.

H. ALABASTER, GATEHOUSE & KEMPE,
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for keeping them quiet so that the employing and possessing classes may pursue their policy of exploitation. We have to allay that suspicion. Employers have to show that they recognise the rights of the workers and that the old mean rates of wages have to pass away."

Here, it seems to us, is the crux of the problem. Industrial unrest at the present time need be no matter for surprise. It may be sufficiently explained by the tension common to us all. But industrial mistrust, though perhaps intensified by the existing rarefied atmosphere, is not a new feature. If the Industrial League and the many authorities who are earnestly working to secure harmonious co-operation can do anything to remove that mistrust, they will deserve to rank amongst the benefactors of the nation.

Why London? SINCE 1914, when the outbreak of war caused what has turned out to be a prolonged diversion of the normal current of affairs, it has become a habit amongst certain societies to hold their annual meetings in London.

Why this should be so we do not know; London is not centrally situated for the majority of provincial members, its hotels and assembly rooms have been largely commandeered, and, in any case, to those who are interested in such, it can show no industrial developments such as may be found in the provinces. There is a want of cohesion amongst the visitors to a London conference, which is apt to breed disunity and lack of interest; in the result the only opportunity for mutual intercourse on the part of provincial visitors is frequently lost. This has been the case for three successive years with the Municipal Electrical Association, and we venture to suggest to the new President, Mr. S. J. Watson, that a change to some progressive electrical centre, such as Manchester or Sheffield, would be welcomed by many of the members, who would have an opportunity of seeing for themselves what they can only vaguely talk about in London.

Propaganda in Spain. A prominent feature of the state of affairs that has prevailed in Spain during the war has been the widespread and very characteristic work of German propagandists. It is well known that Germany has nursed Spain electrically, and by means of a very extensive organisation, very effectively for years past. Nobody knows what may be the outcome of the war in that very much disturbed country. But, whatever may be the course of events, the influence of the German agent, revealed or unrevealed, will have to be seriously reckoned with if we intend to secure a more reasonable share of electrical and engineering trade there. It is of the greatest importance that attention should be paid to this question of propaganda, whether carried on from Great Britain direct or conducted indirectly through individual joint representatives in Spain. All literature and correspondence must be prepared in Spanish, which is also the language of Mexico, and of all the States in South America, except Brazil. The study of Spanish under the circumstances should be widely cultivated, as it is indispensably necessary in order to promote our export trade with Spain and South America. Our French friends are advocating the undertaking of educational work of this nature in the commercial and high schools for the purpose of developing business with Spain, and we should not be backward in learning what is really a simple and beautiful language, which can be easily acquired, particularly by those who are acquainted with French.

So great and so manifest are the **Off-peak Loads.** advantages of off-peak loads to electricity supply undertakings, that it is a matter for surprise that they have not been more assiduously sought and cultivated in the past, at any rate in this country. However, we are going to turn over a new leaf in the future—the near future, we should like to say—namely, when peace returns, and we all take a long breath and look round to see what the next job is to be. Not only shall we push on with the reform of our system of generating and distributing electrical energy, of which it stands, sadly in need; we must equally accelerate the growth of the demand in directions tending to improve the load factor, not by the slow methods of evolution, but by leaps and bounds.

To this end, the experience gained in the war will prove of immense assistance; the infinite flexibility and universal applicability of electrical energy have been abundantly demonstrated, new and unexpected uses have been found for it, new industries have been created which require its services, and new conditions have arisen which will profoundly modify the progress of electricity supply. Not least amongst these factors must be numbered the developments which have taken place with regard to electrochemistry and electrometallurgy. We have already drawn attention to the rapid advance of the electric steel furnace, which has now firmly established itself in favour by merit; the electric furnace has innumerable other applications, and lends itself to designs of the most diverse characters, such as the nitrogen furnace of Mr. E. Kilburn Scott, which is dealt with elsewhere in this issue. Some of these uses, and notably the last-mentioned, are particularly welcome to station managers, as they can be arranged to fall entirely within the off-peak period, and thus enable the supplier to improve his load factor. Another opening of this kind is indicated by an engineering contributor in this issue—the driving of refrigerating plant, which is still more grateful to the heart of the supplier in that it attains its maximum demand in summer time. The supply of power to farms also possesses this merit, though in less degree. Charging the batteries of electric vehicles is going to be a very valuable aid in off-peak hours, when the manufacture of such vehicles is freed from the restrictions at present necessarily imposed upon it. The manufacture of bleaching fluid by electrolysis, which is discussed on another page, may not attain to similar dimensions, but can certainly be cultivated as an off-peak load.

Many other items could be added to the list. Our purpose, however, is not to schedule every possible example, but to draw attention "right now" to the importance of due preparation, in three particulars: (1) The education of the public to the infinite possibilities of electricity as an aid in their businesses; (2) the instruction of the staffs of electricity supply undertakings as to the requirements of their business and the opportunities which lie before them; and (3) the provision of suitable tariffs for guaranteed off-peak loads, easy to understand, and attractive by virtue of their cheapness.

It is not enough to announce that electrical energy is on sale for all purposes; steps should be taken to tell the people for what purposes it can be used, how to set about using it, what it will cost, &c. We have recently given a number of examples which show that the use of electricity does not merely lead to economy in itself (it may even happen that the energy costs more in the electrical form)—it often effects economies of labour and improvements in quality and quantity of output that are totally unexpected, and are found to be surprisingly great. Nearly all the trumps are in the hand of the electricity supplier—let him play his cards well, and he must win!

ELECTROLYSERS AND THEIR MANAGEMENT.

By ERNEST REUSS.

THE increase of recent years in the use of electrolyzers is undoubtedly due to growing confidence on the part of users, and a greater willingness on the part of men entrusted with their management to take an interest in, and learn something of, a new process.

The successful manipulation of electrolyzers demands at the outset the same amount of observation and study as is called for in any other manufacturing process; a few hints as to the nature of the problems to be encountered may therefore be useful.

Temperature plays a leading part. The passage of a current of electricity through water engenders heat, the addition of salt increases the conductivity of the water, more current passes, the raising of the brine temperature still further increases its conductivity, consequently the tendency to heat is further increased; these are problems to be contended with in the working of electrolyzers, which are liable to be aggravated by a changeable climate.

The best temperature for electrolysis has been found to be 25° to 28° C. If this be exceeded, a falling-off in chlorine production is noted; and if the temperature be allowed to exceed 35° C., there is an actual loss in the chlorine made, which is either driven off or converted into chlorate, useless for bleaching or sterilising.

Again, if the temperature of the electrolyte be too low, as in frosty weather—say, 0° C., or even 5° C.—electrolysis hardly takes place, electrolytic decomposition is retarded. When the temperature of the brine is raised—say by a steam coil—rapid electrolysis commences, as evinced by the smell of chlorine given off. Users of electrolyzers should, in cold weather, bring up the temperature of the brine to, say, 25° C. before commencing electrolysis; it saves current and time.

In hot weather the control of temperature requires some attention; but before discussing this subject, it should be stated that there are two distinct types of electrolyzers in use—the “constant flow” and the “circulating” types. In the former, the liquor runs once through and is ready for use; but it is weak in chlorine, and mainly suited to laundry and sanitary work. This form of electrolyzer is, however, fairly cheap to construct, and there are a number in use bleaching textiles and paper.

The only means of increasing the chlorine strength in the “constant flow” system is:—

1. To employ stronger brine (causing more amperes to flow).

2. To increase the area of the electrodes, or to combine both methods (this is already done in the largest patterns of this type).

3. Reduce the speed of brine flow, allowing more time for the current to do its work.

The hindrance to the development of this type of electrolyzer is, that the limit of temperature has already been reached.

Refrigerating within the electrolyzer was long ago attempted and abandoned on account of its complications and the formation of scale, mentioned later, with the attendant difficulty of its removal.

The “circulating” type was the outcome of the attempts made to solve the problems involved when it was attempted to increase the chlorine strength in the earlier types.

To counteract the rising temperature, refrigeration was resorted to. In the Schuckert type, a coil immersed in running water is placed below the electrolyzer, and the brine in process of electrolysis is circulated by a pump through the coils. In the Oertel type the process is reversed; the electrolyzer is placed in a generating tank, in which there are two or more refrigerating coils, through which the water flows by natural fall.

The circulation of the brine through the electrolyzer is automatic, being effected by the effervescence caused by the liberation of the hydrogen gas in the electrolyzer, which raises the level of the liquor in the cell some $\frac{3}{4}$ in., when it overflows naturally and briskly.

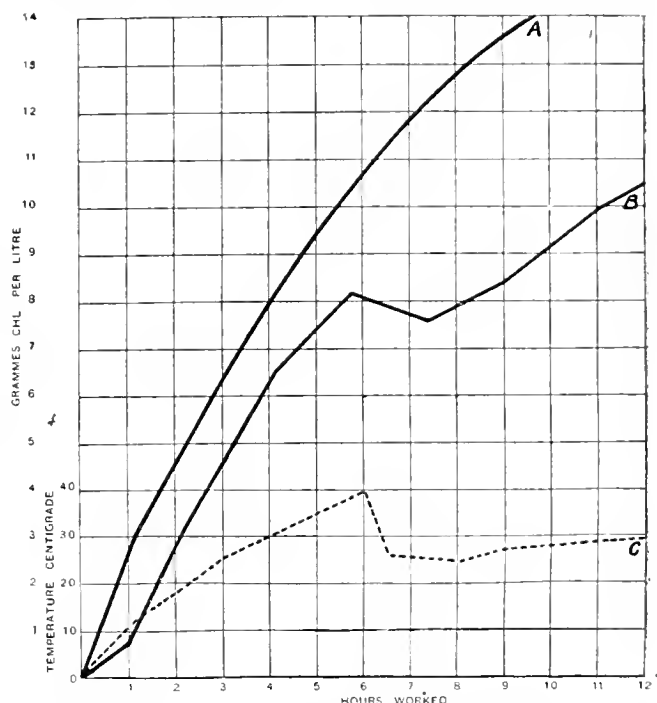
This system avoids the cost of driving the pump, together with its frequent repair, and the gradual loss of efficiency due to the furring-up of the coils with a deposit of scale, which cannot be got off, otherwise the output of both systems is about the same, for salt and current employed.

Control of temperature is effected in the “constant flow” type by accurately mixing the brine to a given standard, the only effective test being the hydrometer. Mixing by weight is fallacious, as salt in damp weather rapidly gains weight (and here again a note of warning is called for; the best salt for the purpose is the rough crystal variety, as used for fish curing; if rock salt is employed, containing 15 per cent. or more of clay, the density of the brine will be somewhat affected).

The rate of flow through the electrolyzer is regulated by a tank provided with float feed giving constant pressure, also by a check valve allowing of the passage of a measured quantity of brine per hour.

Should the temperature rise in summer beyond these controls, there are two methods of checking it, either by reducing the density of the brine (causing less to flow) or by increasing the rate of flow of the brine, the former being the most rational and cheaper method.

In the “circulating” type, the temperature is ordinarily controlled by the cooling coils. This suffices in England;



VARIATION OF CHLORINE PRODUCTION WITH TEMPERATURE.

in hotter countries, the number or area of the coils may be increased, the strength of the brine may be reduced, or the water itself may be artificially refrigerated (by no means so expensive a process as has sometimes been asserted).

In connection with the water supply, means should be employed to keep the pressure constant; a diminished pressure means reduced flow and a rise in temperature. The use of a reliable and sensitive thermostat is strongly recommended, capable of checking a rise of 2° F. in temperature. The adoption of these thermostats in electrolyzers has been one of the most notable improvements effected since electrolyzers were introduced, comparable only to the use of a good governor on an electric light engine, as varying temperatures were accountable for most of the troubles in connection with the running of electrolyzers; but, as with automatic cut-outs, it pays to secure the best type procurable.

The accompanying chart illustrates the effects of irregular temperature on chlorine production; A is the ideal chlorine curve, corresponding to steady electrical current and perfect water control; B is the actual curve, showing the faults due to irregular temperature; C is the temperature line.

At first, chlorine production is very slow, due to low temperature. As soon, however, as 20° C. is reached the curve rises rapidly, but it is then arrested by excessive temperature, when some of the chlorine made is doubtless lost;

at this point water was turned on, and as soon as the brine had cooled down again normal chlorine production was resumed, but the total production in 12 hours only reached 10.5 grammes per litre, in place of 12 per 10 hours, which it should have been, or 14 grammes under ideal circumstances (14 grammes per litre corresponds to the performance of a steam boiler using best coal, carefully stoked, with flues recently cleaned; the writer recently, working under very favourable conditions, produced 13 grammes in eight hours).

Another point not generally known adversely affecting chlorine production is bright sunshine in hot weather. The electrolyser whilst at work in the summer should have the bright light screened from it (in hot climates totally excluded), and the liquor as soon as made run into the storage tank, which is closed to light and the atmosphere. As warm liquor keeps badly, it might be advisable after completion of electrolysis to continue the circulation of cold water until the liquor is chilled to 20° C., or, even better, to 15° C.

Another method of improving the stability of the made bleach is to render the liquor distinctly alkaline by the addition of caustic soda in the storage tank; but this requires an appreciable quantity of caustic, and is otherwise not advisable, as it makes bleaching very slow, and introduces the old irregular bleaching action that electrolytic chlorine is intended to obviate. If loss is to be avoided the bleach should be employed as soon after making as possible, the ideal method being to prepare it overnight, and use fresh in its highest state of perfection next morning; this is practicable where an efficient thermostat and a sensitive cut-out, both of the best makes, are in use, as if current and temperature are constant electrolysis will be perfect.

Cleansing.—No water is pure—it holds carbonates and sulphates of lime and magnesium in solution. Salt, particularly rock salt, contains both these minerals, which are deposited on the *positive* side of the electrodes in the form of scale, which, if not promptly removed, causes serious trouble and loss of efficiency, which is easily increased if the brine is turbid through being mixed or stirred just before use; if the brine holds clay in suspension, cleansing may be very difficult, as it sticks like paint. The removal of scale is, fortunately, very simple; reversal of the current loosens the scale, as hydrogen gas is generated between the face of the electrode and the scale, loosening it; it is then easily washed off by a powerful snicing with a hosepipe. Usually this washing is done in a perfunctory manner, and sufficient care is not taken to see that the circulating passages are kept open. Sometimes the scale is very hard, and falls off in flakes, which require breaking up with a steel rod; at other times it comes away in grains resembling old mortar. If the passages are blocked, experienced observation of the diminished flow will show where to locate the trouble. Scale, and particularly a coating of clay, impedes the passage of the current by insulation, and naturally greatly diminishes the chlorine output.

New electrolyzers do not show their maximum output for the first day or two; it takes time for the electrodes to become saturated with brine and for certain impurities to be eliminated. On the third day of running, it is very advisable to take hourly records from starting up, for future reference, of volts, amperes, temperature, and chlorine yield. Thereafter, one or more observations a day, compared with the standard chart, will indicate any falling-off, when the cause should be sought; a drop of a few volts will affect the amperes considerably. This will affect the chlorine yield and also the temperature; if the brine is too weak, the amperes will be down.

A brisk circulation during the first few hours shows everything is right; a sluggish circulation denotes something wrong—electrodes dirty, passages choked, &c. The electrolyser, practically, *cannot* go wrong beyond righting, unless the electrodes are worn out, and they should last 18 months' day work, always provided that they have not been overheated, which makes them spongy, when they waste.

The electrolyser should be washed and wiped down daily to remove the salt crusts carried by the spray all round,

which would in time cause leakage of current, and this applies to the exterior foundations, which are all the better for a few coats of bitumastic varnish, to prevent absorption of brine, an excellent medium for carrying current to earth.

Electrolysers are employed to-day for bleaching every class of textile fibre, and the bleached article, whether sewing thread or cloth, shows from 8 to 10 per cent. better breaking strain, due to the bleaching liquor distributing itself more regularly among the material; being quicker in its action, it should be used weaker. Its level work is quickly appreciated by dyers. Excellent results are also obtained in laundries. Hospitals and asylums are well satisfied with the electrolyser as a steriliser. Manufacturers troubled with foul reservoirs or mildew among goods in course of manufacture, and with evil-smelling water, have found relief by the adoption of the smallest electrolyser made.

Quite recently a firm of flannel manufacturers, whose reservoirs were so choked with weed that it was impossible to draw a rake through, cleared them completely in 10 days at a cost of 1s. 6d. per day, and this without any nuisance or interruption to their working; nor were the fish killed. As a proof of their satisfaction, they have expressed their willingness to answer any inquiries addressed to them. The same size of electrolyser employed for sterilising drinking water would be capable of dealing with 200,000 gallons a day, which is represented by a volume of water measuring 80 ft. x 50 ft. x 8 ft. deep.

A GOOD SUMMER LOAD.

By "RESEARCH."

SUPPLY authorities all want a consumer who will take a good deal of power in summer and very little in winter. It is doubtful if many of them realise the benefits to be derived from pushing the use of refrigerating plant. Most of this plant is at present steam-driven, and it is up to the electrical industry to see that the steam engines are replaced by electric motors. Also this type of plant is not nearly so extensively used as it might be, and the advantages of such plant could be laid before the right people by motor manufacturers and supply authorities. Who are the right people?

Butchers.	Dairies.	Butter factories.
Fishmongers.	Hospitals.	Dry cold air for blast
Abattoirs.	Large private houses,	furnaces,
Hotels.	Provision m ^r chants,	Fur stores,
Restaurants.	Markets,	Docks.
	Ice stores,	

What revenue are the supply authorities likely to get? Let us take the case of a butcher's shop of medium size. A 5-H.P. motor is installed, and the yearly revenue is £25. Of this sum £16 is received for the two summer quarters. The price charged per unit is 2d. The capacity of the plant is 2,000 cb. ft. of insulated space kept at a temperature of 30° F. The motor is run about six hours per day, and meat and game are kept in the ice room until required. The approximate yearly cost, apart from electricity, is about £12 for oil, ammonia, and upkeep of plant.

The working of the plant is as follows;—The motor drives a compressor which compresses ammonia gas. The ammonia is passed through an oil separator to a condenser. In this condenser the ammonia gas is condensed into a liquid, which flows into a storage tank. From this tank it passes through an expansion valve into coils of pipes situated where the low temperature is required. In these pipes the ammonia again becomes a gas, and passes back to the compressor to pass through the above cycle of operations.

It will be seen that the process is very simple, and the plant requires very little skilled attention. The capital cost is the only objection a consumer might have, and the running costs are practically only for the electricity consumed. As a nation, we have to be very careful just now that all food is utilised, and if there were refrigerators at all our docks and markets, we would not hear so much of food being sold to soapmakers or thrown away as useless.

ELECTRIC COOKING IN THE FACTORY.

DURING the last few years a great amount of thought and attention has been given to the beneficial effects arising from improved hygienic conditions in the factory. The subject is a difficult one, because the would-be reformer and the workman often hold radically different opinions as to what constitute im-



ELECTRIC KITCHEN, MESSRS. HAWORTH'S MILLS.

provements, especially if traditional methods are at all disturbed.

One direction, however, in which considerable improvement has taken place is in the provision of well-cooked food at low cost for those employees who prefer to obtain their meals in this way, and many elaborate works' kitchens and dining-rooms have come into being as a result of the realisation that improved health means a higher standard of efficiency.

An example of welfare work of this class is found in the four modern electric kitchens which have been installed by Messrs. Richard Haworth & Co., Ltd., at their mills in Ordsall Lane, Salford.

Messrs. Haworth are one of the largest, and oldest, cotton manufacturing firms in the Kingdom, and their several adjacent factories employ a large number of operatives, many of whom reside in the vicinity and obtain their meals at home or bring food with them. The supply of food, cooked in the mill, has therefore been somewhat of an experiment, though we gather that its advantages are becoming gradually recognised by the operatives, of whom about 500 are now being catered for.

Through the courtesy of Messrs. Haworth, and of Carron Company, who supplied all the equipment, we were recently able to inspect the cooking arrangements above referred to.

The kitchens are very similarly equipped, each having a large three-oven range with ample boiling and grilling accommodation, a heavy boiling

table, and hot closets for keeping food warm. The apparatus is "Carron standard," with white enamelled back plates, stove enamelled black parts, and plated and polished mouldings, &c., presenting a smart appearance, in keeping with the bright and well ventilated kitchens in which it is installed.

Each range comprises three ovens, each measuring 22 in. x 20 in. x 22 in. inside, built up on the unit principle, with top and bottom heating elements, each arranged for three heat control and loaded to a maximum of 5.5 kw.

The heaters, divided into four groups, top and bottom, are carried in shallow trays, which can be slid out for examination at a moment's notice, having pin and socket connections at the back. The heaters are built up of standard Carron porcelain bars carrying exposed heating spirals.

The ovens have porcelain enamelled interiors, doors fitted with toughened glass inspection windows and thermometers, and the interior fittings being all detachable, the ovens can be washed out when necessary.

The hot-plate over the ovens has two boiling sections—each having three intensely heated portions, arranged for suitable heat regulation—also a third simmering section, with a griller and toaster underneath, wired for 5 kw., with two separately controlled elements.

Hinged doors under the boiling sections enclose hot closets heated by the latter, and the controlling switchboards, on which are mounted three-heat rotary indicating switches, fuses, and pilot lights, are supported over the hot plate by brackets attached to the splash plate behind. Each range is loaded to approximately 32 kw.

The hot closet accommodation varies, two of the kitchens each having two 11-ft. closets, in another case an 11-ft. and a 6-ft. closet are installed, while one 11-ft. closet only is fitted in one instance.

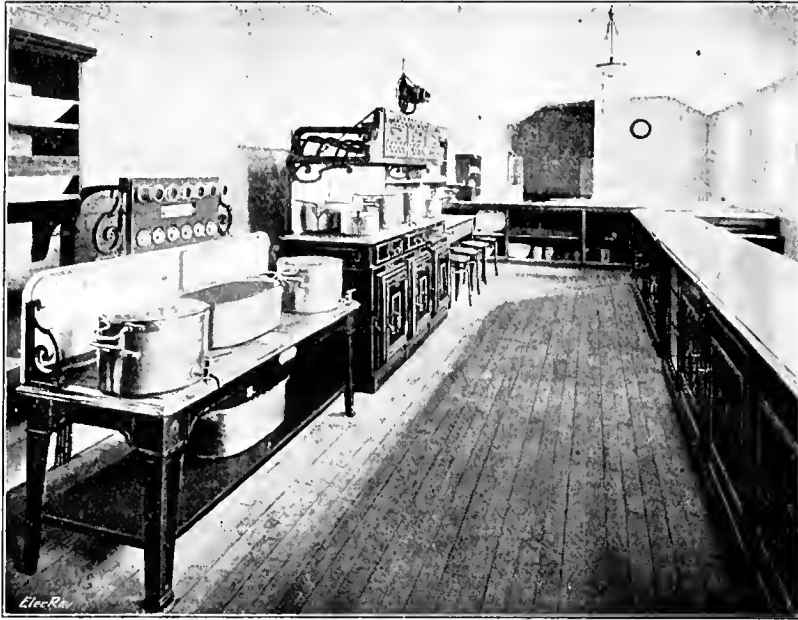
These closets also serve the purpose of counters over which food is handed to the operatives; the closets are constructed of fine cast-iron panelling with mild-steel sliding doors, are lined with white



STANDARD CARRON RANGE AND BOILING TABLE.

porcelain enamelled sheets, and fitted with white enamelled perforated shelves. The heaters consist of groups of Carron porcelain bars carrying wire spirals, and are all interchangeable, fitted in the back of the compartment, and can be pulled out instantly, as they have pin and socket connections.

The total loading of these hot closets is 21 kw., each section being separately controlled and the connecting leads carried to terminal boxes at opposite ends, where three-heat rotary indicating switches and fuses are mounted.



ELECTRIC KITCHEN AND DINING ROOM, MESSRS. HAWORTH'S MILLS.

Three of the kitchens have 6-ft. boiling tables, while the fourth is equipped with a table half this size; both sizes are built up on the unit principle, having certain intensely heated, separately controlled areas in the boiling top; each table is mounted on heavy cast-iron feet, has a pot rack underneath, and a white porcelain enamelled splash plate and switchboard over this carrying three-heat rotary indicating switches, fuses, and pilot lights.

The large tables are each loaded to 6 kw. maximum, and the small table has half this loading. A distinctive feature of the boiling tops or hobs on Carron ranges and boiling tables—to which attention was drawn in our issue of April 6th last—is the system of intensely heated surfaces employed in place of the hot plate commonly found in such circumstances. The surfaces are heated by groups of mica insulated elements each with 300 kw. loading, which are clamped between asbestos pads and a planed surface under the top plate. These elements are connected where possible to small ribbon bus-bars at the ends, and are each clamped independently, so that the removal or replacement of one of them is a small matter, merely involving the raising of the top plate and loosening a few nuts; usually the interior connections of heating elements are of beaded nickel wire.

It will be gathered that this arrangement safeguards the working of the installation, though we understand that experience has shown, as one would expect, that it is inherently more reliable than the usual hot-plate system, and practically no trouble has been experienced with it.

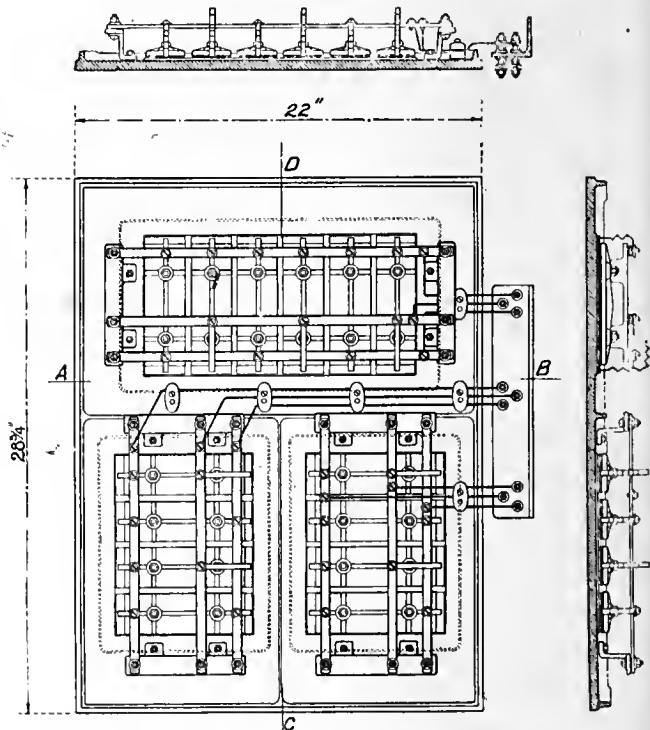
At Messrs. Haworth's establishment, the workers are required to purchase checks the day before (which enables the food requirements to be estimated), which are exchanged over the counter for food, men being charged 6d., and women 4d., for a cut off the joint and two vegetables; in addition puddings, pastries, and sweets are provided at extra charges. Breakfasts are supplied, and food brought from home is also warmed up; a considerable amount of pastry is also supplied for consumption at home, and the charges are based on the bare cost, it being considered that the firm benefits indirectly from the improved health of the worker. No tea is provided in these kitchens, as the predilec-

tion of the cotton operative for that beverage at all hours of the day has long necessitated the provision of a regular supply of boiling water for that purpose in various parts of the mill.

The apparatus is run at 220 volts, being roughly balanced on the 440-volt circuits of the Salford Corporation, and, as the supply is obtained on bulk terms, the cost per unit amounts to between .5d. and .6d.

The kitchens are in charge of an experienced cook, with a staff which, apparently, appreciates the facility of electrical methods; the equipment has been in use for varying periods, and is not working at its full capacity, one kitchen having only recently been completed. Under present conditions, however, we understand that the cost of energy works out at less than one halfpenny per person per meal, including the cost of energy for kitchen ventilation.

In conclusion, we are indebted to Messrs. Haworth and to their chief electrical engineer, Mr. Forbes, for supplying many interesting details regarding the operation of this equipment; we also have to acknowledge the assiduous attention of Mr. C. McKinlay, of Carron Company, under whose aegis the visit was under-



ARRANGEMENT OF HEATING ELEMENTS, STANDARD CARRON RANGE BOILING UNIT.

taken, and our indebtedness to Mr. A. R. Wood, manager of the Carron electric cooking and heating department, for arranging the visit.

Electricity used for Driving Cattle.—It is reported that an electrically charged rod for driving cattle is being introduced upon some of the ranches of Western Texas. It is said to be specially suited for making rebellious cattle enter dipping vats, branding pens and other enclosures into which it is ordinarily a difficult matter to drive them. The rod is constructed with four dry cells and a coil and is equipped with a button by which the current may be turned on when it is desired to apply it to an animal.

—*Electrical Review and Western Electrician.*

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

B.T.H. Ironclad Switchgear.

The BRITISH THOMSON-HOUSTON CO., LTD., of Rugby, has brought out improved patterns of ironclad oil-break switchgear for mining and industrial service. It is designed on the draw-out principle, with interlocking devices to prevent accidental contact with live metal; all parts are readily accessible when made dead by withdrawing the carriage. The switches are of the free-handle type, and have an accelerated gravity break, and double-break on each pole. They are made in two sizes, rated at 120 and 500 amperes up to 650 volts, and 50 and 120 amperes up to 3,300 volts. The larger size is illustrated in figs. 1 and 2 herewith. The switches

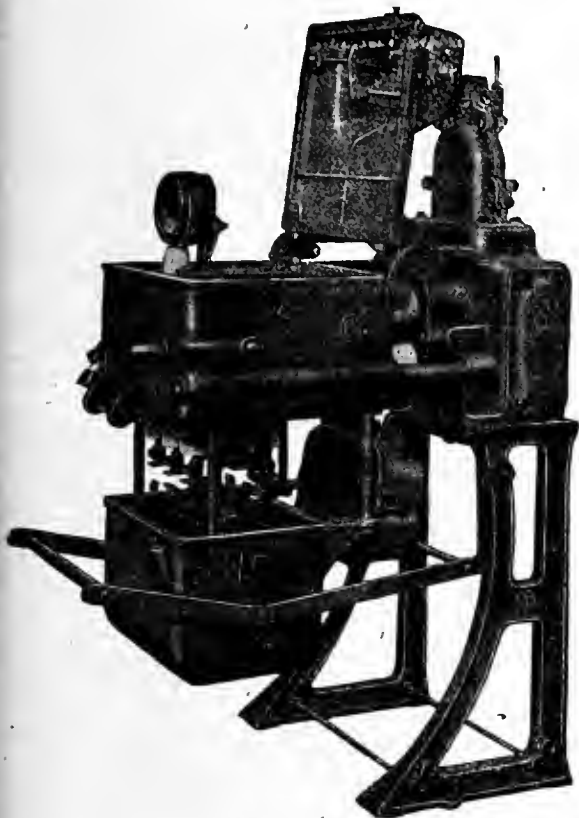


FIG. 1.—B.T.H. IRONCLAD SWITCH, WITH CARRIAGE WITHDRAWN, COVER OPEN, AND TANK LOWERED.

can be mounted side by side and coupled up to common bus-bars carried in connection chambers; automatic features and a time-element device can be supplied if desired.

For starting induction motors an automatic device is provided which temporarily raises the current setting, thus enabling the momentary starting current to flow without tripping the switch. Leakage protective relays, and electrical interlocks with controllers, may be employed, and provision is made for mounting ammeters and voltmeters on the switch body. We note that the dimension diagrams are figured in both inches and millimetres; metric weights and measures are also given in the shipping specification, in addition to the English units.

A Convenient Electroscopie Exciter.

The illustration, fig. 3, shows a very simple device for exciting electroscopes, and for similar purposes when a small charge of known sign is required, which has been found to be of con-

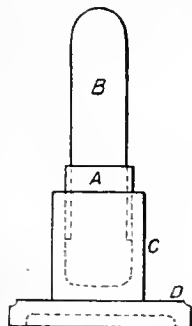


FIG. 3.—ELECTROSCOPE EXCITER.

siderable use in experimental work. The appliance consists of a smooth metal tube, A, one end of which should be closed and rounded, fixed to a varnished glass handle, B, by means of shellac.

The sharp edge of the tube should be well covered with the insulating adhesive. This fits rather loosely into a somewhat larger tube, C, also of metal, but lined thickly with fur. This may be screwed to a wooden base, D, preferably hollowed at the back and weighted with lead. The tube, A, becomes negatively charged by merely raising from the table, only one hand being required, since the base is sufficiently heavy to retain its position. An electroscopie may be charged negatively by contact with the small tube, or positively by induction. In the instrument constructed by the inventor the inner tube is the nickelled case supplied with a small stick of shaving soap, the fur being a piece of moleskin. The inventor is MR. H. J. GRAY, of Lewes.

The "Diffusa" Reflector Fitting.

This unit is designed by the SUN ELECTRICAL CO., LTD., of 118, Charing Cross Road, W.C.2, for use with half-watt lamps, and consists of a standard "Sunlite" P.E. extensive reflector fitting, having an opalescent reflector bowl suspended from it by three chains and ingenious spring clips. These clips, while securely

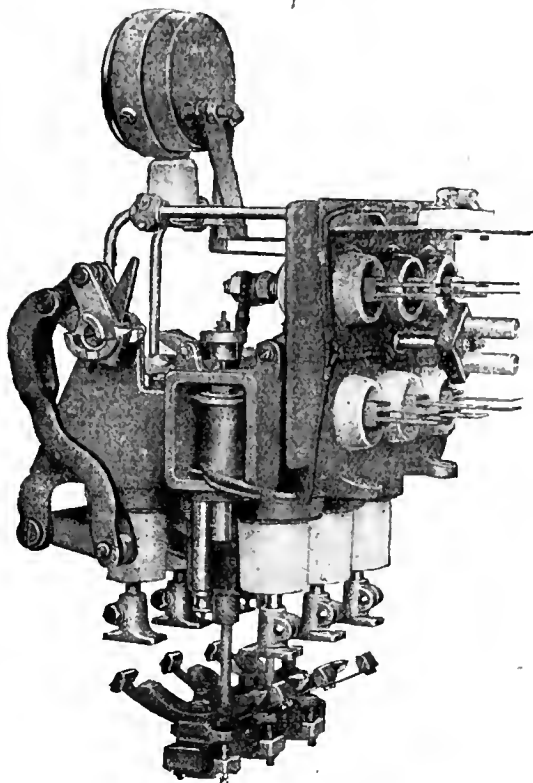


FIG. 2.—MECHANISM OF SWITCH.

holding the bottom reflector in position, do away with the necessity of boring the glass bowl. The bowl is so placed in relation to the top reflector that the resulting illumination is a combination of diffused and indirect light. The lighting effect is similar to that obtained with the makers' standard semi-indirect unit, but is concentrated over a slightly smaller area. The three-point suspension does away with the shadows usually thrown by ring fittings.

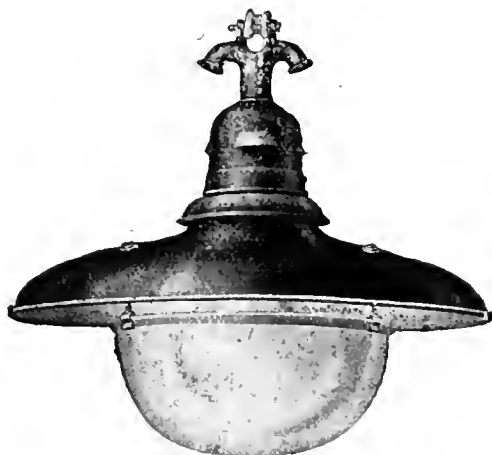


FIG. 4.—"DIFFUSA" REFLECTOR FITTING.

Ample ventilation is provided, there being, in addition to the opening between the top reflector and bowl, adequate ventilation holes in the neck of the fitting. This system of lighting is especially suitable for use where fine, intricate work involving great accuracy is carried out, as it does not tire the eyes.

A NEW INDUSTRIAL LEAGUE.

THE objects of the Industrial League for the Improvement of Relations between Employers and Employed were explained in a series of speeches delivered at a well-attended dinner at the Café Monico on Friday last.

Mr. Lee Murray presided, and amongst those present were Sir Albert Stanley, M.P. (President of the Board of Trade), the Rt. Hon. F. Huth Jackson, Mr. G. H. Roberts, M.P. (Parliamentary Secretary to the Board of Trade), Mr. G. Wardle, M.P. (Chairman of the Labour Party), Sir A. Denny, Sir J. McCall, Sir C. Allom, and others.

THE CHAIRMAN said that their meetings had been going on for about two years. They started with a number of men who held diverse opinions on almost every subject, and who came together to see if they could not find some means by which they could compromise, or, at all events, to find the explanation as to why they differed. The result had been that they had found that the men who differed from them were men who sincerely and honestly held their views because of their particular experience. Latterly they had concentrated on what was the second important menace that Great Britain would have to face after the war, namely, the enormous debt piled up against us in foreign countries on account of the war. That debt had to be reduced, and it could only be tackled by increased productivity, which would mean less imports and more exports. Our imports so enormously exceeded our exports that we could reduce imports tremendously without affecting our exports position at all. In order to do this it was necessary (1) to get the orders, (2) to manufacture the goods. During the last two years there had been set up in England a number of co-operative organisations consisting of different employers whose business it was to get out after trade after the war. Those organisations, strong as they were in finance, in personnel, and in technical and commercial ability, had the necessary qualifications for their work, securing new markets and increasing our trade in existing ones. They could leave to those organisations and to the individual manufacturers the task of securing increased orders. But how were we equipped for turning out the goods when the orders were obtained? He always combated the statement that our manufacturers had failed as producers; they had not done so. If they said that our manufacturers had failed to stem the aggressive competition of the Americans and the Germans then they would certainly be right. The aims of our manufacturers had been too local and personal instead of national. Since the war we had had an enormous increase in productivity in this country, and the capacity for production was greater than was ever imagined before the war, which would enable us to cope with the whole of the increased orders that we should get. The American did not hesitate to scrap anything the moment he knew there was something better to be obtained. Our manufacturers would have to do the same, and to be supported by the trade unions and the Labour people in introducing improvements when they were possible. All the endeavours of the organisations he had mentioned to get fresh orders would be rendered vain and useless unless they had a proper relationship between employers and employed, and unless they appreciated their community of interest. If the relations were to be as they were before the war, then it would not be worth while to get out for new business, but if the relations were as they should be, they would want all the orders they could get, for they would then be able to get the stuff out and fill the orders. There must be a minimum wage for every willing worker. That being conceded by the employer, he had to have the unquestioned right of sacking any man who could not or would not earn that minimum wage. There was to be payment by results. By that, every class of work that could be measured would be paid for according to the industry and the energy shown by the men engaged on it. He did not doubt that different systems would be in use in different parts of the country, but a man had to be paid what he earned. Manufacturers must keep their plant and equipment up-to-date. How they were to get the money could be left to those who were going into the industrial banking system. The workers must do everything possible to secure a maximum output. There had to be no more restrictions of output, no more "ca canny." If the men realised that their interests and those of their employers were identical they would show that their hearts were in this thing by turning out every possible ounce of stuff. The social status of all the workers must be uplifted. The employers had to be educated up to a realisation of their responsibilities. Their employes also had to be educated, and their children thoroughly educated in ideas of patriotism. Where would the Germans have been to-day but for that? The workman must not be allowed to think that he was a machine tool; that sort of thing had to stop. Another thing necessary was the encouragement of the small manufacturer. He disagreed with the view that headway could only be made through huge industrial organisations. Big organisations were necessary for the technical advancement of experimental work, because they had the finance and the facilities, but the history of England had been the history of the small manufacturer, and the small manufacturer, specialising in a few lines, had held his own against departments of the big

octopus concerns. The small manufacturer had also a great part to play in the solution of the problem of the relations between employer and employed. It was to him that they had to look in a very large measure for the propaganda work that had to be done. How could they help to put those ideas into effect, and how could they do their best to get increased productivity by improving the relations between employers and employed? Those were the questions they had to ask themselves.

Mr. H. SCHOLEY said that they were a society of missionaries. For the past 20 months they had been holding comparatively small meetings, and hardly one of them had not modified his views in connection with the great industrial question. An absolute frankness had prevailed at their meetings, and in consequence they had been able to understand one another's difficulties, and had been able to sweep away a good many misconceptions. The Association started with a gathering of six or eight men, and was gradually extended until it came to the decision that it might be made of advantage to the rest of the industrial world, and now they were seeking to extend it still further. They had done a great deal of good work, and would like to go down to the large centres of industry and organise allied associations. Their work should be of an educational character—education in its widest possible sense was meant, including anything that was embraced in the subject of scientific management. They aimed at a propaganda which would bring before the employer and the workpeople the absolute necessity of composing their differences so that when the proper time came they would be able to present a united front to the great industrial struggle that was going to take place. They wanted an immediate increase in their membership, and were going to invite the co-operation of employers throughout the country, no matter what industry they represented. They would also ask the assistance of the trade unions. The Association should develop by forming branch organisations, which could arrange small meetings of employers' and employed, and they in the central association might give them a great deal of help. Their special speakers could pay special visits to places where help was particularly needed. They must, if possible, get to the individual worker. There were a good many questions that they thought the worker should understand, or he could not appreciate the employers' difficulties. The worker could not be expected to take a proper interest in the great problems of trade and finance unless he was brought in touch with them, though not in detail. Education was needed for the manufacturer also, because he was afraid that many of them were going to give some difficulty, but with a well-informed public opinion and with a number of employers taking a real interest in those things, the ultimate result would be that the difficult employers would take a much wider view of their responsibilities to their people, to their industry, and to the nation at large. As to the lines on which the Association should be run, they were aiming at the small manufacturers. Very large numbers of them would be interested in this scheme. It had been questioned whether the Association was not in danger of overlapping the work of other organisations. They had ascertained what those organisations were doing, and as a result they thought that they were on a special line of their own, though they were working in close harmony with other associations, and at any time that it might be necessary, they would be ready to come together in the common cause.

Sir ALBERT STANLEY said that he had never had any objections to associating with so-called Labour leaders. At the Board of Trade they were prepared to take the responsibility for dealing with the most serious outstanding problem that confronted them—the relation of the employer to the employed. He had had a good deal of experience in America. He was identified with two separate undertakings, one rapidly succeeding the other. Each of those undertakings had in its employ practically 30,000 men. One of the undertakings was really the last word in trade unionism. Every single employe was bound to accept membership of the union. The other undertaking was entirely free from that sort of influence; so far as he knew not a single man identified with it had any connection with any trade union movement. He found that in the trade union undertaking provision was made whereby any grievance could be brought forward and carried right to the very top for the purpose of adjustment. It frequently came to his notice, as manager of that undertaking, that grievances on the part of the men had a real genuine foundation. It frequently came to his notice that some unofficial was not justified by the facts in some action he had taken. As a result of the method which existed many grievances were remedied. No such machinery, at least no adequate and satisfactory machinery existed in connection with the other undertaking. If there was any grievance it lay smoldering beneath the surface and had no opportunity for adjustment. The result convinced him that whether it was done by established trade unions or by securing the co-operation of the man's selected leaders whatever the system might be it was absolutely essential for the successful conduct of a business in which a large number of men were employed that there should be set up machinery which would secure to the men an opportunity for bringing their grievances forward and securing them against punishment on the part of the officials. Undoubtedly, in this

country to-day there was a great deal of dissatisfaction, and a growing dissatisfaction among the working people. They had to face that and recognise it, and it was the duty of every man who employed labour, everyone connected with the Government, and every trade union leader, to recognise it, to face it honestly, and to take the right steps for bringing about an immediate improvement. The lesson that he learnt in America was a lesson which could be adopted here to-day. Taking it on the whole, he could not help feeling that the working men of this country had not been sufficiently educated, and had not a sufficient knowledge of the problems that confronted the business interests of this country. He felt that somehow, whether it was done through their accredited leaders, or however it might be done, they had to find a way whereby those great problems, which were going to be infinitely more serious when the war was ended, could be brought home to the working people so that they might have a better understanding of them, and so that their decisions on them might be based on an intelligent knowledge of what needed to be done. Thereby they would have the opportunity, the privilege, the right of associating with the employers so that whatever might be their action, it would be based on facts, and not on mere gossip, or, as sometimes was the case, on an unfortunate expression in the daily Press. The chairman had paid proper tribute to the success which had crowned the efforts of the men who, in times past, by hard work and diligent effort, had established business undertakings in this country. What they had to consider now was whether they could travel on that same road and continue to apply those same methods in the future. If they investigated the progress which had been made by Germany during the last 15 or 20 years, and if they compared the value of her export trade, and saw the curve of her alarming growth and expansion, they would observe how close that line came to the value of the exports of this country in 1914. When they saw that, he could not help but think that they would then give careful investigation into the methods which brought that country so alarmingly close to us. The chairman had suggested that the ideal to aspire to was that our exports should show an enormous expansion, and our imports a corresponding diminution. During the seven months that he had held Cabinet office there had been times when he had felt that if he could be relieved of some of the burdens of that office he would be quite content, but if he could be assured that by holding on he would be helping to bring about the accomplishment of that particular object, then he would be very happy indeed to be President of the Board of Trade. He was satisfied that in this country we had the ability and the resources that were necessary, and he knew, too, that every one of our Overseas Dominions and all our possessions were most anxious to co-operate with us in solidifying this great Empire and in making it one unit with one common aim and aspiration—the creation of the greatest trading and industrial Empire the world had ever seen. But unless they found some solution to that problem, some way whereby the employé would be more contented, and have a better recognition of the great issues that confronted them, he could not see any hope of that ambition being fulfilled. He felt that if the employers of this country would only recognise the altered circumstances, realise that the conditions had changed, that we were living in an entirely new world, and that the working man was going to demand more and more his share of the comforts of life, then he believed that that would at least go a long way toward solving that terrific problem. Sir Albert referred to the necessity of co-operation of the employés, without which there was no possible chance of a permanent success.

(To be concluded.)

LEGAL.

W. SANDORIDES, LTD., v. FRANCO-BRITISH ELECTRICAL CO., LTD.

IN the King's Bench Division, on July 19th, Mr. Justice Ridley heard an action in which plaintiffs sued defendants for rent in respect of an electric sign at 7, Oxford Street.

MR. J. G. PEARCE, for the plaintiffs, said the claim was for four quarterly payments, from August, 1915, to May, 1916, due to the plaintiffs from the defendants under an agreement by which the plaintiffs granted to the defendants a licence to place an illuminated sign over a part of 7, Oxford Street, W., for a period of five years from August, 1914, and for which the defendants agreed to pay £120 a year in quarterly instalments. The sign which was placed there on the execution of this agreement, and which was there still, was an advertisement of Pears' soap. It was a very striking feature as one came along Oxford Street or down Tottenham Court Road. The defence set up was that under the Defence of the Realm Act there were certain regulations regarding the lighting of the London streets, and restrictions were imposed by which the defendants were no longer able to carry out their agreement. Apparently, said counsel, this meant that the contract was dissolved. But the answer to this was obvious. The sign was a sign by day as well as by night. By day it was visible from 300 yards; it was there still. The only effect the working of the Defence of the Realm Act could have would be to make the sign of less value—certainly not of no value. There was nothing

in the Defence of the Realm Act to prevent the sign being illuminated during certain hours even now, and a great many signs were at the present time being illuminated up to nine o'clock.

MR. DUGGON POLLOCK, for the defendants, argued that if the sign was not lighted, it was of no use to his clients. If his Lordship held that the sign still had a day value, then the defendants had a totally different thing to that for which they contracted.

HIS LORDSHIP said the plaintiffs were entitled to succeed in this case. The defendants might think they had a hard case, but there was a certain amount of hardship either way. In this case it did not appear to him that this was a contract which was rendered impossible. Mr. Pollock had argued that the contract was only for an illuminated sign, but it seemed to him (his Lordship) certain that the sign was being used in the day time. He was not inclined to accept the position of the defendants, who took the electrical view, that it was impossible to do without electricity. The restrictions on the electric lighting of the London streets had been lightened, and the defendants still had the advantage of the illuminations during certain hours, and in the future there might be still further facilities.

HIS LORDSHIP entered judgment for plaintiffs for £120 and costs, and on the application of Mr. Pollock granted a stay of execution pending a possible appeal, the money to be paid into Court within 14 days, and costs to be taxed and paid to plaintiffs.

E.S. CO., LTD., v. TREDEGARS, LTD.

IN the King's Bench Division, on July 18th, Mr. Justice Ridley had before him the action E.S. Co., Ltd., proprietors of Electrical Supplies Co. v. Tredegars, Ltd.

The plaintiffs claimed the sum of £263, the price of goods sold and delivered, and defendants admitted that they were indebted to the plaintiffs for that sum, but counterclaimed for £193, goods supplied to plaintiffs, and paid the balance into Court.

MR. A. H. RICHARDSON, for the plaintiffs; MR. C. H. SMITH, for defendants.

MR. SMITH, opening the case on the counterclaim, said the action was originally brought by the Electrical Supplies Co. for £263 for goods supplied. The defendants, who also dealt in electrical goods, claimed that they had a set-off against the amount claimed for £193, goods supplied to plaintiffs, and the defence to the counterclaim was that, although the plaintiffs actually ordered these goods, it was on the condition that they were to be equal to sample and subject to the approval of a customer. The plaintiffs said the goods were not according to sample, and, therefore, there was no contract.

The plaintiffs, said Counsel, approached the defendants with regard to the purchase of electrical switches, and defendants said they had 45 gross of Japanese switches, of which they would supply 30 gross at 10s. 9d. per dozen. Mr. Summer, their manager, said he would like a sample, and then he would let them know, definitely whether he would take the 30 gross. The next day he sent for the sample, and the defendants eventually sold the plaintiffs the switches as Japanese switches. What had evidently happened, suggested Counsel, was that the plaintiffs had a contract to sell to Edison & Swan some English switches, and that they were trying to pass off on them Japanese switches. Edison and Swan refused to accept them, and then the plaintiffs tried to repudiate the contract.

After hearing evidence,

HIS LORDSHIP, giving judgment, said he was of opinion that the contract was provisional, and subject to an order from Messrs. Edison & Swan, who, when the goods arrived, refused to accept them, as they did not comply with their order, because their order was for English, and not Japanese, switches. He had come to the conclusion that there was a conditional term upon which these goods were ordered. The plaintiffs succeeded on the claim, and the defendants failed in their counterclaim, and there would be judgment for plaintiffs for the amount paid into Court, and for £193, the balance, together with costs on the claim and counterclaim.

C. J. FERGUSON & SONS v. C. ISLER & CO., LTD.

IN the King's Bench Division on July 19th, before Mr. Justice Atkin, an action was heard in which plaintiffs, electricians, of Chiswell Street, E.C., sued C. Isler & Co., Ltd., Artesian Works, Bear Lane, Southwark, in respect of the alleged detention by the defendants of a 50-H.P. motor and starter, which, it was said, was hired to them for a definite period of one week for work in connection with the Hackney Borough Council electrical supply service. The plaintiffs said they let the defendants have the hire of the motor under an agreement of April, 1915, together with apparatus for electrical wiring, and they also did the work of wiring cables suitable to enable the motor to do the work that was required. They claimed damages because, as they said, the defendants had wrongfully detained the plant, and in consequence they (plaintiffs) had had a claim against them by the firm of A. Bridgman & Co., Ltd., of City Road, from whom they had hired in order to re-hire to the defendants. The defendants denied that there was an agreement to hire for the exact period alleged, and they denied liability for more than had been paid into Court.

In giving judgment after hearing the evidence, MR. JUSTICE ATKIN said he was of opinion that it was agreed that the period of the hire should be one week. It appeared that another starter had to be provided, and when the motor began to work it was found that the results were not as speedy as anticipated. The motor was kept for several weeks on the work. In the meantime, Messrs. Bridgman were wanting the plant and pressing the plaintiffs for

its return. The defendants wrote to say that they were ready to pay an additional hire figure, and they had had to keep the motor longer than was thought through difficulties that were not anticipated. He (the Judge) was satisfied that the period of hire agreed on was one week on the terms of £25, £20 for the fixing, and £5 for the hiring. The defendants kept the machine for some weeks, and then took up the position that the motor was hired without any stipulations whatever. He thought the plaintiffs did agree to the defendants retaining the motor for a certain period, but they gave notice of the termination, and henceforward there was wrongful detention by the defendants, and a violation of the plaintiffs' rights. He thought the defendants must have known that the consequence of their detaining the motor was that Messrs. Bridgman would take steps against the plaintiffs; and, in fact, Messrs. Bridgman did claim special damages against the plaintiffs because of the detention of the machine. The defendants did not release the motor until it was convenient for them to do so. He thought the plaintiffs were entitled to judgment on the claim for a total of £71 10s.; and he gave them judgment for this sum, and costs, including certain costs incurred in connection with the action against the plaintiffs by Messrs. Bridgman.

GAS LIGHT AND COKE CO. v. HACKNEY BOROUGH COUNCIL.

IN the Chancery Division, last week, Mr. Justice Astbury began the hearing of an action by the Attorney-General at the relation of the Gas Light and Coke Co. against the Mayor and Corporation of Hackney, which involved a complaint by the plaintiff company that the defendants were making differential charges in their supply of electricity, in breach of sections of the Electric Lighting Act, and plaintiffs asked for a declaration to that effect and an injunction.

Mr. Russell, K.C., Mr. Colefax, K.C., and Mr. Percy Wheeler appeared for the plaintiffs; and Mr. A. J. Walter, K.C., and Mr. Spence for the defendants.

MR. RUSSELL said the plaintiffs supplied gas for lighting and power and other purposes within a certain area, and the Borough Council of Hackney supplied electrical energy for lighting and power within a certain area which was within the plaintiffs' district, and they did that under the provisions of the Hackney Electric Lighting Order of 1893, the principal Act being the Electric Lighting Act of 1882, Sections 19 and 20 of which plaintiffs said were being violated. These set forth that where a supply of electricity was provided in any part of an area for private purposes, except in so far as otherwise provided by licence or special Act authorising such supply, every company or person within that part of the area should, on application, be entitled to a supply on the same terms on which any other company or person in such part of the area was entitled under similar circumstances to a corresponding supply; and the undertakers should not, in making any agreement for the supply of electricity, show any undue preference to any local authority, company, or person, but might make such charges not exceeding the limits of the price imposed by the licence or special Act. The matter in respect of which the plaintiffs were suing was the scale of prices published by the defendants in July, 1914. The scale was for lighting, alternative I, for any quantity of electrical energy used each quarter, not exceeding the equivalent of one hour's supply per day, at the maximum demand, 6d. per unit; for any further quantity of electrical energy in each quarter, 1d. per unit; alternative II was a flat rate. For power (this was what plaintiffs complained of), alternative I, a fixed charge of £1 per quarter per kilowatt of maximum power demanded, and a charge for electrical energy used of ½d. per unit. Consumers paying under this scale are allowed to use 20 per cent. of the energy consumed for lighting. The effect of that, said counsel, was that consumers of energy for power were supplied with energy for light at a lower rate than the persons who were consumers of light only. Counsel argued that a light consumer was entitled to be supplied with his light on the same terms as another person, and to give favourable terms to a power consumer in respect of his lighting was to induce him to become a customer.

SIR JOHN SNELL, Vice-President of the Institution of Electrical Engineers, then gave evidence, and said he had investigated the question whether or not the defendants had been supplying electricity at a profit or loss, having regard to the charges that were made, and he had come to the conclusion that a profit was made on lighting but a loss on the supply of power.

In cross-examination, MR. WALTER asked Sir John whether he was aware that this year, with 1 million units less for lighting and 6 millions more for power, Hackney had wiped out a loss, and carried forward £6,000 for the relief of rates.

SIR JOHN said he did not know that, as he had not had access to the accounts for this year.

MR. WALTER: And the whole net increase to consumers is not 15 per cent.

WITNESS: You have done very well.

MR. WALTER said the cost of material, including coal, had much increased, and the witness agreed. Sir John also agreed that, as a class, the power consumer had a better load factor than the light consumer, and the former class had also a better diversity factor.

Then there is a further factor that, as a rule, the power user, as a class, uses more electricity than the light consumer as a class. As a rule.

All these factors, of course, are circumstances which are taken into consideration in fixing the price. Certainly; that is why you charge twice as much for lighting as for power.

In so far as the power user has 20 per cent. of light, his load

factor is slightly worsened by that percentage?—If he has power alone it is worsened.

SIR JOHN was then cross-examined on the 1914 accounts of the Borough Council with reference to their electrical undertaking, these being the accounts which were placed before him for the purpose of investigation.

On Thursday, last week, MR. A. J. WALTER, K.C. (with him Mr. Spence), for the defendants, submitted that the action was entirely misconceived. It was founded on an entire misunderstanding of Sec. 19 of the Electric Lighting Act (the section which with Sec. 20 plaintiffs complained that the defendants had violated), and of the Long Eaton lighting case which, properly understood, was the authority directly in favour of the present defendants. The plaintiffs came to the Court as the champions of light, though their real business was to sell gas.

HIS LORDSHIP pointed out that the point between plaintiffs and defendants was as to the relative profit made by the defendants' undertaking during a particular period as between power and lighting. Sir John Snell thought that the power was being supplied at a loss, or, at all events, at a less advantageous rate than lighting.

MR. WALTER said Mr. Merz, his witness, said the business was paying on the power, and the figures showed that in 1916, when the price of coal was up, the defendants converted a loss of something like £8,000 into a profit of over £6,000, although the lighting load had gone down 1,000,000 units.

MR. CHARLES MERZ, consulting engineer, gave evidence for the defendants. He said the capital cost was a considerable item in all electrical undertakings, and the plant must be sufficient to supply the maximum demand. The regularity of the supply was a most important factor in the cost of production of the supply. As between a lighting load running only two hours a day and what was called the high-load-factor consumer, the difference of cost might be several hundred per cent. in a municipal undertaking. Two hours a day was generally known to cover a very large number of lighting consumers. Power users for the purpose of their own businesses desired to have the highest possible load factor; it affected the wages bill and every other item in connection with factory cost, and the load factor was reflected back to the station. There had been a large number of Power Acts passed by Parliament. The North-East Coast group of power companies turned out about one-fifth of the total electricity of the country. Electrical energy was by the Power Acts allowed to be supplied for power purposes, and it followed that it was also necessary to supply light for all the factory purposes, and to allow 20 per cent. of the supply to be used for lighting purposes. The electrical energy supplied took no notice of whether it was supplied for power or light. The result of that was that in all power businesses a large undertaking must seek more and more to supply the manufacturer or factory user who would insist on being able to take his light or power from one set of wires. With regard to the Hackney Borough Council undertaking, witness said the power business was undoubtedly paying in 1913. The lowest charge was ½d. per unit, and the lowest cost was 348d. The fixed charges amounted to £12,000 per annum, and supposing that power had not been sold, the Corporation would have lost £12,000 right off. He had gone into the question of the actual payments with the view of trying to check the diversity factor. As the power business was the one which had a diversity, that was the one class of business whose combined demand could not be got from the consumer's account, as they did not know the incidence of the lighting demand. The diversity factor of the other business was practically negligible. Losses were higher on the peak, because on a direct-current system there was no loss on low load, though there was an increasing loss on the high load. The system he had adopted of ascertaining the cost was the one usually adopted to get at the rate to be paid by those who took power in the daytime. During the period of non-peak load the losses were less, and it was utterly unfair to charge those losses to the day load. The result of the power business was to put the undertaking in a better position by £12,000 a year.

MR. J. A. JENKINS, accountant of the Borough of Hackney, said the accounts of 1916-17 showed that for lighting 1,825,075 units were sold, and for power and factories 12,465,635, and the amount carried forward was £6,918, without taking into account £14,691 allowance to employees at the war. The net profit was £5,456. That was after meeting every obligation. The capital to date was about half a million. A large sum was paid off capital except in the first two years, and there had been a large contribution to the rates during the period of working the business. A reserve of £21,669 up to March 16th had been created. There was a deficiency only up to 1902. Owing to the large increase in the cost of coal last year, £6,000 had to be debited to reserve.

On Wednesday last MR. JUSTICE ASTBURY delivered judgment, holding that the defendants had not threatened or intended to do anything in breach of the provisions of the Act of 1882. The action therefore failed, and was dismissed with costs. The detailed judgment will appear in our next issue.

ELECTRICITY WORKS FATALEITY: COMPENSATION.

AT Bolton County Court, last week, application was made for the appropriation of a sum of £300 which had been paid into Court in connection with a fatal accident some time ago to George Edward Horler, switchboard attendant at the Bolton Corporation's Electricity Works, Back-o'-th'-Bank. On behalf of the widow, Annie Horler, it was stated that there was an unborn child, and its interests would have to be considered when the money was allocated. His Honour sanctioned the payment of £10 down and £3 a month, and asked that the case should be mentioned again when the child was born.

LEAVING CERTIFICATE GRANTED.

AT the Oldham Munitions Court, last week, an employé of an electricity undertaking asked for a leaving certificate. His wife was in London as a teacher under the London County Council, and he wished to take an appointment there, and so be near her. Each month for the last 11 months he had asked the chief engineer of the works to release him, but each time the request had been refused. It was not a question of money with him, as he would be receiving less in London. A letter from the employers said the applicant was their shift engineer, and he had got married since accepting the appointment with them. The leaving certificate was granted.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

A Revelation Concerning the Ways of Reviewers.

As regards my quotation last week from the remarks of one of your reviewers in the preceding issue, it was clear that about the only defence that could be put forward for those remarks would be that they were made as a joke. In your comments on my letter you make this very excuse for your reviewer; but why not have let him give his own explanation?

Assuming the matter was a joke, may I point out that it was a dangerous sort of joke, being of the type that could be variously described as the boomerang, spring-back, or double-edged. In plain language, your reviewer cited the very procedure which is sometimes adopted by unscrupulous reviewers, and he consequently laid himself under suspicion. A parallel example would be that of a baker who joked about sawdust in flour.

As in the course of the next few months three or four new publications from my pen will be submitted to you, I venture to hope that they will be handed to reviewers who will "get interested" in them.

W. Perren Maycock.

West Norwood, London, S.E. 27,
July 21st, 1917.

[Be it understood that we disclaim all responsibility for the joke referred to; it is coeval with the mother-in-law joke, and we should have thought that every writer of books was familiar with it.—EDS. ELEC. REV.]

WAR ITEMS.

German Control of Electricity Consumption.—The Federal Council has authorised the Imperial Chancellor to exercise control over the production, transmission, and consumption of electricity and gas, as well as of steam, compressed air, and hot and potable water. A department has already been created to carry out the order issued to this effect, which aims at the uniform regulation of the agencies in question.

Trading with the Enemy.—The "London Gazette" for July 20th contains further names of persons and bodies in the following countries with whom trading is prohibited:—Argentina, &c.; Brazil; Chile; Netherlands and Netherland East Indies; Norway; Spain, &c.

Recovering the French Collieries.—We read in the *Times* that Mr. Maurice Deacon, M.I.C.E., has accepted the honorary position of technical adviser to the British Government, in association with the French Ministry of Mines, with regard to the recovery of the French collieries which have been destroyed by the Germans in the Lens coalfield.

Thyssen Profits.—A German newspaper states that the Thyssen Factory, at Mülheim, shows a profit of 14 million marks, with a dividend of 10 per cent.—*Times*.

Hull Electricity Employés and Substitution.—At the last meeting of the Hull Electricity Committee, the acting engineer stated that the Military had asked for six more of their men under the substitution scheme. He had pointed out that it was impossible for them to be released, and if they were taken the authorities would have to take the risk of the undertaking. The matter had therefore been deferred for a time.

Exemption Applications.—At Blackpool Tribunal, it was mentioned that in the cases of 14 employés of the electricity and tramways department it had been agreed with the Advisory Committee that 13 should have temporary exemption to the end of December, and leave to appeal be given in the other case in the event of his being called up. Mr. J. W. Mitchell asked if any Corporation officials sat in these cases, and the Assistant Military Representative replied that they would. He added that all the men were in certified occupations, and the department was working at the lowest possible minimum.

At Aldershot, Messrs. T. White & Co., Ltd., appealed for G. S. Velvick (33, B1), who has charge of the firm's electric light branch and supervises all the work. The Military objected, as Velvick has had exemption since June, 1916, but three months were conceded.

At Eastbourne, Mr. Brydges, borough electrical engineer, appealed for 12 employés at the works. The cases had been adjourned to see if the men would be protected by the Government, as they were partly engaged on munition work. Mr. Brydges said that the Government would not protect men where the output was less than two-thirds. He contended that all the men were engaged on work of national importance in supplying light and power, even if they did not do any munition work at all. The appeals were resented for further consideration.

On the appeal of the Aldershot & District Traction Co., three months have been allowed to a fitter and driver, six months to another driver, and in the case of a third driver, he was reserved for substitution.

Pershore Rural Tribunal has granted temporary exemption until September 15th to G. Ballard (32), electrician to Lieut.-Col. H. M. C. Porter, of Birmingham, who is on active service.

Extended exemption until the end of the year has been granted by the Nuneaton Tribunal to P. H. Howe (28), electrical fitter, on the ground that he is doing work of national importance.

Before the Hants Appeal Court, the Military appealed against exemption held by H. W. Keeping (40, B1), electrician, of Shanklin (Isle of Wight). The Military Representative suggested that the business was only a small one, but respondent said that it was established in 1859, and he took it over from his father. He was the only electrician in the town, and did work at the hospitals and nursing homes. The appeal was allowed, the calling-up being fixed for August 7th.

An appeal was made at Peterborough for the retention of T. C. Roskelly (31, Class B1), electrician to Mr. H. Czarnikow, of Stoke Doyle, who has been previously rejected. The appeal was refused.

A Military review was made at Hastings of the case of R. H. Pattenden, electrician, with Messrs. Upfield & Son. It was stated that Pattenden had a number of electric lifts to look after, and it was suggested by the Military Representative that in war time people might walk upstairs. The Tribunal allowed two months in which to find a substitute.

Bedfordshire Appeals Court has given delay until September 16th to Edward Foster, electric light attendant, appealed for by Captain R. S. Bruce, of The Knolls, Leighton Buzzard.

On the recommendation of the Advisory Committee, Rochdale Tribunal has given exemption until October 31st to R. H. Hogg (37), motorman on the Corporation tramways. The Tribunal has also given exemption until October 15th, on the appeal of the tramway manager, to J. T. Hoyle (34, B1), controller, examiner, and cleaner, and J. E. Kershaw (36, B1), traffic clerk and week-end inspector.

Chatham Tribunal has confirmed a previous decision giving conditional exemption whilst holding Ministry of Munition certificates, to five motormen with the Chatham & District Light Railways Co.

At Douglas (Isle of Man), the Military appealed against conditional exemption granted to L. Dyer (27, C2), electrician engaged at the Manx Brush Factory and elsewhere. The appeal was disallowed, and the exemption confirmed.

The Whitechurch and Pangbourne Electric Supply Co. appealed for further exemption for J. L. Rushby (18), electrical engineer, passed in Class C3. It was stated that he assisted with the engine switchboard, and often ran the water power alone in the absence of the engineer. There were only two employés left out of five. Six months' conditional exemption was granted.

The cases of three car drivers with the Electric Tramways, Ltd., were considered by the Bath Tribunal. W. Swift (24, C3) and F. G. Atwick (36, C2), were given conditional exemption; and exemption was refused in the case of G. O. Snell (25, C2), whose retention was not pressed for by the engineer and manager.

At Oxford, the Military had a review of conditional exemption granted on June 15th to F. M. Stedworthy (38, general service), electrician and fitter with Mr. A. H. Pearson. The latter said that Stedworthy was his last man. Two months were granted.

At Rugby, Mr. W. H. Linnell appealed for H. W. Gilbert (24, Class C2), the only electrician left on his staff. Captain Wratislaw expressed the opinion that there were sufficient electricians in the town to do the private work. The Chairman said that as the man was a skilled craftsman he would have a code number, and under the circumstances they would dismiss the appeal, and throw the man on the mercy, tender or otherwise, of the Complaints Section of the Munitions Committee.

At Farsley, near Leeds, the Morley Electrical Co., Ltd., appealed for their secretary, Mr. N. Hill, single, aged 29, and classified C3, and for a foreman winder, H. Moore, aged 26, married. Mr. Hill was stated by Mr. Sumnerscales, the manager of the company, to be the only man left in the office, and the commercial side of the business was complicated, and it would take a long time to train a new man to the work. He had not been medically examined since being originally passed, but Mr. Sumnerscales thought he would certainly be in Class A. These two men ran the shop, and

if they were taken it would mean shutting down. The last time Moore was appealed for it was agreed that he was in a certified occupation. The Military Representative said that Moore was not certified on the new list, as armature winding had been removed. In answer to Mr. Summerscales's statement that the firm were on munition work, Mr. Sugden said if they could show they were on munition work they could retain Moore by putting him in a protected trade. Mr. Hull was given to September 30th, and Moore to July 31st.

BUSINESS NOTES.

The South African Electrical Market.—The ordinary household metal filament lamps are scarce, and the price has advanced smartly in consequence. The prospects of getting adequate supplies are anything but bright, as very little electrical goods came out by the last mails. Business is quiet through the shortage of stocks, which requires qualifying. It appears there are plenty of some kinds, but many of the etceteras are lacking, therefore jobs cannot be completed, and another reason is that the Johannesburg municipality is not giving any new (as distinct from old premises) electric light connections. The mines have practically cleared the merchants' stores of electric motors and power plant, as well as cables.—*S.A. Mining Journal*.

Time Checking.—The war has brought many radical changes into the large industrial works of the United Kingdom, and not the least amongst these is the accurate checking of employees' time, the exact regulation of meal intervals, also starting and stopping of work. MESSRS. GENT & CO., LTD., have orders in hand for many munition factories and Government-controlled works for "instituting time circuits" for controlling existing spring-driven workmen's check clocks and other clocks in buildings. By a simple and efficient means, all workmen's check clocks are controlled by their Pulsynetic electric transmitter, thus ensuring correct and uniform time throughout the establishment. The system is so elastic that any number of check clocks or time dials may be added to the circuit as occasion demands, and alarm bells or sirens can be operated automatically to any given programme or programmes. In many instances these programmes vary with the day of the week, and also with the department. All such variations can be dealt with effectively.

Catalogues and Lists.—MESSRS. FERRANTI, LTD., Central House, Kingsway, London, W.C.—Pamphlet TA 174 (10 pages), giving detailed and illustrated instructions for the installation and maintenance of oil-immersed static transformers. "Z" ELECTRIC LAMP MANUFACTURING CO., LTD., Southfields, London, S.W.—Specimens of postcards and billheads that have been designed for the use of the trade, and will be supplied over-printed with customers' names and addresses. The billheads are in pads of 100.

WESTINGHOUSE COOPER HEWITT CO., LTD., 80, York Road, King's Cross, N.1.—List No. 75A (8 pages), dealing with the mercury vapour converter for transforming A.C. General information, tabulated data and prices, and dimensioned diagrams, are given. A special series of rectifiers is now being manufactured for the charging of telephone batteries.

MESSRS. J. B. SAUNDERS & CO., LTD., 91, York Street, Westminster, London, S.W.—Interesting pamphlet on the advantages of overhead mains for the electric lighting of small towns. Only the first few pages contain letterpress, the whole of the remainder giving excellent half-tone photographic views showing overhead electrical distribution work in Carmarthen, Maesteg, Sirhowy Valley, Faringdon, Woodbridge, Whitstable, Braintree, and at a number of military camps.

Trade Announcements.—MR. F. H. MORLEY, of Star Buildings, Northumberland Street, Newcastle-on-Tyne, has been appointed representative for the Newcastle district by the New Switchgear Construction Co., Ltd., for the sale of their switchgear and apparatus.

MR. FRANK FILLINGHAM, late of Messrs. Wright & Fillingham, electricians, of 215, Beverley Road, Hull, has commenced business on his own account at 121, Beverley Road.

Book Notices.—"Memoirs of the College of Science of Kyoto Imperial University, Japan." Vol. II, Nos. 1 and 2, have come to hand. The second number contains particulars of a research by Mr. Usaburo Yoshida on the figures produced on photographic plates by electric discharges; an explanation of the mode of formation of the figures is put forward, and a series of beautifully executed reproductions of spark figures is given. The spectra of metals in the extreme ultra-violet are the subject of a research by Messrs. Toshio Takamine and Shigeharu Nitta, and the former, with Mr. Yoshida, also studied the effect of an electric field on the spectrum lines of hydrogen.

"Logarithms for Beginners." By C. N. Pickworth. Manchester: Emmott & Co. Price 1s. This work is now in its sixth edition. The principal alteration is the addition of a table of logarithmic trigonometrical functions to the collection of tables previously included.

"Indicator Handbook. Part II." By C. N. Pickworth. Manchester: Emmott & Co. Price 3s. net. This, the sixth edition, contains a new table of mean-pressure factors for different conditions of expansion, and has been revised in other respects.

"Post Office Electrical Engineers' Journal." Vol. X, Part 2, July, 1917. London: H. Alabaster, Gatehouse & Kempe. Price 1s. net.

For Sale.—The Central Electric Supply Co., Ltd., has for disposal one triple-expansion 2,200-I.H.P. non-condensing marine type standard Belliss engine, complete, direct coupled to one 1,400-KW., three-phase alternator, &c. Full particulars are given in our advertisement pages to-day.

Fires.—A fire (damage £500) occurred last week in the electric generating station of MESSRS. SAMUEL HEAP & SON, LTD., Spotland Bridge Mill, Rochdale. The cause was the tipping of hot blue dirt against the door of the building.

A fire occurred last week at the premises of MESSRS. GILLETT, electrical engineers, Great Market, Newcastle.

The fire which occurred at the works of MESSRS. D. H. BONNELLA AND SON, LTD., Mortimer Street, W., last Friday, was confined to a portion of one floor. The general operations of the factory are not in any way interfered with.

Holidays.—The works of the TYLER APPARATUS CO., LTD., Banister Road, North Kensington, W. 10, will be closed for the holidays from August 3rd to 13th.

The works and offices of the GENERAL ELECTRIC CO., LTD., Witton, will be closed from the evening of Friday, August 3rd, until the morning of Monday, August 13th.

THE BRITISH WESTINGHOUSE CO. announce that, though their works at Trafford Park will be closed from to-day until August 7th for overhauling and repairing the plant, special arrangements have been made in the Receiving-Department to accept materials, and also for the despatch of completed apparatus, during that period.

Dissolutions and Liquidations.—KORTING BROS., LTD.—Meeting of creditors August 7th, at 2, Coleman Street, E.C. Liquidator, Mr. A. G. Parker. Cheques for the full amount due to all creditors will be dispatched prior to the meeting date.

PLUTTE, SCHEELE & CO., LTD.—The Controller, Mr. G. W. Roberts, 133, Wool Exchange, E.C., has applied for his release.

STEEL'S ELECTRIC AND ENGINEERING CO., LTD., Poplar.—First meeting of creditors and contributories August 2nd, at Carey Street, W.C.

WRIGHT & FILLINGHAM, electricians and plumbers, 215, Beverley Road, Hull.—Messrs. J. Wright & F. Fillingham have dissolved partnership. Messrs. Walker & Colbeck, 9, Parliament Street, Hull, will attend to debts, &c.

LIGHTING AND POWER NOTES.

Ashton-under-Lyne.—The electricity undertaking, which of late years has made substantial contributions to the rates, will require the provision of about £3,500 this year.

Australia.—The Chief Commissioner for Railways has informed the Newcastle (N.S.W.) Municipal Council that he is prepared to supply electricity for power and other purposes. It is stated the arrangement will obviate the necessity for extending the municipal plant.—*Sydney Daily Telegraph*.

Bath.—At the last meeting of the Council the electrical engineer submitted the tenders for an Underfeed stoker to be fitted to a marine boiler, and a transporter for the conveyance of coal to the stoker. He estimated that £1,000 per annum would be saved by this installation, and the Council decided to expend up to £1,200 on the plant.

Brighton.—PRICE REVISION.—The Electricity Committee has decided that the charge for electricity supplied to all classes of consumers other than power-users within the borough be increased by 10 per cent.; that the flat rate of 6½d. per unit for electricity supplied outside the borough be increased by 10 per cent.; that a meter charge of 2s. 6d. per quarter, payable in advance, be made for each prepayment meter installed; that the charge for electricity supplied to the Corporation tramways be increased from 1½d. to 1½d. per unit; that, except in the case of special contracts, the power rates be increased by 10 per cent.—the increased charges to take effect at the expiration of the current quarter. No alteration is to be made in the charge for bulk supply to the parish of Aldington, and the charge for street lighting is to remain as at present.

China.—A large cotton spinning mill is now in course of erection at Wuchang for a Chinese syndicate. The machinery for the spinning mill, which will be equipped with 40,000 spindles, is to be of the latest pattern, and is to be electrically driven, power being obtained from the Wuchang Electric Light Co. It was found to be impossible, under present circumstances, to obtain the motors from England, and the order has accordingly been placed with the Westinghouse Co., of America. In addition to the spinning mill, it is also proposed to install later a weaving shed with 500 looms.—*Indian Textile Journal*.

The Foochow Electric Light Co. has increased the capacity of its plant from 500 to 1,500 KW., in order to meet increasing demands. The necessary machinery has been purchased from the United States, delivery from England being impossible. This year the company earned 10 per cent. on its capital, and paid a dividend of 13½ per cent. Other small electric light companies are being formed with light Japanese plant at Chuanchou and Sien-yu.

Electric lighting has recently been adopted in the town of Mengtze, Southern China.

Continental.—SPAIN.—A concession has recently been granted for the establishment of a plant to utilise the water power of the River Segura, near Ulco (Province of Murcia), in the generation of electrical energy for industrial purposes.

Darwen.—For the year ended March 31st last, there was an adverse balance against the electricity department of £2,631.

Farnham.—The B. of T. has extended the Farnham Electric Lighting (Extension) Order, 1914, by 12 months.

Great Harwood.—PROVISIONAL ORDER.—The U.D.C. has decided to make application to the B. of T. for a renewal of the Electric Lighting Order.

Halifax.—NEW PLANT.—A 6,000-KW. turbine set, costing some £26,000, was officially started last week by Lady Rhondda. Subsequently the guests were entertained at Bankfield, where Mr. James Parker, M.P., congratulated the Electricity Committee on its work, and Mr. Clem. Edwards, M.P., referred to the great industrial developments of the future, which would necessitate the extended supply of electricity.

At a special meeting of the T.C. on Tuesday, last week, it was decided to secure 21½ acres of land at Copley, as a possible site for a new station, at £3,600, and that expert advice should be obtained on the question of building the station there. Ald. Spencer (a member of the B. of T. Committee on Electricity Supply) pointed out the impossibility of extending on the present site, and stated that the new station would not be built in any case until the proposals of the Government Committee were made known.

The Corporation has appointed Sir John Snell to advise as to the most suitable site for electricity works.

Huddersfield.—PROVISIONAL ORDERS.—The Corporation has notified the Kirkheaton, Marsden, Meltham, Kirkburton, and Lepton U.D.C.'s of the intention of the Corporation to apply, in December next, for Provisional Orders authorising the supply of electricity in those districts.

India.—CAUVERY POWER SCHEME.—The fifth installation of 4,000 H.P. of the Cauvery power scheme at Sivasamudrum Falls, will be completed in September next. It will be by far the biggest unit hitherto provided in Mysore. Only a portion of a generator, quite the last piece of machinery received in these days of restricted freightage, says *Indian Engineering*, has just been delivered at the works. It weighs 13½ tons, and was taken along from the railhead at Maddur station, inch by inch, on a 12-ton lorry drawn by 22 pairs of bullocks. The turbine is the biggest ever shipped East.

Kirkcaldy.—YEAR'S WORKING.—The report of the working of the Corporation electricity undertaking for the year ended May 15th, 1917, shows a total income of £15,321, working expenses, amounting to £10,609, and the gross profit, plus £57 income-tax retained, amounted to £4,768. After deducting interest on capital, £2,557, sinking fund, £2,339, and other charges, £55, totalling £4,951, there is a debit balance of £183. The total number of units sold was 2,314,591; 675,179 units were supplied to the tramways, 230,513 units for lighting, and 1,408,899 for power. The total works cost per unit sold was 1'096d., and the average price obtained per unit sold 1'586d.; the quantity of coal consumed per unit sold was 9'42 lb., against 10'13 lb., the cost being 5'65d., against 6'28 in 1916. The maximum load recorded was 1,034 KW., as against 950 KW. in the previous year; the load factor was 25½ per cent., as against 23½ per cent. The total capital expenditure was £81,316, and sinking fund repayments, £24,426.

Liverpool.—WAGES.—The City Council has formulated a new war bonus scale for its employes, ranging from 3s. a week to 12s. for men and 7s. 6d. for women, and including all wages up to £4 a week. Over £4 and up to £400 a year the scale is 15 per cent.

London.—POPULAR.—The Electricity Committee recommends that the charges for electricity for lighting be increased by 10 per cent, as from October 1st next. The Committee reports that the net profits of the electricity undertaking for the year ended March 31st last were £12,011, of which £7,702 was available for distribution, £3,059 was recommended for the relief of rates, £1,418 for bonus to staff, and £3,224 for reduction of assets.

The City Corporation proposes to agree to the City of London Electric Light Co. increasing its rates for public lighting by 15 per cent. until a year after the war.

Londonderry.—Mr. J. Christie, engineer and manager of the Brighton Corporation electricity undertaking, has been invited by the authorities to collaborate with the resident city engineer in carrying out the extension of the electricity installation in the shipyard.—*Daily Telegraph*.

Mansfield.—YEAR'S WORKING.—The annual report of the Electricity Committee for the year ended March 31st shows a gross profit of £7,121, as compared with £7,934 in 1916, and, after payment of interest on loans (£3,133), contributions to sinking fund (£2,366), a net profit remains of £1,664, as against £2,718. Coal has cost about £1,140 more and taxes £200 more than in the previous year, but the expenditure on mains and services has been £2,160 less. An item of £489, balance of income-tax, stands over, there being a question as to liability of payment. The Committee has decided to pay over the sum of £500 to the general district rate, and to appropriate the balance of £1,087 to the reserve fund.

Mytholmroyd.—E.L. PROPOSALS.—Having been informed by the Electrical Distribution of Yorkshire, Ltd., that it is about

to make application for lighting powers within the district, the U.D.C. has decided to notify the company that Mytholmroyd does not consent to the proposed prov. order.

Newcastle (Co. Down).—The Urban Council has now accepted the tender of the Irish Towns Lighting Co., Belfast, for the lighting of the town by electricity for the ensuing three years, at £230 per annum.

Norwich.—YEAR'S WORKING.—The report of the Electricity Committee for the year ended March 31st last, shows gross receipts amounting to £57,187, working expenses amounting to £39,293, and after meeting financial charges, &c., the sum of £17,011 was carried to appropriation, as compared with £14,503 in the previous year. From the appropriation account £271 was paid for sub-station premises, £2,283 carried to depreciation, and the balance carried forward. The output advanced by more than 1½ million units to a total of 9½ million units in the year. It was decided to reduce the charge for public lighting to one-third (a saving of £1,100 per annum), which, with the extra cost of labour, represented the proceeds of the extra 5 per cent. added to current charges. It was also decided to obtain a 3½-ton electric wagon from Messrs. Ransomes, Sims, & Jefferies.

Nuneaton.—The Electricity Committee has considered the question of a site for a new generating station, and has recommended the Council to purchase about 3½ acres adjoining the Corporation pumping station, at a cost of £1,200.

Rotherham.—The Sheffield Corporation has given notice to the R.D.C. of its intention to apply to the B. of T. for an Order for the distribution of electricity within the Council's area.

Rochdale.—NEW PLANT.—The Corporation Electricity Committee recommends the installation of three new mechanical stokers of the Babcock type at the generating station, at a cost of about £6,000. The L.G.B. has approved a loan of over £20,000 for extensions to the buildings and plant, and some of this work is already being carried out.

Sutton (Surrey).—The South Metropolitan Electric Tramways and Lighting Co. has informed consumers that the minimum charge of 13s. 4d. per quarter, hitherto not enforced, has been put into operation.

Tunbridge Wells.—YEAR'S WORKING.—The working of the electricity undertaking for the year ended March, 1917, resulted in a total revenue of £15,205, working costs amounting to £8,547, and a gross profit of £6,659, as against £7,214 for the previous year. Interest and repayment of capital dropped from £6,615 to £6,112, leaving a net surplus of £545 against £598. The output in units sold increased from 1,095,874 to 1,188,478; power and heating accounted for 612,073 units, as against 464,690, and the lighting units were 576,405, as against 631,184. There were 317 KW. connected during the year, bringing the total connections to the mains up to 4,164 KW. Some 238 tons less coal were burnt and 173,464 extra units generated. The coal used per unit generated dropped from 6'1 to 5'1 lb., the coal cost per unit sold was reduced from 9'6d. to 8'9d., and these results were obtained without any increase on the pre-war charges.

West Bromwich.—YEAR'S WORKING.—The annual report of the Corporation's electricity undertaking shows that the receipts were £32,047, compared with £24,173 in the previous year. The expenditure on trading account was £29,458, an increase of £8,403, and the gross profit was £2,589, a decrease of £528. Loan charges amounted to £7,285, and there was a net loss of £4,696. The balance remaining in the reserve fund was £2,162. The scale of charges had been advanced during part of the year, but these, it was stated, had not been sufficient to meet the additional cost of manufacture caused by the constant advance in the price of coal, wages, repairs, and maintenance. The Committee recommended further increases in the price of electricity for lighting and motive power purposes as well.

West Ham.—YEAR'S WORKING.—The total income of the electricity undertaking for the year ended March 31st last was £157,148, as compared with £143,611 in the previous 12 months. The total expenditure on revenue account amounted to £110,037, as against £120,066 in the previous 12 months. Including repayment of loans, contributions to sinking fund, and interest, there was a net deficiency of £35,424. The borough treasurer says it is important to consider whether the revised charges still to be put into operation are adequate to meet the case, especially when it is borne in mind that the major portion of the supply is for power for private trading, and that substantial deficits are being charged against the rates—the deficit for this year alone, after deducting allowances to men on active service (£4,612), representing a rate of about 6d. in the £. The Committee is further reminded that there is no reserve or renewal fund to meet any further demands for replacements of any portion of the assets required before the expiration of the loan periods.

Willesden.—There was a surplus of £1,614 on the net revenue account of the electricity undertaking for the year ended March 31st, 1917. The electrical engineer has been instructed by his Committee to point out to the Government Departments concerned conflicting instructions issued by them. It appears that the Priority Branch of the Ministry of Munitions, on July 5th, 1917, prohibited the installation of any new plant without a permit, whereas a letter from the Coal Controller urged the installation of electric heating and cooking apparatus to effect economy in the consumption of coal.

TRAMWAY and RAILWAY NOTES.

Australia.—The employees of the Western Australian Government Tramways are dissatisfied with the result of the recent arbitration award. The Court gave an increase of wages which they expected to be retrospective to December 19th, 1916. The Railway Commissioners have declined to accept this date, and have applied to the Court for an interpretation of the retrospective clause.—*Sydney Daily Telegraph*.

Bradford.—At a meeting of the Tramways Committee it was reported that all claims arising out of the tramway accident at Wyke, last January, had now been settled, the total cost amounting to £2,377.

Continental.—**RUSSIA.**—It is stated in the *Noroye Fremya* that the Minister of Ways of Communication has instructed the engineer, G. E. Grahptlo, to report on the possibility of introducing electric traction in some sections of the Russian railway system, to take the place of steam. This is no doubt due to the present lack of fuel and the prospective scarcity of it in some parts of Russia, even after the war.

PORTUGAL.—In the course of recent labour troubles at Lisbon, the tramway service has been completely stopped.

Darwen.—There was a deficiency of £2,806 on the tramways undertaking for the year ended March 31st last.

Huddersfield.—The manager having reported on the advisability of doubling the track on the Bradley section, the Tramways Committee has decided that application be made for authority to purchase the necessary materials.

Kirkcaldy.—**YEAR'S WORKING.**—The annual report of the Corporation tramways department for the year ended May 15th, 1917, shows a total income of £18,816, working expenses amounting to £12,707, and a gross profit of £6,109; after deducting interest, sinking fund, and other charges, amounting to £5,690, there remains a credit balance of £418. The passengers carried amounted to 5,272,292, a reduction of 130,916. Ordinary halfpenny fares were abolished in September, 1916, and the traffic receipts have increased by £1,377 over the previous year. The average traffic receipts per car-mile were 10'152d., and operating costs 7'01d. per car-mile.

Leeds.—**WOMEN INSPECTORS.**—The proposed appointment of female tramway inspectors is understood to be not favourably received amongst a large section of the employees, and women conductors are amongst the strongest opponents of the idea. The workers concerned object that these jobs should be given to men with long experience in the service, and to men who have come to the tramway from the Army. The employees have taken the matter to their Union, of which most of the women conductors are now members, and the Union has put its views before the Tramways Committee.

Londonderry.—**PROPOSED ELECTRIC CARS.**—At the meeting of the Corporation, on Monday last, a resolution was passed in favour of obtaining powers to run electric railless trolley vehicles, or, in the alternative, motor-buses or electric cars. The general opinion was that the city should have a more up-to-date means of street locomotion.

Manchester.—**WAGES AWARD.**—The Commissioners of the Committee on Production who inquired into the application of the employees of the Corporation for an increase in the war bonus of 2s. 6d. awarded them on June 11th last, have decided that the workpeople have not made out any case for such advance. The text of the award is as follows:—"The Committee on Production on July 16th heard representatives of the Manchester Corporation and the Manchester Corporation tramway workers, and gave the fullest opportunity to enable the employees to give particulars of any difficulties relating to the advance given under the finding of June 11th, and of any special conditions that may operate in Manchester, and having heard the representatives of the Corporation in reply, the Committee's decision is that the case presented to them differed in no material particular from that put forward for hearing on June 8th, and offered no reason for a departure from the award of June 11th." When the Minister of Labour intervened in the Manchester tramway dispute on July 6th the employees at a mass meeting decided to abide loyally by the decision which would be reached as the result of his intervention.

Salvador.—H.M. Consul reports that a British subject has secured a concession to operate electric street cars, for a term of 75 years, in San Salvador and its suburbs. The track is to be of the groove type, and the length of the proposed lines, which will replace the existing mule tramway lines, will be 18 km. (about 11 miles). The concessionaire has the right to increase the track to 50 km. (about 31 miles) later. The State will subsidise the new lines. *Board of Trade Journal*.

South Africa.—The revenue of the Johannesburg municipal tramways for the year ended March last was £35,000 and the profit £6,351. The average working profit per car-mile was 10'21d., compared with only 7'25d. in the previous year.

Southend-on-Sea.—The Tramways Committee has considered the question of providing and fixing a safety device for arresting the fall of trolley booms which may leave the overhead equipment, and has instructed the electrical engineer to provide his safety device upon each of the cars, at an estimated cost

of £3 10s. each. The electrical engineer is to report as to the practicability of running a service of through cars from Leigh to Southchurch and to the Beach.

Tynemouth.—**PROPOSED TRAMWAY DEVELOPMENT.**—The T.C. is considering a scheme for the development of that portion of the Tynemouth and District Electric Tramway Co.'s undertaking which lies in the borough, and which, in March, 1920, it will have the option of purchasing. The present line runs from the New Quay, North Shields, to the end of the Grand Parade, Tynemouth. A Sub-Committee, specially appointed, considered the matter, and recommended that a scheme be provided for a service to connect the several residential areas with the railway station, the shopping district, public institutions, places of worship and entertainment, works, the ferries, and the coast; to link-up the borough with Newcastle and the interlying districts; and to facilitate the development of unbuilt areas which are not now easy of access. The present narrow-gauge system is condemned as unsatisfactory, and it was held that the gauge should be the same as the Tyneside Co.'s system to facilitate through services. The scheme also outlined five different routes. The subject is at present before the Trade and Commerce Committee.

U.S.A.—A recent issue of the *Railway Gazette*, discussing the operating results of the electrified Elkhorn division of the Norfolk and Western Railroad, says the system is a single-phase 11,000-volt, 25-cycle distribution to the trolley, the locomotives being equipped with phase converters and step-down transformers, which convert the single-phase to three-phase energy for use in induction type motors. Electric operation resulted in increasing the speed from 7 to 14 M.P.H., the traffic being mineral. The loco.-mileage increased from an average of 60 under steam to 100 with electric locomotives, per day; practically, the latter can run 24 hours per day. As a result, the number of locomotives dealt with at Bluefield has been reduced from 17 steam to 5 electric, and banking engines from 7 steam to 2 electric. The number of steam locomotives required to deal with the maximum day's traffic was 43, but the heaviest day with electric working was handled by 9 locomotives. Under electric working an increase of 25 per cent. in loaded cars going east, occurred over steam working in 1914; but a decrease of 48 per cent. in engine-hours occurred, despite this. The electric locomotives have not only increased the capacity of the line by 100 per cent., with a considerable reduction in operating costs, but are likewise paying a return on the net cost of the installation.

West Ham.—**YEAR'S WORKING.**—The income of the tramway undertaking for the year ended March 31st last amounted to £166,142, as against £164,110 in the previous 12 months. The expenditure came to £149,989, as against £124,926 in the 12 months ended March 31st, 1916. Deducting interest, repayments of loans, renewals to permanent way, &c., and £16,670, allowances to men on active service, the deficit for the year was £41,197, as against a deficit last year of £10,462. The borough treasurer, in submitting the above figures, suggests that immediate consideration should be given to the question whether the present basis of charge for traffic revenue is sufficient. He points out that after taking in the deficiency for this year, the total either charged or chargeable to rates amounted to £71,026, in addition to which there was a short payment in respect of rates during the period from the commencement to 1909, when the undertaking was not fully rated.

Wolverhampton.—**WAGES ARBITRATION.**—The award of the Chief Industrial Commissioner, in the differences between the Corporation and its employees on the tramways, is an advance in wages of 5s. per week to workers of the age of 18 and upwards, and 2s. 6d. per week under that age, to take effect as from April 1st. Time and-a-quarter is to be paid to members of the traffic staff in respect of all hours worked on week days in excess of 10, and time and-a-half paid for Sundays in respect of Sunday excursion and other special cars run outside and beyond the ordinary Sunday working hours. The case of cleaners and other night workers is left for the consideration of the Corporation.

TELEGRAPH and TELEPHONE NOTES.

Brave Wireless Operator.—The Rear-Admiral Commanding the British Naval Forces in the Adriatic has forwarded to the Admiralty the wireless telegraph logs of H.M. trawler *Floanda*, as an exhibit for the National War Museum. This log was found in a damaged condition in the wireless operating cabin of H.M. drifter *Floanda* after an attack on the drifter line by three Austrian cruisers in the Adriatic on May 15th last. The wireless operator, Douglas Morris Harris, R.N.V.R., continued to send and receive messages, although the drifter was being riddled by shells, until he was killed by a piece of shrapnel whilst writing in the log. Before joining the Navy, Harris was engaged on the clerical staff of the Wolverhampton Corporation Electricity Department for a period of nearly three years.

Halifax.—At Halifax Juvenile Court, last week, five boys were fined £1 each for throwing stones at telegraph insulators. The Magistrate intimated that future offenders in this way would receive more severe punishment.

Secret Wireless in Norway.—The police have discovered two secret wireless stations in Norway. One was at Hangesund, in a bower in a small forest, and the other on an island at Arendal.—*Daily Telegraph*.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—**SYDNEY.**—August 22nd. N.S.W. Government Railways and Tramways. Thirty-six induction motors (Specification No. 488). September 19th.—One 225-H.P. synchronous motor (Specification No. 489). Particulars from Electrical Engineer's Office, 61, Hunter Street, Sydney.

MELBOURNE.—October 10th. Department of the Navy. Pumping plant and equipment for the Commonwealth Naval Dockyard, Cockatoo Island, Sydney. Specifications from the Director of Navy Contracts, Melbourne.

Blackburn.—August 4th. Steam coal for 12 months for the Electricity Department. Mr. P. P. Wheelwright, Engineer and Manager.

Ilford.—July 31st. Electricity Department. Two rotary or motor converters, 4,400 yards E.H.T. cable, 3,600 yards stoneware conduit. See "Official Notices" July 20th.

Keighley.—August 3rd. 12,000 tons best slack and small slack coal for Electricity Department. Six-monthly and twelve-monthly period. Mr. H. Webber, Boro' Electrical Engineer.

Warrington.—August 14th. 7,500 tons of slack coal for the Electricity and Tramways Committee during six months from September 10th, 1917, and alternatively for part or whole of 15,000 tons of slack during 12 months. Mr. F. V. L. Mathias, Borough Electrical and Tramways Engineer, Howley, Warrington

CLOSED.

Australia.—**MELBOURNE.**—Electricity Supply Committee. Accepted tenders:—

699,000 carbons, £2,629.—Beacon Carbons, Ltd.
260 cast-iron boxes, £508.—Cleveland Engineering Co.
150 contact suspension gears, £337.—Lawrence & Hanson Elect. Co., Ltd.
10,000 metal-filament lamps, £667.—Aust. General Electric Co.
1,700 gas-fitted metal-filament lamps, £1,206.—Aust. General Electric Co.
Meters.—Group A, £500, ditto B, £467, ditto D, £490: British Westinghouse Manufacturing Co. Group C, £1,228: Reason Manufacturing Co.

—Tenders.

Government Contracts.—List of new contracts placed during June, 1917:—

WAR OFFICE.

X-ray apparatus and accessories.—F. R. Butt & Co., Ltd.; Cavendish Electrical Co., Ltd.; H. W. Cox & Co., Ltd.; A. E. Dean; Edison Swan Electric Co., Ltd.; Everett, Edgumbe & Co., Ltd.; Medical Supply Association; Watson & Sons (Electro-Medical), Ltd.; White Electrical Instrument Co.

Electric bells.—Cox-Walkers, Ltd.; Peel-Conner Telephone Works, Ltd.
Bridge meggers.—Evershed & Vignoles, Ltd.
Cells (electric).—Siemens Bros. & Co., Ltd.
Insulator cups.—T. De la Rue & Co., Ltd.; Litholite, Ltd.
Electric light fittings and accessories.—Edison Swan Electric Co., Ltd.; General Accessories Co., Ltd.; General Electric Co., Ltd.; J. Sax and Co., Ltd.

Galvanometers.—R. W. Paul.
Copper wire.—Callender's Cable & Construction Co., Ltd.
Electric wire.—British Insulated & Helsby Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; Connolly Bros., Ltd.; W. T. Glover and Co., Ltd.; Liverpool Electric Cable Co., Ltd.; London Electric Wire Co. & Smiths, Ltd.; Midland Electric Wire Co., Ltd.; St. Helens Cable and Rubber Co.; Ward & Goldstone.

Works services.—Installation of electric light: Ellis & Ward, Ltd.

POST OFFICE.

Telegraph apparatus.—Automatic Telephone Mfg. Co., Ltd.; I.R., G.P. and Telegraph Works Co., Ltd.; W. G. Pye & Co.; R. Stafford, Tyler and Co., Ltd.

Telephone apparatus.—British L. M. Ericsson Mfg. Co., Ltd.; General Electric Co., Ltd.; Peel-Conner Telephone Works, Ltd.; Western Electric Co., Ltd.

Telegraph cable.—General Electric Co., Ltd.; Henley's Telegraph Works Co., Ltd.; Siemens Bros. & Co., Ltd.; Telegraph Construction and Maintenance Co., Ltd.; Western Electric Co., Ltd.

Cells.—Siemens Bros. & Co., Ltd.
Arm grips.—Bayliss, Jones & Bayliss, Ltd.
Terminal irons.—Walls, Ltd.

Glow lamps.—British Thomson-Houston Co., Ltd.; Edison Swan Electric Co., Ltd.; General Electric Co., Ltd.

Distribution cable plugs.—B.J. & Helsby Cables, Ltd.

Stay rod.—Bayliss, Jones & Bayliss, Ltd.

Insulator spindles.—Bullers, Ltd.

Cable suspenders.—E. & J. Richardson.

Bronze wire.—T. Bolton & Sons, Ltd.; B.J. & Helsby Cables, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co. (incorporated in the London Electric Wire Co. & Smiths, Ltd.).

Copper wire.—T. Bolton & Sons, Ltd.; B.J. & Helsby Cables, Ltd.; Elliott's Metal Co., Ltd.; R. Johnson & Nephew, Ltd.; F. Smith and Co. (incorporated in the London Electric Wire Co. & Smiths, Ltd.); Shropshire Iron Co., Ltd.; J. Wilkes, Son & Mapplebeck, Ltd.

Galvanised-iron wire.—Dorman, Long & Co., Ltd.; Rylands Bros., Ltd.; Shropshire Iron Co., Ltd.

V.I.R. wire.—Union Cable Co., Ltd.

Laying pipes and ducts, Whitehall, S.W.—J. Mowlem & Co., Ltd.

Two electrically-driven fans at Great George Street, S.W.—Sturtevant Engineering Co., Ltd.

Johannesburg.—Council. Tenders for 25 commutators for trams:—

Rand Electrical Co., £37 each; eight in four weeks, balance five weeks later (made in Johannesburg).

British Mining Supply Co., £12 7s. 6d. each; 14 weeks, subject to Ministry of Munitions (made in London, France & Co.).

Hubert Davies & Co. accepted, £11 3s. each; 12 weeks at makers' works, subject to priority certificate (made in England, Duck, Kerr and Co.).

Tenders for 10,000 carbon brushes for tramcar motors:—

Stanton & Co., 28s. each (made in England).

Hubert Davies & Co. (accepted), 3d. each (made in England).

Griffin Engineering Co., 32s. each (made in France).

R. H. Gould & Co., 34s. each (made in France).

Rintoul & Davis, 5s. each (made in France).

Newport (Mon.)—Electricity Committee. E. Green and Son: Alterations and additions to fuel economiser, £711.

New Zealand.—**WELLINGTON.**—The Public Service Stores Tender Board has received the following tenders for 100 miles of 1/18 rubber-insulated wire:—

P. R. Baillie & Co.	accepted	£2,800
Richardson, McCabe & Co., Ltd.		2,397
P. R. Baillie & Co.		2,474
E. W. Cardale		2,585
Tolley & Sons, Ltd.		2,750
F. W. Markmann		3,764
Turnbull & Jones, Ltd.		3,000

* Delivered from Australia.

—N.Z. Shipping and Commerce.

Weymouth.—T.C. Coal for the electricity works:—

G. Bryer Ash.—Best through steam coal, 24s. 9d. per ton; best Writhlington small coal, 21s. 9d. per ton; Gwann Cal Gurwen washed anthracite nuts, £2 2s. per ton; Pontheny washed anthracite nuts, £2 2s. 6d. per ton, delivered free into bunkers.

NOTES.

Federated Labour.—The *Daily Telegraph* states that the organisation of the National Federation of General Workers is now complete. Mr. Clynes, M.P., has been elected president of the Federation; Mr. J. N. Bell (Newcastle), vice-chairman; and Mr. J. O'Grady, M.P., general secretary. The Federation represents a number of labourers' unions, with a total membership of a half a million.

Cleaning Insulators.—In the article published in our issue of June 22nd on this subject, the use of Quebracho was strongly recommended. As this substance—a boiler composition, obtained from Argentina—may not be generally known, we may say that it is obtainable from the sole British agents, Messrs. McArthur & Co., Tower Buildings, Liverpool.

Employment of Disabled Soldiers.—The steps that have been taken by the Institution of Electrical Engineers and other public bodies to provide for the training of disabled fighting men, to enable them to perform the duties of switchboard and substation attendants, have been from time to time recorded in our pages. Needless to say, the training is intended for the benefit of men from the ranks who have not had the advantage of a thorough education and have been rendered unfit to follow their former callings by injuries sustained in the war. We note with surprise, therefore, that a municipal undertaking is advertising for invalid young officers to act as switchboard attendants, at a salary, inclusive of war bonus, of 37s. a week.

Without wishing for a moment to disparage the capabilities and merits of the lower ranks who have suffered for their country, we cannot help feeling that this offer borders upon an insult to the men who have been judged fit to lead their platoons and companies "over the top," who have received a liberal education, and who in civilian life have occupied positions of trust and responsibility. Have we nothing better to offer to our disabled officers than work which, in many cases, is now performed by women after a few weeks' training? And is it right, on the other hand, that the men who have the first claim on such appointments should be put into competition with officers, against whose qualifications they would have no chance?

The proposal appears to us to be in every aspect inappropriate and ill-advised, and we trust that its originators will realise that an error has been made in putting it forward.

An Industrial Training College.—Messrs. Lever Bros. have just established at Port Sunlight a staff training college, which is a model of its kind and an object-lesson to other great industrial concerns. The college has an advisory committee, a competent principal, and a board of studies consisting of experts.

The scheme has the unique feature of training the staff in the firm's time, instead of in the evening in the employé's time. One branch of the college comes under the head of technical and the other commercial. The technical branch has a staff of experts dealing with electrical matters, building, chemistry, engineering, and printing, the sub-sections including teachers in drawing, mathematics and physiography. On the commercial side there are expert teachers in accountancy, finance, buying and selling, and secretarial practice, the subjects under this branch including English, correspondence and office routine, commercial geography, arithmetic, typing, shorthand and book-keeping. The college staff consists altogether of 28 under the direction of Principal J. Knox, M.A. We hope that Messrs. Lever Bros.' example will be followed by other large industrial establishments.—*Daily Chronicle*.

Volunteer Notes.—COUNTY OF LONDON VOLUNTEER ENGINEERS (FIELD COMPANIES).—Headquarters, Balderton Street, Oxford Street, W.

Orders for the week, by Lieut.-Colonel C. B. Clay, V.D., commanding:—
Officer for the week, Platoon Commander P. Bowden.

Monday, July 30th.—Technical instruction (searchlight) for No. 3 Company, Right Half Company, at Regency Street. Drill, No. 3 Company, Left Half Company. Signalling Class. Recruits' Drill, 6.30.

Tuesday, July 31st.—Lecture, 6.30. Physical drill and bayonet fighting, 7.30.

Wednesday, August 1st.—Drill and elementary bridge construction, No. 1 Company, Left Half Company.

Thursday, August 2nd.—Drill and elementary bridge construction No. 2 Company, Left Half Company. Ambulance Class.

Friday, August 3rd.—Technical instruction (searchlight) for No. 3 Company, Left Half Company, at Regency Street. Drill, No. 3 Company, Right Half Company. Signalling Class. Recruits' Drill, 6.30.

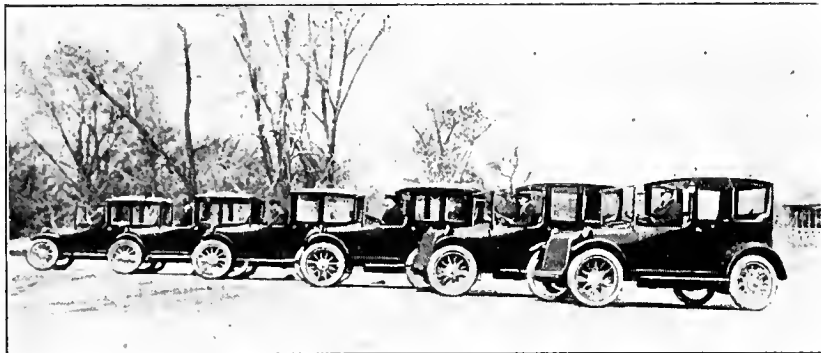
Saturday, August 4th, to Monday, August 13th.—A camp will be held at Esher from August 4th to 12th. Parade at Waterloo, opposite No. 10 Platform, on Saturday, August 4th, at 2 p.m.

Headquarters.—Headquarters at Balderton Street closed August 4th to 12th. Headquarters will be transferred to Clarendon Park, Esher, for that period.

Holiday Addresses.—These must be given in to the Orderly Room without fail.

MACLEOD YEARSLEY, Company Commander and Adjutant.

Electric Taxicabs in the U.S.A.—The most recent installation of electric taxicabs, which have met with phenomenal success in Detroit, is in St. Louis, where six cars make up the nucleus of a fleet. The clean, silent, smooth-running, attractive electric taxicab has made a strong and immediate appeal, and has proved itself to be extremely well fitted for this service, especially because of its low operating costs and its simplicity of operation through congested streets, ensuring safety to its occupants. The mileage of these "electrics" is practically unlimited, as facilities



ELECTRIC TAXICABS IN ST. LOUIS.

for curb "boosting" are provided in various parts of the city, so that the battery may be charged while it is waiting, even though it may be only a few minutes.

The Electric Vehicle Section of the National Electric Light Association is advised that an electric taxicab company is now being organised in Mexico City, and it is interesting to note that whereas the electric taxicab met its first success in Detroit, the home of the gasoline car, it is now to compete with the gas car in the vicinity of hundreds of oil wells.

Apart from the generally appreciated virtues of the electric taxicab, it is cosmopolitan, for we also find it in successful operation in Shanghai, China, where it has to a great extent replaced the quaint and quite inexpensive jinricksha.

Progress is being made in the provision of an initial fleet of about 500 electric taxicabs of the most advanced type, which it is intended to install in New York City.

Westinghouse Turbo-Alternators.—With reference to our article on this subject in our last issue, we find that the endeavour to squeeze the essence of the pamphlets reviewed into the space at our command has resulted in a loss of accuracy in the following respects:—While the British Westinghouse Co., as stated, have taken out licences to manufacture under the Rateau patents, and have adopted the impulse principle for their standard machines, the American Westinghouse Co. still manufacture the "drum and disk" type. In cases where no advantage is to be gained by the use of the velocity wheel on the high-pressure end of the turbine, it is not provided, the turbine rotor then consisting throughout of wheels having single rows of blades. The over-speed device not only closes the main governor valve by releasing the oil pressure in the relay cylinder, as stated, but also trips the external stop valve, which is shut down by a spring. The statement that small turbines can compete with the high-speed steam or gas engine in price and efficiency, which we reproduced from the pamphlet, requires modification; the makers now point out that such machines present many advantages when used on board ship or for driving auxiliaries in large power stations, since they do not require internal lubrication, the exhaust steam is therefore free from oil, and the heat contained in the exhaust can be most advantageously utilised in a feed heater. But apart from this, considered independently on their merits as producers of power, small turbines of the type in question are not considered as economical as high-speed steam or gas engines.

Department of Scientific and Industrial Research.—The offices of the above Department (including the Fuel Research Board) have been removed to 15, Great George Street, S.W., which is nearly opposite to the Department's present offices. Telegraphic address: "Resciendus, Parl., London." Official telephone number as before—Victoria 7910 (two lines).

Electric Light Switching.—Messrs. Lundbergs' examinations have the advantage that the papers may be worked at home, in camp, or on board ship, whenever there is any available leisure. Any of these papers may be had on application to the firm at 477—489, Liverpool Road, London, N. 7, and the answers may be submitted as soon as worked. The papers are revised from time to time, and we have just received a new Intermediate Grade paper which, we are told, contains an entirely fresh set of problems. There are 12 questions in all, and as the examinee is not allowed to tackle more than nine of them, and need only attempt seven, he has a wide choice.

The Wild-Barfield Steel-Hardening Process.—The Wild-Barfield patent process of steel hardening as worked by the Westminster Electrical Testing Laboratory, to which we recently referred, was described in the last issue of the *American Machinist*. Electrical resistance furnaces are used; the gauge or other article is heated in one bath and quenched in another, special salts being used in each case. The heating bath has both an ordinary heating coil and in addition an outside winding of small-diameter wire, which is simply connected direct to a galvanometer. The main winding, besides forming a source of heat, also magnetises the object to be hardened. The temperature required is determined approximately by means of a thermo-couple pyrometer. Quenching does not depend on this, however, but on the firm's pyroscopic detector. At the temperature correct for quenching, carbon steel becomes non-magnetic, and the collapse of the magnetism produces an electromotive force in the outer winding, and thus

causes a deflection of the galvanometer needle, the deflection persisting for the whole time during which the steel is passing through the decalescence temperature. As soon as the galvanometer needle returns to zero, the steel is removed from the heating furnace and quenched. By heating the steel quickly in the bath, the minimum of surface decarbonisation and oxidation occurs, with also the minimum of viscous flow on the surface of the article, and therefore of change of form. The quenching mixture employed has a high vaporising point, and therefore does not produce vapours, giving even cooling with even hardening effect and prevention of distortion. This, of course, contrasts with the use of water for the same purpose, the water giving off steam. The furnace takes 1,300 watts when fully at work and 600 watts standing, and this, with energy at 1d. a unit, is said to work out at about 2s. a day, continuous working. The furnace shown at a recent demonstration takes articles up to 2 in. diam. The demonstration was made in connection with the hardening of a thread gauge of about $\frac{1}{4}$ in. diam., the time required in the heating bath being 1½ min. Ganges can be used practically direct from the bath, requiring no special cleaning, and the only visible effect of hardening is to render them black instead of bright in appearance.

Sentence.—At the Acton Police Court, last Friday, Harry H. Sheppard, 45, an electrical engineer, was sentenced to four months' imprisonment with hard labour for stealing electric fittings valued at £70 8s., the property of his employers, Messrs. C. A. Vandervell & Co. Defendant had been in the firm's service for a year and 10 months, and his wages, with war bonus, were £4 6s. per week. He was in the employ of the Sheffield Corporation for some years, and had never been in trouble before. The goods were taken for his small business at Hammersmith, and his friends attributed the present case to worry, trouble, and illness in his family.

B. of T. Committee on Electrical Supply.—The Association of Municipal Corporations has sent out a circular letter with regard to the B. of T. Committee on Electrical Supply. The Association states that three witnesses have been nominated by the Association to give evidence before the Committee, from the city of Leeds and the boroughs of Blackburn and Sutton Coldfield respectively, the inquiry being obviously one of great importance to those municipalities who own electrical undertakings, and points out that the following, amongst other questions, will probably come under consideration:—(a) The question of forming entirely new and large areas of supply and distribution, irrespective of existing municipal boundaries; (b) the question of the constitution of the managing body to deal with the supply in each of these areas. The Association asks to be furnished with any observations which Councils think would be useful for their witnesses to have.

Air Raid Warnings.—Writing to the *Times*, Mr. W. H. Allen says that when it is determined whether sounds or scenes should prevail, there will be no difficulty about the former. Steam is absent from the City and County of London, while electric current is everywhere. A large diapason tube with a touch of gamba in it, supplied with compressed air from a motor-driven compressor, will reach large areas, and can easily be put up in the fire stations of the various municipalities.

Prohibited Exports.—The supplement to the *Board of Trade Journal* of July 26th contains complete lists of articles which, according to the latest information received by the Board of Trade, are prohibited to be exported from the Straits Settlements, Hong-Kong, Nigeria, Jamaica, Barbados, Trinidad and Tobago, and British Guiana.

Symbols for Electrical Tenders.—In accordance with a report of the City Electrical Engineer as to the method of comparison of the merits of tenders received for the supply of electrical plant, involving a valuation of a difference in electrical performance, the Sydney Municipal Council has approved of the following as an equation to express the relation between the capital expenditure and the annual cost involving the variables which enter into the calculation:—

$$x = y \left[\frac{(1 + b)^n - 1}{b - a + a(1 + b)^n} \right]$$

in which the symbols have the following significance:

- x = the capital sum, *i.e.*, the excess capital value of the higher-priced apparatus.
- y = the annual excess cost of using the less efficient apparatus.
- n = the number of years estimated to be the life of the apparatus.
- a = the rate of interest payable for loans at the date of purchase, expressed decimally (*i.e.*, 5 per cent. would be expressed as '05).
- b = the rate of interest obtainable on sinking funds.

Post-War Foreign Trade Competition Measures.

Ever since the European war started in the summer of 1914, says the *Electrical World*, countless rumours have gone out regarding the action that was to be taken by German industries in foreign trade after the war was over. The most persistent rumour has been that German goods would be dumped upon the markets of the world in such quantities as to flood them.

The dye manufacturers of the world know full well the methods employed by the German dye manufacturers to secure the control of the dye industry of the world. It amounted to nothing more or less than putting German goods on foreign markets to be sold at a price less than it cost the domestic manufacturer to produce goods of similar quality. Of course, the German manufacturers were losing money on the transaction, but they had prepared for it for a long time, and had laid up a reserve to be used for just such a campaign. As a result it was not long before the German manufacturers had this market in their control, and when the war broke out the world found itself at a loss to secure sufficient materials of this character.

Recent investigations show that the German electrical manufacturers have undoubtedly something of the same kind in mind for foreign trade competition after the war is over. It is now definitely known that certain of the more important German electrical manufacturers have since the war began been accumulating large surpluses designated as reserves to be used in after-the-war commerce.

Right now American and English manufacturers are enjoying practically the entire foreign trade of the world in electrical goods, but their prices are high, particularly those of American-made goods. The American foreign trade in electrical goods has virtually doubled since the war began. In order to retain this trade after the war German competition will have to be met, and if the above indications are finally borne out, then it becomes evident that American manufacturers must employ some similar measures in order to protect their interests in foreign trade as soon as the war is over. American manufacturers are now enjoying a larger business than ever before, and are in a position, generally speaking, to lay aside sufficient reserve for just such a contingency.

Educational.—UNIVERSITY OF MANCHESTER.

—We have received the prospectus of University courses in the Municipal School of Technology for the session 1917-18. Prof. Miles Walker is head of the Department of Electrical Engineering, assisted by Mr. J. L. Langton and Mr. A. E. Moore. The electrical equipment includes four 100-kw. steam dynamos and a 50-kw. turbo-generator, 100 motors aggregating 1,250 H.P., and a large number of experimental generators, motors, rotary converters and transformers, besides an ample equipment of instruments, &c.

Wire Lamp Patents in Germany.

—It is reported in the German newspapers that the Imperial Court has now given a definite decision in favour of the A.E.G. in the matter of Patent 269,498 for the manufacture of wolfram (tungsten) wire for lamps. The company in question acquired the patent for Germany some years ago from the United States General Electric Co., and then made an interchange of working rights with the Siemens & Halske Co. and the Auer Co., whilst a licence was subsequently granted to the Bergmann Co. The validity of the patent was contested by a competitive group consisting of the Pintsch Co., the Radium Co., the Bergmann Lamp Co., &c., and the proceedings have extended over a period of five years. As mentioned, the highest Court has now maintained the validity of the patent, and dismissed the application for a declaration of nullity. The Pintsch Co., as recently reported, has entered into a price agreement with the other companies controlling the patent for drawing thin tungsten wire, capable of being easily wound on formers, and other companies have also given their adhesion to the scheme.

Economies Effected by Electricity in Industrial Heating.

—In a doll factory at Chicago three 39-kw. electric drying ovens have been installed to drive moisture out of doll heads and bodies after they have been moulded from a plastic composition. This installation shortens the drying time from three or four days to one hour. The method previously used was air drying. It was impossible to use gas, owing to explosive vapours given off from

the plastic composition. Steam heat was out of the question on account of its inability to give sufficient high temperatures. The installation of electric ovens eliminated the work of eight girls, who were paid \$7 per week each. Electric heat also gave a much better product.

In a factory engaged in making paper roofing, an application of heat was necessary to join the ends of the paper passing through the process of manufacture. At first three tailors' irons were used for applying heat to the joint; with this process it was necessary to stop the machinery for five or six minutes. A home-made heating unit has replaced the irons. This consists of a large block of iron kept at a constant temperature by electric heat. Formerly, when the roofing machinery was stopped for the joining operation the parts remaining in the hot liquid, colouring liquid, or sand received a surplus of this material, thus materially reducing the quality of the roofing, which consequently had to be sold at a lower price. The installation of the iron block made it possible to complete operations without stopping the machinery. This contrivance, while it did not reduce labour charges, materially increased the production and also the quality of the goods. Three of these heaters are in use; two are rated at 18.5 kw. and one at 16 kw.

A third installation which is proving quite successful is a 236-kw. conveyor-type oven about 80 ft. (24 m.) long. It is used for jappanning automobile parts, and supplanted gas equipment; it is showing a consumption of 9 kw.-hours per 100 lb. (45.35 kg.) of metal baked, and still better results are expected when the workmen become more proficient in handling it. When the change from gas to electric heat was made the number of workmen required was reduced by six. A. F. Allsop, in the *Electrical World*.

Trade Openings.—The Department of Commercial Intelligence of the Board of Trade has received applications for the names of British manufacturers or producers of the following (amongst other) articles:—

- Carbon electrodes.
- Diamond dies for wire drawing.
- Boilers designed for using peat as fuel.
- Gas generators designed for peat.
- Machinery for excavating and generally handling peat.

Saving Labour on Pole Holes.—In the June issue of the *Telephone Engineer*, Mr. J. B. Stoneking describes the use of explosives as a substitute for digging in various sorts of soil. His attention was first called to the practicability of the dynamite method of hole digging by an old miner on some telephone line construction in Montana, where the men were paid a certain sum per hole. The soil was a clay loam slightly moist, but firm enough to require barring in digging the material. A bar was driven 30 in. into the ground to make a hole for the dynamite, from $\frac{1}{4}$ lb. to $\frac{1}{2}$ lb. of which was used per hole, generally without tamping, but in some cases in more compact material a short plug of wet clay was used. A bridge of earth was left over the cavity formed by the explosion, but a few blows with a shovel eaved this in, and the debris was removed from the bottom. A good hole from 10 to 14 in. in diameter and from 3 to 3½ ft. deep, when cleaned, was obtained, the sides and bottom being well compacted. The miner was enabled by this means to complete nearly twice as many holes per day as any other man in the digging crew.

Later trials in different soils have shown that what is a good loading practice for one condition does not always hold true for others, and it is necessary to shoot a few holes in order to arrive at a correct loading.

Better results have been obtained by removing the top earth to a depth of several inches and to the diameter of the pole hole desired before making the bore hole for the dynamite. This has the effect of relieving the pressure and diminishing the formation of the bridge over the cavity. In making the holes for the dynamite a punch bar driven by hammers, a soil auger with a long handle, or a churn drill is generally used, although a large telephone company uses a specially made hollow pipe which is churned up and down, doing very effective work in the soil, enough water being used to make a thin mud.

For deeper work, up to 6½ ft., very good drills are made by tying small pieces of from one-eighth to one-half cartridge to a small straight lath or stick, starting at the bottom end and spacing them about 6 to 12 in. apart, leaving the last piece about 18 to 24 in. below the top of the ground. This distributes the charge along the entire hole and packs the earth tightly against the sides, leaving a cavity from 12 to 18 in. in diameter. Sometimes the dynamite is inserted into a long roll or cylinder of heavy stiff paper, and held in place by sticking pins through it, or by cutting short sticks the length it is desired to space the cartridges. Care should always be taken not to allow earth to fall into and close the hole between the cartridges, for this has a tendency to break the detonating wave from one cartridge to another, and may result in misfires.

Ordinarily no tamping is necessary, but for harder material a small amount of tamping has the effect of confining the gases formed in the explosion and forcing them to do more work laterally. Tamping generally leaves a bridge over the cavity. By varying the size of the cartridges, the spacing apart along the hole, and the amount of tamping, in a few trial holes the engineer is able to obtain a system of loading to fit almost any conditions.

Due to the wide adaptability and elasticity of this method of digging holes, the quickness, absence of high first cost for equipment and overhead charges for maintenance, and low cost per hole, as compared to hand labour, it has met with much favour from engineers and contractors who have given it a thorough trial.

Appointments Vacant.—Shift engineer (63s.) for the Stalybridge, Hyde, Mossley and Dukinfield Tramways Board; draughtsman, engineering clerk of works (£285 + £15 bonus), assistant engineering clerk of works (£5 per week), and an electrical engineer (£5 per week), for a large power station; invalid young officers wanted to act as switchboard attendants in an electricity generating station (25s. + 12s. war bonus); switchboard attendant for the Stepney B.C. Electricity Department. See our advertising pages to-day.

Institution and Lecture Notes.—Diesel Engine Users' Association.—The June meeting of the Association was held during the week in which the Incorporated Municipal Electrical Association was holding its meetings in London. This arrangement had been made for the convenience of engineers in the provinces, who in some cases are members of both Associations, and who, in consequence of being at a long distance from London, may not have frequent opportunities of attending to discuss Diesel engine matters. There was a large attendance, including a few visitors interested in the Association's work who had been invited by the Committee to attend on this occasion. The election of several new members and "subscribers" was announced.

The result of the lengthy negotiations with the Inland Revenue authorities in the matter of the allowance for depreciation of Diesel engines for income-tax assessment was reported. The new rate allowed for this purpose for Diesel engines is 10 per cent., and this increased allowance is to remain in force for three years after the cessation of the war, when either party is to be at liberty to claim a revision.

Considerable interest had been aroused by Mr. Geoffrey Porter's paper on "Tar Oil Fuel and Diesel Engines," which had been read at the previous meeting, and in the course of the discussion which took place at this following meeting a further amount of useful information on the subject was forthcoming. In response to requests received from several quarters, the president announced that reprints of the report by Dr. E. Graefe on "The Influence of Sulphur in Liquid Fuels in Internal-Combustion Engines," which had been circulated among the members in February, 1915, would again be sent out to members and "subscribers" of the Association.

Illuminating Engineering Society (U.S.A.).—The Council has decided that any Member or Associate Member of the Society in good standing when entering the military or naval service of the United States, or any of its Allies, may upon request before October 1st, 1917, or if called out after that date, have his name retained upon the Membership Roll of the Society without payment of dues, during the year ending September 30th, 1918. The Council has invested \$1,000 in United States Liberty Bonds.

In lieu of the regular Annual Convention, which has been abandoned, the Society will hold a "Correspondence Convention," during which the papers prepared for this Annual Convention will be circulated, and written discussions on these papers may be submitted for publication. Any who are interested in such papers may receive a copy and submit discussions upon application to the General Offices of the Society, 29, West 39th Street, New York, N.Y.

Society of Engineers.—The balance-sheet for the year 1916 shows an excess of assets over liabilities of £753. The income was £673 and the expenditure £700, showing a deficit of £27.

Railway Employees' Wages, &c.—The Executive Committee of the Associated Society of Locomotive Engineers and Firemen was to meet the Railway Executive in London, on Tuesday, to discuss a programme of a universal eight hours' day for locomotive men; 14s. a day for drivers and electric motormen; 10s. a day for firemen; and 7s. a day for cleaners, with a sliding-scale arrangement to provide for any further increase in the cost of living.—*Times*.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station and Tramway Officials.—Exeter T.C. has rejected a proposal, by the Electricity Committee, to increase the salary of the engineer, Mr. H. D. MUNRO, from £475 to £550 a year.

Southwark Council's Electric Light Committee reports that it has received a report from Mr. D. M. KINGHORN, the electrical engineer, to the effect that on the National Service Act coming into operation, followed by the appeal to municipal officials to enrol, he offered his services to the Government, with the result that he has now been offered the position of general manager of an assembly station by the Trench Warfare Supply Department. The position is of great national importance, and he asks for the necessary permission of the Council to accept it. The Committee gave the matter very careful consideration, and, having regard to the whole of the circumstances surrounding the application, feels that it is one which it would not be advisable in the interests of the Council generally to grant. It has accordingly refused to grant the permission.

Grays U.D.C. has granted a war bonus of £20 a year to Mr. E. D. LONG, electrical engineer.

Bury Corporation Electricity Committee has congratulated Mr. S. J. WATSON, the borough electrical engineer, upon his election as President of the Municipal Electrical Association for the ensuing year.

Ashton-under-Lyne T.C. has increased the salary of Mr. W. A. WALES, chief assistant engineer in the electricity department of the Corporation, by £50 per annum. All officials of the Corporation in receipt of salaries under £300 a year are to have an increase or war bonus of 10 per cent.

Mr. C. H. MANNING desires to relinquish the duties of traffic superintendent under Preston Tramways Committee.

The salary of Mr. A. ASPINALL, electrical engineer to the Frithgouse Corporation, is to be increased from £160 to £169 per annum, as from April 1st.

General.—Mr. W. T. TARLETON, a member of the British Westinghouse staff in Johannesburg, and eldest son of Mr. W. I. Tarleton, mains superintendent of the Corporation electrical department at Cape Town, has joined the South African Field Artillery.

Mr. H. P. GIBBS, general manager of the Tata Hydro-electric Scheme in Bombay, has left for America on seven months' leave, and has given up the position of consulting electrical engineer to the Mysore Government. Mr. S. C. FORBES, chief electrical engineer in Mysore, having returned from leave, has taken over charge from Mr. S. D. SESHADRI IYENGAR, the chief operator from Sivasamudram.—*Indian Engineering*.

Mr. A. A. CAMPBELL SWINTON, F.R.S., has been elected chairman of the Council of the Royal Society of Arts.

According to the *Morning Post*, Mr. ROBERT MOLESWORTH KINDERSLEY has joined the board of the Eastern Telegraph Co., Ltd.

It is stated in the Press that previous to the changes in the Government, Dr. Addison had invited Sir Thomas Munro, County Clerk of Lanarkshire, to accept the position of Chief Director in the Labour Regulation Department of the Ministry of Munitions, in order to supervise the work in connection with general labour matters affecting wages and disputes, and, in particular, the formation, as soon as possible, of representative committees of employers and workpeople.

Roll of Honour.—Captain JAMES ANDERSON, K.O.Y.L.I., aged 28 years, who has died of wounds, was an electrical engineer.

Sergeant D. LAWRIE, who was an electrical engineer in Glasgow, is now officially presumed to have been killed in action. He had previously been posted as missing.

Private A. FRASER, Highland Light Infantry, who was formerly a conductor on the Glasgow Corporation tramways, has been awarded the Military Medal.

First-Class Wireman F. J. MARSHALL, lost by the blowing up of H.M.S. *Vanguard*, was, before joining the service, with Mr. J. Richards, electrical engineer, of Burton-on-Trent.

Lieutenant O. J. T. RUNGE, Machine Gun Corps, reported killed on October 15th, was formerly with Messrs. Fraser and Chalmers, of Erith. He came home from Montreal to enlist on the outbreak of war. He was awarded the Military Cross in June, 1916.

Private R. A. TAY, Royal Warwickshires, aged 22, who has been killed in action, was an electrician at the Jubilee Pits, Sandwell.

Corporal A. FEATHERSTONE, Manchester Regiment, awarded the Military Medal, was an employé of Messrs. C. Macintosh and Co., Ltd., electric wire and cable manufacturers, Manchester.

Private C. HAMPSON, Manchester Regiment, killed in action, was also employed by Messrs. C. Macintosh & Co., Ltd.

Fitter F. H. DAVIES, R.G.A., killed in action on July 5th, was employed at the Hulme Electric Works, Manchester.

Lieutenant H. BUTLER, R.F.C., killed, was on the staff of Messrs. Dick, Kerr & Co., Ltd., of Preston.

Obituary.—Mr. A. MOSELY.—We regret to record the death of Mr. Alfred Mosely, C.M.G., which occurred on Sunday, at the age of 62 years. It will be remembered that he organised an Industrial Commission to the U.S.A. in 1902, and an Educational Commission in 1903.

Sir C. S. MILBURN.—The late Sir Charles Stamp Milburn was a director of the Newcastle & District Electric Lighting Co., Ltd.

Mr. R. ROWLAND.—The death took place on July 7th of Mr. Richard Rowland, mains superintendent at the Peterborough Corporation electricity works. He was 37 years of age, and was brother of the acting engineer of the works, Mr. T. Rowland.

NEW COMPANIES REGISTERED.

Karting Bros. (1917), Ltd. (148,041).—Private company. Registered July 21st. Capital, £15,000 in £1 shares. Founders, electrical, mechanical, gas, heating, and ventilating engineers, &c. The subscribers (each with one share) are: F. G. Kerly, 10-11, Austin Friars, E.C., solicitor; H. Glenister, 28, Egerton Gardens, Hendon, N.W., solicitor's clerk. The first directors are: F. A. Robinson, E. H. Beckett, and O. Lindemann. Registered office: 53, Victoria Street, W.

Alfred Herbert (Russia), Ltd. (147,920).—Private company. Registered July 10th. Capital, £25,000 in £1 shares. To carry on in Russia, or elsewhere in Europe, Asia, the United Kingdom, the United States, and Canada the business of buying, selling, manufacturing, repairing, and letting on hire machinery, machine tools, plant, motor cars and cycles, electrical, hydraulic, and mechanical engineers, &c. The subscribers (each with one share) are A. Herbert, Dunkley Manor, Whitechurch, Hants, chairman of Alfred Herbert, Ltd., Coventry; H. C. Chambers, Harn, Blakesley Road, Yardley, Birmingham, solicitor's managing clerk. Permanent governing director: A. Herbert. Solicitors: Pinsent & Co., 6, Bennett's Hill, Birmingham.

National Union of Manufacturers, Incorporated (147,967).—Registered July 13th by Moreton, Phillips & Son, 11-12, Finsbury Square, E.C., as a company limited by guarantee, not formed for purpose of profit. The word "Limited" is omitted from the title by licence of the Board of Trade. The number of members is unlimited, and each member is liable for five guineas in the event of winding up. Objects: To undertake all or any of the liabilities and assets of an unincorporated association known as the British Manufacturers' Association, 1915, whose principal office is at 11, Paternoster Square, E.C., to promote the home, colonial, and foreign trades and industries of the United Kingdom, to encourage free intercourse between masters and workmen, to render pecuniary, legal, and other assistance to small essential industries in case of need (provided that no such assistance shall be given to members of the Association, and that the laws relating to charity and maintenance shall be observed), to collect and disseminate statistical and other information, &c. The management is vested in an executive council. President, G. Terrell, M.P. (Tyler & Co., Ltd.); deputy-chairman, R. L. Mathews (W. J. Turner & Co., Ltd.); treasurer, J. Walker (John Walker & Co., Ltd.). Solicitors: Moreton, Phillips & Son, 11-12, Finsbury Square, E.C. Secretary: G. W. Cheesman. Registered office: 11, Paternoster Square, E.C.

British Ignition Apparatus Association, Ltd. (148,001).—Private company. Registered July 18th by A. R. Monks, 123, Cannon Street, E.C., as a company limited by guarantee, with not more than 50 members, each liable for £1 in the event of winding up. Objects: To promote and protect the interests of manufacturers of ignition apparatus in the United Kingdom, to conduct and assist in experiments, to promote the standardisation of quality and form of ignition apparatus, and the adoption of equitable forms of contracts, &c. The subscribers (each with one share) are: P. F. Bennett, Ardencote, Four Oaks, manufacturer; R. B. North, St. Willfred's, Magden Lane, Walford, manufacturer; G. A. Lister, Coundon Road, Coventry, engineer; W. A. Anderson, 94, West Road, Westcliff-on-Sea, company secretary; G. H. Woods, 2, Norfolk Street, W.C., engineer; E. Garton, Tralee, Kenilworth, engineer; M. C. Lusk, 83, Cannon Street, E.C., manufacturer. The first members of the governing committee are to be appointed at the first general meeting. Registered office: 29-34, Mansion House Chambers, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Tyne Electric Steel Foundries.—Issue on June 19th, 1917, of £200, and on June 25th of £100 debentures, part of a series of which particulars have already been filed.

South Metropolitan Electric Light & Power Co., Ltd.—Second debenture dated July 18th, 1917, to secure £50,000 charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Minister of Munitions.

CITY NOTES.

British Thomson-Houston Co., Ltd.

In their report for 1916, the directors refer to the completion of the canteen and works extension at Willesden, and to the fact that a canteen is approaching completion at the Rugby works. Owing to further dilution of labour and the absence of employés who were familiar with the stocks, it was not possible to take an inventory at the Willesden factory and at the Rugby main factory, so that book figures had been relied upon. The usual complete inventory was taken at the other factories and branch offices. As stated last week, the profits, after deducting all expenses and charges other than debenture and loan interest, were £359,364, plus £73,359 brought forward. £50,000 is required for excess profit duty and munitions levy and for increased depreciation to the end of 1915. The reserve *re* raw materials made at December, 1915, has not been required, and has been written back. Interest on debentures and loans for 1916 has absorbed £70,100, and there is to be appropriated for depreciation £153,700 (depreciation of goodwill, patents, and licences £40,636; depreciation of plant, £103,715; depreciation of shares and debentures, £4,589; and depreciation of apparatus, supplies, and meters, &c., £4,759). £163,923 is being carried forward subject to the deduction of munitions levy for 1916, the amount of which has not yet been ascertained. [For 1915 the profit was £262,361, interest was £57,922, and depreciation appropriations were £144,878.] The total par value of debentures returned to date is £38,505, and the net amount outstanding to date is £173,495. The usual practice has been followed in making reserves to cover risks in connection with bad debts and other contingencies. The report refers to the death of Sir George Franklin (a director for 18 years), and to the resignation of Mr. J. F. Nanheim (a director for 20 years), and Mr. E. Thurnauer, who for 21 years had represented the French shareholders, does not now stand for re-election. Mr. H. C. Levis, the managing director, has been appointed chairman. 152 employés have fallen in the war, 138 have been wounded, 102 have received commissions, 27 have won special honours, 9 have been mentioned in dispatches, and 11 have been specially commended for service in the field. A permanent memorial tablet, containing the names of all who have died in active service, will be erected at the end of the war.

Clevedon, Portishead & District Electric Supply Co., Ltd.—At the annual meeting, the directors reported a satisfactory growth of the undertaking, in spite of the very difficult conditions prevailing, the gross revenue being more than double that of the previous year. The number of consumers connected in Portishead has been increased from 179 to 193, and the sub-station at Bowyer Ashton is supplying power to the South Liberty Colliery and the Ashton Vale Brick Works. The extension of mains through Long Ashton village is almost completed, and a number of consumers have been connected. The total receipts on revenue account amounted to £3,965, compared with £1,737 last year. Notwithstanding the increased cost of fuel and all other expenses, the gross profit is £224, compared with £696 last year.

North Melbourne Electric Tramways & Lighting Co., Ltd.—The gross receipts show an increase from £33,162 to £40,358. The expenses principally due to increased wages and high cost of materials and freight, factors which, unfortunately, show no sign of disappearing—increased from £21,730 to £28,888, the net revenue therefore being £11,170, as compared with £11,732 for the previous year. Capital expenditure amounted to £1,917. A contract has been entered into with the Melbourne City Council for the lighting of Flemington and Kensington. The necessary work of laying the mains and erecting the standards is being proceeded with as rapidly as possible.—*Financier*.

Eastern Extension, Australasia & China Telegraph Co., Ltd.—Owing to delays arising from the war in obtaining the necessary returns from foreign stations and administrations it will be impossible to present the accounts and balance sheet, duly audited, for the year 1916 to the shareholders until the autumn. As, however, it is necessary, under the provisions of the Companies' (Consolidation) Act, 1908, to hold a general meeting within 15 months from the date of the last preceding meeting, the directors convened an extraordinary general meeting, which was held on 17th inst., Sir J. Wolfe Barry presiding. The proceedings were purely formal.

Greenwood & Batley, Ltd.—The report for the period from July 12th, 1915, to March 31st last states that, after providing for interest on debentures, expenses of management, doubtful debts, the writing down of war capital expenditure, and the company's anticipated liability under the Finance Acts, there is a profit of £119,242. The directors have appropriated £45,000 for depreciation and £13,000 to reserve account, and recommend that a final dividend on the ordinary shares of 15 per cent. (that is, 30s. per fully-paid share and 15s. per £5 paid share).

Crompton & Co., Ltd.—The issue of the accounts for the year ended March, 1917, has been postponed pending the settlement with the Ministry of Munitions of various matters connected with the "control" of the business. The profits for the year justify the dividend of 5 per cent. per annum on the ordinary (and 7 per cent. on the preference) shares. The works continue to be fully employed on orders of national importance. Meeting: August 1st.

South Brazilian Railways Co., Ltd.—In their report, the directors show that there was a loss on the Curitiba tramways undertaking of £2,856, and a net profit of £12,472 on the electric light and power undertaking, leaving the net earnings £9,616. Of this £5,218 has been paid to the unsecured creditors, £773 has been put to accident damages account, and interest on debentures is to be paid at 2s. 11d. per £20 debenture for the year 1915-16.

France.—La Société Hydro-Electrique et Metallurgique du Palais is the name of a new company which has recently been formed in Paris, with a capital of £200,000, to establish new electrometallurgical works. The Société d'Electro-Metallurgie de Dives is interested in the new undertaking.

General Electric Co., U.S.A.—The "Times" New York correspondent states that this company has just issued \$15,000,000 of three-year 6 per cent. notes, which have been offered to the public at 99½.

Liverpool Overhead Railway Co.—Interim dividend for June half-year at the rate of 5 per cent. on the preference and 2½ per cent. per annum on the ordinary, less income-tax 5s. in the £.

South American Light & Power Co., Ltd.—After paying 5 per cent., less income-tax, for 1916, £2,000 is written off discount on debentures, and £3,696 is to be carried forward.

Kaministiquia Power Co.—Quarterly dividend, \$1¼ per share (seven per cent. per annum).

Anglo-American Telegraph Co., Ltd.—Interim dividend for the quarter, 15s. per cent. on the ordinary stock, and £1 10s. per cent. on the preferred stock, less income-tax.

Bournemouth & Poole Electricity Supply Co., Ltd.—Interim dividend on the ordinary shares at the rate of 5 per cent. per annum, less tax, for the half-year ended June 30th.

Electrical Utilities, Ltd.—A dividend of 1½ per cent. on the preferred stock is announced.

City of Buenos Aires Tramways Co. (1904), Ltd.—Dividend of 1s. 3d. per share, less income tax, for three months ended June.

London Electric Railway Dividends.—*Central London Railway Co.*—Interim dividends for the six months ended June 30th on the undivided ordinary stock of 1½ per cent., and on the preferred ordinary stock of 2 per cent.

London Electric Railway Co.—Dividend for the half-year at the rate of 2 per cent. on the four per cent. preference stock and ½ per cent. on the ordinary shares.

City & South London Railway Co.—Dividends of 2½ per cent. on the five per cent. preference stocks, 1891, 1896, 1901, and 1903, and 1 per cent. on the ordinary stock for the six months.

Metropolitan District Railway Co.—Interim dividends for the six months ended June 30th on the four per cent. guaranteed stock of 2 per cent., on the first preference stock of 2½ per cent., and on the second preference stock of 1½ per cent.

Underground Electric Railways Co. of London, Ltd.—Interest on the six per cent. first cumulative income debenture stock, less tax, at 3 per cent., and coupon No. 19 off the six per cent. income bonds, free of tax, at 2 per cent.

Trowbridge Electric Supply Co., Ltd.—The result of working for 1916 is a profit of £546. Dividend, 7½ per cent. on ordinary shares, 5 per cent. on preference. To depreciation £225, to reserve £75, carried forward £56. The output of electricity has increased considerably, due in part to new consumers for lighting, but mainly to heavy day loads for power purposes, in addition to an all-night supply.

Spain.—A new company has recently been organised in Madrid with a capital of no less than £1,000,000, and the title *La Sociedad Espanola de Construcciones Electro-Mecanica*, to establish works near Cordoba for the electrolytic manufacture of copper and also electrical material. The *Schneider Co.*, of Le Creusot, France, and a number of the leading Spanish iron and steel companies are interested in the new undertaking.

STOCKS AND SHARES.

TUESDAY EVENING.

Stock Exchange markets are overshadowed by the news from Russia. That this should cause a certain amount of depression is only natural, but the depression is noticeable more in the way of a check administered to business than in any violent fall in prices. The Russian disappointment is neutralised to some extent by the comforting reflection that every day brings the United States nearer to the firing line with a substantial new army, and this suffices to hold prices reasonably steady. Rumours of a new War Loan continue to be very persistent, and the latest vote of credit taken by the Government has pointed the prophecy of those who anticipate a new issue in the forthcoming autumn. At the same time, many good authorities hold the view that another War Loan is unlikely to appear for some time yet.

The principal feature in the domestic markets is the declaration of Home Railway interim dividends. Of these, the announcement of the Underground Electric Railways Co. occasioned surprise and disappointment, because the market had been looking for 5 per cent., whereas the company declares 4 per cent., the same rate as that of six months ago, but comparing with 6 per cent. this time last year. The dividend on the bonds for the time being, therefore, becomes 1 per cent., and at 80 the return is exactly 5 per cent. on the money, which is equivalent to 6½ per cent., less tax. The price of the bonds has fallen 4 points to 80, and the £10 shares are ½ down at 1½.

The London Electric and the City & South London Companies are paying 3 per cent. on their ordinary stocks, while the District is to distribute 1½ per cent. on the 2nd preference. All three are the same as those of a year ago. The Metropolitan dividend comes out on Thursday in this week. The market as a whole is inclined to be reactionary, following the course of Consols, which have given way from the highest point touched last week. Metropolitan fell ½; Districts followed suit. But Central London Assented ordinary has gained a point.

The telegraph and cable market is uniformly good. Further advances have been obtained by the higher-priced stocks and shares, and notwithstanding the dulness of investment securities generally, in this particular section there is certainly no set-back. The telegraph market is one of those in which current quotations stand as a rule higher than the levels current on the outbreak of war. For instance, Eastern Telegraphs at 141½ and Eastern Extensions at 141 show rises for the three years of 11½ and 1½ respectively. Globe Ordinary at 12½ are 27s. 6d. up, although the preference at 10½ show a fall of 2½, fixed interest shares having, of course, suffered in sympathy with Consols, the price of which has come down from 72½, at which it stood on the outbreak of war, to 55½ to day. Anglo-American preferred at 99 is 9½ down over the three years, another instance of the way in which the price of fixed-interest stocks have fallen, while Westerns at 14½ are £1 up, and Panamas at 31s. 3d. show a rise of 6s. 3d. The principal improvement in this market, comparatively speaking, is that secured by Marconis, the ordinary shares having risen from 1½ on July 27th, 1914, to 3½ now, an advance

of 25s., and the preference at 2½ are 1 1/16 up. Canadian Marconi at 10s. 9d. have practically doubled within the period, while the Americans at 17s. 6d. are 7s. to the good.

Underground Income Bonds at 80 show a fall of 7½ since July, 1914. Metropolitan Consolidated at 23½ is 13½ down, while Districts at 16 are 6 points lower. Central London deferred, now standing 60, compares with 81 on the outbreak of war.

Once again it is the London section in the electricity supply market that stands out with prominent strength on the week. City Ordinary at 12½ are 5s. up. County Ordinary are 10s. higher at 11½. South Metropolitan preference have jumped up 1s. 6d., and the ordinary are very firm at a guinea. St. James's rose 5s. on the dividend, and the remainder of the list keeps hard. Edison Swan partly paid changed hands at 15s. the other day. British Aluminium are a noteworthy feature of strength at 30s. Edmundson's non-cumulative preference are wanted at about 11s. 3d.

Callenders continue to advance, a rise of 10s. taking the price to 14½. In the iron and steel group, Babcock & Wilcox are better at £3.

The Gas Light & Coke Co. has reduced its dividend, and the stock has eased off to 71.

Brazilian varieties are duller on a sharp drop in exchange, and Brazil Traction shed ½ to 49½, the preferred falling a point to 90. Mexico Tramways bonds are a trifle easier, and British Columbia preference has lost 3 points. Argentines are mostly better, and the Tramways First preference sympathised with 1/16 advance. Canadian General Electric is 3 lower at 117½. Industrials as a whole are the least affected by the Russian news, and rubber shares steadily appreciate with the price of the produce, which has improved to 2s. 8d. per lb.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.						
	Dividend		Price July 21, 1917.	Rise or fall this week.	Yield p.c.	
	1915.	1916.				
Brompton Ordinary	10	9	64	—	28 18	6
Charing Cross Ordinary ..	5	5	84	—	7 2	10
do. do. 4½ Pref.	4½	4½	84	—	6 18	8
Chelsea	4	3	24	—	6 4	4
City of London	8	8	12½	+ ½	6 5	6
do. do. 6 per cent. Pref. ..	8	6	10	—	6 0	0
County of London	7	7	11½	+ ½	6 1	9
do. do. 6 per cent. Pref. ..	6	6	10	—	6 0	0
Kensington Ordinary	7	10	5½	—	5 11	7
London Electric	3	8	1	—	Nil	
do. do. 6 per cent. Pref. ..	6	4	8½	—	5 5	8
Metropolitan	8	8	24	—	6 0	0
do. do. 4½ per cent. Pref. ..	4½	4½	84	—	7 4	0
St. James' and Pall Mall ..	8	8	6½	+ ½	6 18	6
South London	5	5	2½	—	7 5	6
South Metropolitan Pref. ..	7	7	21½	+1/8	6 10	3
Westminster Ordinary	7	7	6½	—	6 1	8
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	8	6	99	—	6 1	0
do. do.	83/8	1½	22½	—	8 16	4
Chile Telephone	8	8	7	—	5 14	4
Cuba Sub. Ord.	6	5	64	—	5 17	8
Eastern Extension	8	8	14½	+ ½	6 12	8
Eastern Tel. Ord.	8	8	14½	+1/8	6 13	1
Globe Tel. and T. Ord. ..	7	7	12½	—	5 9	10
do. do. Pref.	6	6	104	—	5 17	1
Great Northern Tel.	22	24	86	—	6 13	4
Indo-European	18	13	61½	+ ½	6 6	3
Marconi	10	10	34	—	8 8	6
New York Tel. 4½	4½	4½	99	—	4 11	0
Oriental Telephone Ord. ..	10	10	2½	—	3 12	9
United R. Plate Tel.	8	8	6½	—	6 18	6
West India and Pac.	8d.	6d.	1½	—	1 12	0
Western Telegraph	8	8	14½	+ ½	6 10	4
HOME RAILS.						
Central London, Ord. Assented	4	4	61½	+1	6 10	1
Metropolitan	1	1	23½	—	4 5	1
do. District	Nil	Nil	15½	—	Nil	
Underground Electric Ordinary	Nil	Nil	18	—	Nil	
do. do. "A"	Nil	Nil	5/9	—	Nil	
do. do. Income	6	4	80	—	6 0	0
FOREIGN TRAMS, &c.						
Dividend						
1915. 1916.						
Adelaide Sup. 6 per cent. Pref.	8	8	5	—	6 0	0
Anglo-Arg. Trams, First Pref.	5½	5½	2½	+ ½	9 11	4
do. do. 2nd Pref. ..	5½	5½	2½	—	—	
do. do. 5 Deb.	5	5	68	—	7 5	6
Brazil Traction	4	4	49½	—	—	
Bombay Electric Pref.	8	8	10	—	6 0	0
British Columbia Elec. Rly. Pice.	5	5	57½	—	9 10	6
do. do. Preferred	Nil	Nil	83½	—	Nil	
do. do. Deferred	Nil	Nil	27½	—	Nil	
do. do. Deb.	4½	4½	57½	—	7 7	10
Mexico Trams 5 per cent. Bonds	Nil	Nil	36	—	Nil	
do. do. 6 per cent. Bonds	Nil	Nil	80	—	Nil	
Mexican Light Common	Nil	Nil	14½	—	Nil	
do. do. Pref.	Nil	Nil	22½	—	Nil	
do. do. 1st Bonds	Nil	Nil	89½	—	—	
MANUFACTURING COMPANIES.						
Babcock & Wilcox	15	15	3	+ ½	5 0	0
British Aluminium Ord. ..	7	10	30½	+1/2	8 13	4
British Insulated Ord. ..	17½	20	12½	—	7 15	0
British Westinghouse Pref. ..	7½	7½	2½	—	5 17	2
Callenders	20	30	14½	+ ½	7 0	6
do. do. 5 Pref.	5	5	4½	—	5 17	8
Castner-Kellner	22	22	8½	—	6 10	2
Edison Swan, fully paid ..	—	—	18	—	Nil	
do. do. 4 per cent. Deb. ..	4	4	70½	—	5 18	6
Electric Construction	7½	7½	4½	—	8 0	0
Gen. Elec. Pref.	6	6	10	—	6 0	0
do. do. Ord.	10	10	16½	—	6 1	3
Henley	25	25	18	—	7 15	8
do. do. 4½ Pref.	4½	4½	4	—	5 12	6
India-Rubber	10	10	12½	—	8 5	0
Telegraph Con.	20	20	82½	—	6 5	2

*Dividends paid free of income-tax.

MANUFACTURE OF SYNTHETIC NITRATES BY ELECTRIC POWER.

At the meeting of the SOCIETY OF CHEMICAL INDUSTRY last week, Mr. E. KILBURN SCOTT read a paper on this subject. He said that when fixing atmospheric nitrogen in an electric furnace, the reaction mainly depended on the contact of air with the arc; many furnaces were faulty in this respect, and it was found that their defects were due to their being of the single-phase type; after showing that the Birkeland-Eyde, Schönherr, and Pauling furnaces were subject to this criticism, he described a three-phase furnace of his own design in which, he claimed, every particle of air must come into contact with the rapidly revolving sheet of flame. This was the only nitrogen furnace that had been developed as a self-contained three-phase unit.*

It was essential that the arcs should be blown into flames, either by a stationary magnetic field, as in the Birkeland-Eyde type, or a rotating magnetic field, as in the Mosciski furnace, or by the air flowing through the furnace, as in the Schönherr, Pauling, and Kilburn Scott types. It was a disadvantage to employ a magnetic field, as this involved the provision of a supply of direct current, whereas the air must pass through the furnace, and the arc flames produced by air flow were just as effective as those obtained by a magnetic field.

An advantage of the three-phase furnace was that it required only three electrodes, whereas three single-phase furnaces required six.

In single-phase furnaces the arc was started by bringing the electrodes together until the air gap was sufficiently short to allow the high-pressure current to jump across, a process involving risk to the plant; in his three-phase furnace the author avoided this drawback by using pilot sparks. A wire placed half-way between the tips of the electrodes was connected to a high-frequency apparatus, and when this was set in operation sparks passed from the wire to the electrodes, thus breaking down the air dielectric and allowing the arc to strike. The electrodes could, therefore, be set at the best distance apart, and a lower pressure could be used to operate the furnace, with a better power factor. He found it beneficial to keep the pilot sparks on all the time, as the yield was improved and continuity of working obtained, thus avoiding surges and other troublesome electrical phenomena. The flow of energy in a three-phase furnace was practically always at a maximum, and the arcs assisted in maintaining each other, whereas in a single-phase furnace the power varied from zero to a maximum twice in each cycle. Preheating the air economised heat, raised the temperature of the furnace, and dried the air, resulting in a larger yield. The higher the temperature the better, as it helped ionisation of the air; he had found it advantageous to use 250 deg. C. The preheat could be obtained from the gases leaving the furnace, and one large preheater could serve several furnaces.

The chemical action being reversible, it was important to chill the nitric oxide gas quickly. With single-phase furnaces, excess air was blown through for this purpose; in the Kilburn Scott type, a boiler was used to form the roof.

This method of cooling was effective owing to the latent heat of steam, and the steam could be used for generating electric power, or providing distilled water for the absorption plant. The boiler was connected to earth, and the blown arc flame acted on it in much the same way as any ordinary flame burning to carbon dioxide. The metal was not affected, because nitric oxide did not attack it. In Norway the furnace gases were passed through an ordinary Babcock-Wilcox boiler when the temperature had been lowered to about 200 deg. C., at which temperature nitrogen peroxide could do damage, and it was much safer in this respect to use the boiler directly on the furnace where the gas was still in the nitric oxide stage.

The yield obtained from single-phase furnaces was generally estimated at 50 to 60 gm. (1½ to 2 oz.) of pure nitric acid per kw.-hour, or, say, half a ton of pure acid per kw.-year. With the author's three-phase furnace yields 50 per cent. greater were quite feasible. Of the total energy put into the furnace, about 10 per cent. could be obtained as low-pressure steam. The yield rose to its full value in about a quarter of an hour from the time of starting the furnace. The pressure required to operate the furnace was under 1,500 volts, and power factors over 0.85 were obtained.

The usual absorption system consisted of a range of high towers of acid-proof brickwork, filled with quartz pebbles or some patented form of acid-proof filling. The gas entered each tower at the bottom and rose through the filling, whilst the absorbing liquid ran down over the filling in thin layers. Dilute nitric acid was collected at the bottom of each tower and forced up to the top of the next one, the liquor passing from tower to tower in one direction while the gas passed in the opposite direction; the acid concentration attained was about 25 per cent., which was high enough to make ammonium and calcium nitrate. Nitrous acid was formed during the absorption process, and split up in the presence of water vapour into nitric oxide and peroxide, the former then taking

up more oxygen from the excess air present; for this reason the gas should move slowly between the towers as well as inside them. Prof. Mosciski found that by making the supply of liquor to the towers intermittent the absorption could be very much improved. His absorption chambers were rectangular in plan, built together in one block, with perforated party walls; the chambers were alternately filled with quartz pebbles and empty, and the gas passed at about 4 cm. per second (1½ in./sec.) horizontally through the block, while the absorbing liquor intermittently ran down the acid-proof filling. With the Mosciski method 97 per cent. of the nitrogen peroxide gas was absorbed, and the nitric acid could be drawn off at a concentration of 40 to 50 per cent.

In the second part of his paper Mr. Scott compared in detail the direct method of making nitric acid with the indirect method (by the manufacture of calcium carbide and calcium cyanamide, and the oxidation of ammonia). He pointed out the many processes required for the latter system, the variety of machinery employed, and the necessity of facilities to supply limestone, coke, or anthracite, and carbon electrodes. On the other hand, the process of direct fixation of nitrogen was simple, the apparatus required a minimum, and the raw materials (air and water) universally available, so that the plant could be situated anywhere where suitable electrical energy was to be had. As regarded the cost of plant, the indirect process was not in the running with the direct, and the latter had a great advantage in respect of raw materials and labour, which would increase in the future.

Before the war electrical energy had been sold in this country at lower rates than at Niagara; in the future cheap power would be provided by large power stations, and some of 120,000 kw. each were already projected. Up-to-date coke ovens, with by-product recovery plant, would provide gas for power generation, and electricity would be largely used for electrochemical and metallurgical processes, one of the chief of which would be the manufacture of nitrates from air by the direct method. This lent itself particularly well to off-peak or off-season loads, as the furnaces could be switched on and off without detriment to themselves or to their products. The process could be established anywhere. In the case of coke-oven plant, the nitric acid could be combined with the ammonia derived from the gases to produce nitrate of ammonia, which was superior to sulphate of ammonia. The sale of such products depended on prices and analysis, and needed no goodwill or advertising; a new concern could sell all its output at once if it could supply a little below market price.

DISCUSSION.

Mr. BOWER said he was very much impressed by the discussion in the paper of the absorption process of Mosciski. This seemed a very good method, because in the absorption of these gases it was necessary to carry out a double function, viz., to oxidise and to absorb, and the Mosciski process seemed to take all the factors into account.

The PRESIDENT (Dr. CHARLES CARPENTER) said this matter had not altogether been neglected by the authorities, and a good deal of work was being done at the present time. The outstanding difficulty when entering on the erection of plants of this magnitude was to decide which process to adopt, viz., the one requiring the minimum amount of power or the process described by Mr. Scott, in which it was suggested that the power requirements were considerably larger, yet the other advantages were such that it might be found in the long run to be the best process to adopt.

Dr. E. FYLEMAN asked whether there was any possibility of electrolytic corrosion in the boiler. He understood that it was almost impossible under practical conditions completely to convert the nitric oxide obtained in this process into nitric and nitrous acids, and that a certain small percentage, which was given as from 3 to 5 per cent., of the total nitrogen which was combined to form the nitric oxide escaped into the atmosphere. If that were so, those wishing to work the process were not absolutely unrestricted as to the spot upon which a plant could be put down. The question of cost was important, and Mr. Scott had given absolutely no basis to go upon in attempting to compare this system with others. Could he give some approximate figures as to the cost of a plant for producing a certain quantity of nitric acid, and the amount of power, labour, and supervision required?

Mr. F. SPROXTON could not see why the yield of the new furnace was only 50 per cent. better than that of the old furnace. It appeared that the advantage should have been much greater. Was there any advantage in modifying the composition of the air by the admixture of oxygen to get nearer to the theoretical composition, say, four volumes of nitrogen to one of oxygen? Theoretically, there would be two volumes of nitrogen to one of oxygen.

Mr. J. B. WEBB said the Mosciski absorption process had been attracting a great deal of attention, and, as the author had pointed out, the important factor in the whole process was the oxidation of NO to NO₂. That seemed to depend on the actual time of traverse of the NO through the absorption towers, and in previous years the absorption was spoilt to a very large extent by the use of very fine packing, such as broken quartz. The packing in the towers must be of such a nature as to give both surface and free space, and he was at a loss to see how Prof. Mosciski's patent packing helped

*The Kilburn Scott furnace, in its original form, was described in the ELECTRICAL REVIEW of February 5th, 1915.

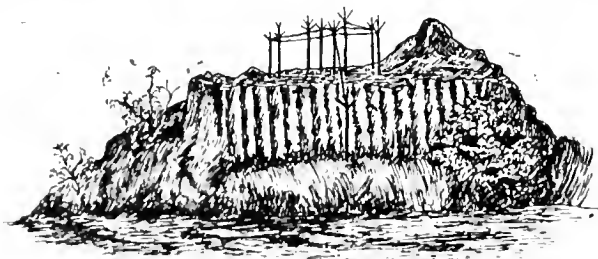
matters. Broken quartz packing gave approximately 40 per cent. free space, but he did not know why there need be two chambers. Why not have one chamber and pack it with, say, ring packing, which gave approximately 75 to 80 per cent. free space and, at the same time, a considerably greater surface than was obtained with broken quartz, unless the broken quartz was of the order of $\frac{1}{4}$ in. or less, in which case he would imagine the draught difficulties would be considerable?

Mr. E. W. MASON called attention to the fact that there was an American process, known as the Rankin process, which had been commented upon favourably by Prof. Norton. It consisted of a cylinder and piston with two small electrodes on it. The air was compressed and the arc started; then the arc was cut off and the gas allowed to expand, and it was claimed that good results were obtained.

Mr. SCOTT, in his reply, said that the fact that Mr. Bower appreciated the absorption system carried a great deal of weight with him, as Mr. Bower had made a considerable number of experiments. The President had mentioned that the Government were doing something at last, but it was three years late. The other day Dr. Addison had mentioned that something was going to be done with the fixation of atmospheric nitrogen. He had not thought of electrolytic corrosion in the boiler. He very carefully earthed the boiler, and alternating current did not give the same electrolytic corrosion as direct current. Nevertheless, it was known that corrosion with alternating current did take place under certain conditions, but he did not think there was much danger in this case. There was some escape into the air with the system used abroad, but he had it in his mind to make a complete cycle by taking the air and, after using it, adding oxygen to it, and not allowing it to go out into the air again. If oxygen were added to the air and then it were allowed to go out into the atmosphere again, it would be necessary to add so much that it would become too expensive. By working through a complete cycle it would only need make-up oxygen. He did not believe a great deal in patent packings. The Norwegians had pinned their faith to quartz. It was impossible, in all these fillings, to get rid of lime, and there was action on the lime; it was for this reason that quartz was better. The cost of a complete plant was, roughly, about £8 per kw. He had received a quotation, with guarantees behind it, from responsible people in Germany two years before the war to erect a complete nitric acid factory in this country for £6 10s. per kw. of plant, and probably £8 was a safe figure now. As to the Rankin process, he doubted some of the figures that had been given with regard to it.

THE MARCILLAC HAIL NET.

It is a curious fact that so many contradictory results have been reported by well-qualified investigators in the field of electroculture and in the electrical protection of districts against hail and lightning. However, evidence is now accumulating to show that electroculture is thoroughly practical and successful when applied in a suitable manner, and probably the same is true of lightning conductors as a protection against hail. We described recently* the use of "barrages" of "electric niagaras" in this connection, and it will be seen that M. P. Marcillac's apparatus and system, as described below, are a good deal simpler and less costly. A considerable amount of evidence is available to show that the present installation, near the summit of Chenavari, gives definite protection against injurious hailstorms, and, in any case, the



THE ELECTRIC NET AT CHENAVARI.

cost of the equipment is so moderate that it is worth testing carefully in other instances.

The "electric net" (*Gérier électrique*) illustrated in the accompanying figure, was erected four years ago at Roche-maure on the extinct volcano Chenavari (at the end of the Colson volcanic chain), at an altitude of 1,600 ft. (506 m.). The equipment consists of nine wooden poles fitted with metallic aigrettes connected between themselves by conductors. Eight of these poles are set on a terrace about 980 ft. (300 m.) long, 650 ft. (200 m.) wide, and 40 ft. (12 m.) high on the summit of the volcano, so as to mark out the apices

and centre of a polygon inscribed in a circle of about 295 ft. (90 m.) diameter and $\frac{1}{4}$ acres (0.6 ha.) in area. The ninth post is set below the terrace, as shown.

The aigrettes are built up from broad strips of iron terminating in points. The conductors connecting them consist of twisted cords of reinforced barbed wire; their length amounts to about 1,970 ft. (600 m.), and the number of points to about 12,000. Ribbons of iron are bolted and soldered to the base of each aigrette, and are carried down the poles and into buried "gutters" of perforated iron filled with moistened coke. The free end of each strip is fitted with a branching distributor (*perd-fuide*). In addition, strips provided with hooks ensure intimate contact between earth-ribbon, coke, iron gutter, and soil, the latter being reached through the perforations in the gutter. Ten earth connections of this type are established, and a supplementary connection is made to a small stream below the terrace.

It should be noted that no copper conductors are used in the Marcillac equipment, which thus differs materially from Beauchamp's "electric niagaras" (*loc. cit.*), these using very substantial conductors of high conductivity electrolytic copper. The distinction is an important one, both as regards capital cost and the risk of theft where a number of equipments are erected to protect an extensive area. There is no reason to suppose that the higher resistance of the Marcillac conductors entails any loss of protective value. On the contrary, high-frequency currents, such as lightning discharges, are conducted more readily by conductors of relatively high ohmic resistance but large surface, than by small conductors of low ohmic resistance. Marcillac secures maximum surface on the aigrettes by using flat strips instead of round rods.

The number of points on the net system is also held to be a factor contributing much to its efficacy. In addition to the aigrette points there are the barbs of the connecting conductors to the number of 12,000 or so. Perhaps the most remarkable feature of the Chenavari installation is that the earth connection has to be made in holes blasted in volcanic rock. There is no trace of the damp soil which one is accustomed to regard as essential to good earthing. One only of the earth connections is under favourable conditions, viz., the one in the small spring at the foot of the terrace. The rock does, however, contain 16 per cent. of iron (as oxide), a good deal being in the form of magnetic oxide. Doubtless this compensates to a great extent for the absence of moisture.

The successful working of the installation has been noted in a number of definite instances. The director of the Services Agricoles de l'Ardeche confirms the protective influence of the equipment, and since its erection, lightning troubles have been practically eliminated on transmission lines in the neighbourhood for several kilometres around. The Paris-Lyons-Mediterranean Railway Co. has decided to use the Marcillac system to protect certain sections of line which are to be electrified. Landowners in the neighbourhood of Chenavari assert that lightning and hailstorms are now very rare in the district, and such hail as falls is "mushy" and harmless in nature. It is true that a very heavy sleet storm was experienced last February, but as the protective equipment was then covered very thickly with rime, the incident rather supports than controverts the claim that the net is normally effective. The equipment is so cheap and simple that it should certainly be tested wherever lightning and hailstorms are prevalent.

UNDERGROUND SIGNALLING BELLS.

In an article under this heading which appeared in the *Iron and Coal Trades Review* of July 6th, the author, Mr. L. FOKES, discusses the design of bells in accordance with the report of Dr. Wheeler and Prof. Thornton, with a view to the removal of danger due to sparking at contacts. Mr. Fokes suggests that the best method of bringing old apparatus into line with the Home Office requirements—a method which can be followed with ease and certainty of success by colliery electricians—is that of rewinding the coils with parallel windings, one of which is short-circuited. This conclusion is open to question, for reasons given below. The author appears to have been led astray by an inaccurate conception of the mode of operation of the auxiliary coil in suppressing the spark. He says:—"In a circuit containing self-induction, such as the magnet coils of an electric bell or relay, it is found that any alteration in the current or the magnetic flux which is produced by it induces an electro-motive force in the coils which always opposes the alteration, whether it is by varying a current already passing through the coils, switching the current on, or cutting it off. The value of the induced electro-motive force depends on the rate of change of magnetic flux in the circuit, and a little consideration will show that the greatest rate of change of magnetic flux occurs at switching on and switching off the apparatus. In closing the circuit no ill effects disclose themselves, but when the circuit is broken the induced electro-motive force tends to keep the current flowing after the circuit is broken at the point of contact, resulting in a spark the heat of which depends largely upon the self-induction of the circuit, but also upon the amount of current flowing in the circuit when the contact is broken."

*ELECTRICAL REVIEW, p. 275, March 9th; p. 303, March 16th, 1917.

So far all is well; but unfortunately he goes on to say that "When a bell or relay is wound with a short-circuited parallel winding, any electro-motive force induced by the varying of the magnetic flux through the circuit, as when the circuit is broken, is neutralised by another magnetic flux *which is opposed to that of the bell coils*, and is supplied by the current induced in the short-circuited winding by the vanishing magnetic flux. This has the effect of rapidly wiping out the spark when the contact is broken, and greatly reducing its temperature."

The italics are ours. What really happens is not that an opposing magnetic flux is created, but that the *original* magnetic flux is maintained in direction, and allowed to die out slowly instead of being suddenly annihilated. Hence, in the absence of a rapid change of linkage of magnetic flux with the winding of the working coil, a high E.M.F. is not induced in the latter, and the spark is reduced to insignificant proportions.

This result is attained by the creation of a current in the short-circuited coil in the same direction as that in the working coil, which, roughly speaking, grows in magnitude at the same rate as the working current falls. The sudden injection of the extremely high resistance of the gap between the contacts into the circuit of the latter causes the current to die out very rapidly, and therefore what practically happens is that, in effect, the current is almost instantaneously transferred from the working coil to the short-circuited coil, and continues to flow in the latter after the main current has completely ceased to flow; it is damped out comparatively slowly by the resistance of the coil alone, and the magnetic flux dies with it.

As a simple analogy, suppose a billiard ball moving without spin to strike a similar ball at rest on a table, fair and square; the first ball stops dead, while the second is set in motion at practically the same speed and in the same direction as the first.

This is the object to be attained. The author remarks that "if the number of effective turns for operating a bell is the same as that of its short-circuited parallel winding, then the most effective spark-reducing element is obtained," and argues that the best course is to wind the bobbin with two wires at once, one winding being afterwards short-circuited; as an objection to winding the additional coil outside an existing winding, he remarks that "very often the amount of existing winding cannot easily be determined, and also, assuming both its resistance and number of turns are known, it is not an easy matter to decide how many turns of short-circuited winding are necessary to produce the desired effect." But this statement assumes that the number of turns on both coils should be about the same; this is an error. The number of turns on the short-circuited coil is immaterial; it is the *ampere-turns* that count. A single turn will suffice, if the resistance is low enough. Hence, a stout copper tube, preferably next to the iron core, is quite satisfactory, cheaper than wire, and much more reliable; it may even be put on outside the working coil, without disturbing the latter at all, but is less effective in that position, owing to magnetic leakage.

Messrs. Wheeler and Thornton in their report pointed out that a copper sleeve gave satisfactory results. They also approved of the use of a non-inductive resistance, connected across the terminals of the working coil, as suggested by Mr. H. R. Kempe; the resistance should be five or six times that of the coil. This method is perhaps the easiest of all to apply in a hurry, and is quite effective.

The rest of Mr. Fokes's article, dealing with the precautions to be taken in winding such coils, and the method which he has found convenient for testing bells for mine-signalling, is admirable.

ELECTRIC POWER GENERATION BY GAS.

THE recent discussion upon Mr. Robertson's paper before the I.M.E.A. indicated that electrical engineers were not carried away by the present prospects of coal carbonisation in conjunction with power generation on a large scale. It is true that the results of the Glasgow experiments, quoted at the I.M.E.A. meeting by Bailie Smith, sounded distinctly encouraging, but it is the fact that the advocates of low-temperature carbonisation systems, which are those involved in the proposition, have never had a very enthusiastic public even among chemists. That fact was again demonstrated last week at the meeting of the Society of Chemical Industry, as will be seen below.

In the course of a paper on "Industrial Fuel from Gas Works," on Thursday, Mr. E. W. Smith, of the Birmingham Gas Department, severely criticised the manner in which low-temperature carbonisation experiments had been carried out hitherto. There seemed, he said, to be no general agreement as to the object of the commercial development of low-temperature carbonisation. Those who had attempted to extend the process from the laboratory stage to practical working had varied in their aims. Some had hoped for high benzol yields; others anticipated high tar yields, whilst others had as their main object the production of a solid fuel which would burn easily in the domestic grate without producing smoke. Those who had been in closest touch

with many of the processes agreed that no really satisfactory results had yet been obtained. That did not mean that there was nothing in low-temperature carbonisation, but in his opinion, there had not been sufficient competent research work carried out to enable an opinion to be passed one way or the other. If one judged from the average published results, no more would be heard of the process. The recent paper by McLaurin, of Glasgow, was typical of what he meant. One of the proposals was that power stations could be put at the pit's mouth, and the gases used for generating electricity, whilst a domestic fuel would be produced. The chief advantage of that would be to centralise carbonisation and power generation, but it would decentralise domestic fuel supply. It had been overlooked that the coke produced would be very large, and that the question of freightage in distributing it to consumers would provide some difficulties. Again, if the question was examined on the basis of the figures which had, so far, been published, it would appear that the costs of washing for the light spirits for motor purposes, &c., were such as almost to neutralise the value of the increased volume of tar obtainable by low-temperature means. Taking all things into consideration, he thought there was need for the appointment of a strong Scientific Committee, versed in conditions of carbonisation, to go into the whole subject in an independent manner, in order to arrive at some definite conclusion, as far as was possible at the present time.

The PRESIDENT (Dr. Charles Carpenter), referring to the last suggestion, said it gave him some satisfaction to be able to say that the Fuel Board, which was a branch of the Research Department, had decided that the matter was so important, and that the opportunities for arriving at a definite conclusion were so unsatisfactory, that it was a matter of national importance that experiments should be made which were absolutely unimpeachable in accuracy. That was quite a broad-minded view to take, and negotiations were in a fairly forward state with regard to a site for the erection of the necessary works.

MR. DRUMMOND PATON, as one who had worked for years on the problem of low-temperature distillation, objected to the disparaging attitude taken towards the experiments upon low-temperature carbonisation by the author. Only by means of this could the millions of tons of waste coal now produced be used. The difficulty of transport of the resultant coke could be got over by briquetting, as in that form the coke could be much more expeditiously handled.

MR. SMITH, in reply, said he had no intention of casting any reflection upon the *bona fides* of the experimenters with low-temperature carbonisation. What he deprecated was that this work was the only work that had been done. It should have been carried out by men who probably had less experience in coal and more experience in research, in conjunction with the other workers.

PATENT LAW.

AT the annual meeting of the SOCIETY OF CHEMICAL INDUSTRY, in Birmingham, on Thursday, last week, DR. REE read a short paper dealing with the position of patents under present legislation. After pointing out that the compulsory working clauses of the Patent Act of 1907 were directly traceable to the efforts of the Manchester Chamber of Commerce, he drew attention to the manner in which these had been rendered very largely nugatory through the judgment of Lord Parker some 15 months later in the Hatchett case. That judgment was based largely on the argument that it was unreasonable to call on a defendant to prove or disprove the plaintiff's case, and that to do so was contrary to the principles of English justice. This reduced the compulsory working clauses to an absurdity, because it was obvious that all the patentee had to do was to refuse any information as to adequate manufacture here. The plaintiff might produce witness after witness to show that he was unaware of any manufacture in this country, but that would be no proof of non-working. As a fact, the principle of calling upon a defendant to prove or disprove what the plaintiff alleged was not contrary to the rules of English justice, and many examples could be cited in which this practice was followed. There was, for instance, the case of the trader who applied to the Railway and Canal Commissioners for a lower railway rate; the railway company was then called upon to show that the rate was a reasonable one. A receiver of stolen goods had to account for possession of the goods, and a publican had to show justification for serving a man who was drunk. In his opinion an applicant for revocation of a patent should have the same right of discovery as the applicant in a Chancery case, viz., by interrogatories.

He would like to revert to the position under the Statute of Monopolies in order to prevent Germans taking out patents in this country, preventing manufacture here, and working them abroad, thus creating a protected market in this country for the goods at our expense, fostering the foreign industry and damaging ours. It should not be enough that *part* of the invention should be worked here. The importance of insisting upon this would be apparent to all who had knowledge of what happened at the outbreak of war, when one of the difficulties was not the production of certain products, but the impossibility of obtaining certain intermediate substances. If this principle had been insisted upon years ago in regard to chemical patents, we should to-day have had an organic chemical industry rivalling that of Germany. He disputed the argument that this was primarily a matter of education; if the

Chambers of Commerce had got what they asked for years ago, there would have been plenty of suitably trained English chemists to carry on.

Either we must revert to the interpretation put upon the compulsory working clauses before Lord Parker's judgment, or to the position as it was before 1907. Compulsory licences were useless, as the patentee would always be years ahead of the licensee, to whom he would not give the latest information, because it was well known that very few patents were worked strictly in accordance with the final specification. The Germans had been fully aware of the benefits to them of the old patent law, and therefore they were the most embittered opponents of any attempts to alter it. For years and years every device was used to prevent any amendment; indeed, it was urged that if any attempt were made to do so it would lead to retaliation. At that time they had clauses in the German patent law far more stringent than those proposed in ours, and nothing happened.

MR. A. G. BLOXHAM submitted that the author was wrong in what he said with regard to retaliation on the part of the Germans, because within a very short time of the passing of the 1907 Act both Germany and Austria altered their laws, and put them on precisely the same basis as the clauses in the 1907 Act—i.e., German patents in the hands of foreigners were to be revoked if the patentees worked the inventions mainly abroad.

DR. REE replied that the clauses of the German Patent Acts with regard to compulsory working were more stringent than ours, and when they were brought into line with our compulsory working clauses in the 1907 Act it really made things easier for us.

MR. J. W. HINCHLEY thought the chemical industry had reached a point at which there was an entire breakdown of the patent system. To patent a process was only to tell everyone what the patentee was doing, and from that point of view a patentee required more protection from the State without so much expense. Many inventions were made which were not patented, simply because the man who worked out the process, or whatever it was, would not be protecting himself at all. He would simply be giving away what he had done. Therefore, it seemed to him that before long we must have some system of State protection quite different from our present patent law. There had been instances recently in which inventions had changed hands for quite considerable sums of money without their having been patented.

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

- 9,868. "Terminals of dynamo-electric machines, &c." HURST ELECTRIC MANUFACTURING CO. & T. H. HURST. July 9th.
 9,889. "Device for protecting electric cable couplings, &c." B. R. CHURCHILL & S. P. COOK. July 9th.
 9,897. "Electric buzzers." MARCONI'S WIRELESS TELEGRAPH CO. & V. A. SMART. July 9th.
 9,898. "Thermionic detectors for alternating currents." W. H. GRINSTEAD AND E. A. LAIDLAW. July 9th.
 9,919. "Supports for electric cables." CALLENDER'S CABLE & CONSTRUCTION CO. & J. F. WATSON. July 10th.
 9,953. "Systems of electric distribution." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). July 10th.
 9,959. "Electrical coils and methods of winding same." UNIVERSAL WINDING CO. & H. WADE. July 10th.
 9,960. "Electric motors." T. L. R. COOPER. July 10th.
 9,962. "Telephone exchange system." WESTERN ELECTRIC CO. July 10th.
 9,964. "Distributing mechanism for electric ignition systems." BOSCH MAGNETO CO. July 10th. (U.S.A., January 31st, 1916.)
 9,973. "Distributing mechanism for electric ignition systems." BOSCH MAGNETO CO. July 10th. (U.S.A., February 15th, 1916.)
 9,988. "Telephone receivers." J. W. HOBLEY. July 11th.
 9,994. "Device for securing in the holder electrodes of electric furnaces." A. M. SPENCER & G. WAINMAN. July 11th.
 10,019. "Electric hand lamps, &c." N. McLEAN. July 11th.
 10,033. "Control of electrically-operated switches." A. WEST & CO. AND W. L. WISE. July 11th.
 10,052. "Electric switch." W. S. SHEPHERD. July 12th.
 10,071. "Adjustable level for timing valves and ignition of rotary engines." G. W. ELLIS & J. A. JOHNSON. July 12th.
 10,072. "Handling anodes in electrolytic baths for separation of metals." ELECTROLYTIC ZINC CO. (July 12th. (U.S.A., July 26th, 1916.)
 10,073. "Methods of refining metallic zinc-bearing materials by electrolytic process." ELECTROLYTIC ZINC CO. July 12th. (U.S.A., July 26th, 1916.)
 10,079. "Electric motor starter." N. B. COOP. July 12th.
 10,096. "Magneto-electric machines." L. G. CAUNTER & F. W. SUTER. July 12th.
 10,097. "Device to facilitate testing sparking plugs of magneto, &c., ignition mechanism for internal-combustion engines." L. CHAWAY. July 12th.
 10,106. "Ignition magnetos for four-cylinder internal-combustion engines." H. A. LEFEVRE & R. A. PERSIN. July 12th. (France, July 12th, 1916.)
 10,109. "Electrical distributors." F. L. HOLLISTER. July 12th.
 10,119. "Means for production of high-voltage discharges." CREED & CO. AND N. F. S. HECHT. July 12th.
 10,113. "Electrodes for use in electrolytic gas generators, &c." I. H. LEVIN. July 12th. (U.S.A., December 20th, 1915.)
 10,129. "Electric batteries." S. S. BIRD & EDISON SWAN ELECTRIC CO. July 12th.
 10,153. "Indicating devices for electric fuses." C. D. FRASER. July 13th.
 10,160. "Electric welding machines." H. R. WOODROW. July 13th. (U.S.A., October 23rd, 1916.)
 10,162. "Mine signalling apparatus." J. MILNEAN. July 13th.
 10,163. "Call distributing systems." I. POLINKOWSKY & WESTERN ELECTRIC CO. July 13th.
 10,164. "Machine switching telephone systems." I. POLINKOWSKY AND WESTERN ELECTRIC CO. July 13th.
 10,178. "Dry batteries." E. ARNOLD. July 13th.
 10,180. "Ignition magnetos." J. H. CHAMBERLAIN & H. LUCAS. July 13th.
 10,182. "Blow-out spark dischargers for impulse excitation and for high spark frequency." A. KOWALSKI. July 13th. (Switzerland, June 2nd.)

- 10,187. "Dynamo-electric machines." REMY ELECTRIC CO. July 13th. (U.S.A., December 19th, 1916.)
 10,191. "Electric valves." G. GILES. July 13th.
 10,211. "Aerial electric dispatch or transmission apparatus." J. G. H. BROOK. July 14th.
 10,213. "Ventilation and cooling of dynamo-electric machines." C. W. MAJOR. July 14th.
 10,220. "Sparking plugs." R. HENRY & E. HERRMANN. July 14th. (France, July 27th, 1916.)

PUBLISHED SPECIFICATIONS.

1916.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

- 5,586. ELECTRIC JUNCTION BOXES. W. A. SUTTON. April 17th, 1916. (107,210.)
 7,121. DYNAMO-ELECTRIC GENERATORS AND SYSTEMS CONNECTED THEREWITH. J. STONE & CO. AND A. H. DARKER. (107,216.)
 8,639. ARRANGEMENT OF ELECTRIC STORAGE BATTERIES IN SURMARINES AND CONSTRUCTION OF SURMARINES FOR THAT PURPOSE. E. C. R. MARKS (SOC. ANON. ITALIANA G. ANSALDO & CO.). June 19th, 1916. (107,233.)
 8,691. TELEPHONE SYSTEMS. RELAY AUTOMATIC TELEPHONE CO., H. J. HERINK AND O. GRAHN. June 20th, 1916. (107,236.)
 8,756. CONTROL OF ALTERNATING ELECTRIC CURRENT INDUCTION MOTORS. W. BROOKE. June 21st, 1916. (107,240.)
 8,796. METHODS OF AND MEANS FOR CONTROLLING ELECTRIC MOTORS. BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., U.S.A.). June 22nd, 1916. (107,242.)
 8,902. IGNITION PLUGS FOR INTERNAL-COMBUSTION ENGINES. J. A. KENNEDY MCGREGOR & E. H. HODGKINSON. June 24th, 1916. (107,248.)
 9,050. SPARKING PLUGS. C. H. WATKINS. June 27th, 1916. (107,254.)
 9,180. JOINTS FOR ELECTRICAL CONDUCTORS. C. VERNIER. June 29th, 1916. (107,258.)
 9,185. ELECTRICAL SWITCHES. J. W. TREHERNE. June 29th, 1916. (107,259.)
 9,203. APPARATUS FOR THE LIGHTING AND/OR HEATING OF MOTOR ROAD VEHICLES, TRAINS, AND THE LIKE. W. F. W. RHODES & J. FIRTH. June 30th, 1916. (107,260.)
 9,246. ELECTRIC SWITCHES. G. ELLISON & A. ANDERSON. July 8th, 1916. (107,268.)
 9,285. ELECTRIC TORCHES. H. GOLDSMITH. July 13th, 1916. (107,270.)
 9,938. PROTECTION OF ELECTRIC TRANSMISSION SYSTEMS. BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., U.S.A.). July 14th, 1916. (107,272.)
 10,088. COMBINED ELECTRIC SWITCHES AND COUPLINGS. A. E. READ, J. E. FRANKS & M. BROOKS. July 18th, 1916. (107,275.)
 10,126. SPARKING PLUGS FOR INTERNAL-COMBUSTION ENGINES. G. ST. B. S. WATKINS. July 18th, 1916. (107,277.)
 11,064. MAGNETIC SEPARATORS. O. S. JONES. August 5th, 1916. (Cognate application, 15,643/16.) (107,284.)
 11,428. ELECTRO-MAGNETIC SWITCHES. BRITISH THOMSON-HOUSTON CO. (GENERAL ELECTRIC CO., U.S.A.). August 12th, 1916. (107,289.)
 17,271. ELECTRIC SWITCHES. L. J. NORTON. December 1st, 1916. (107,336.)
 18,257. ELECTRIC SWITCHES, MORE PARTICULARLY FOR USE IN CONNECTION WITH SWITCHBOARDS. A. H. MIDGLEY AND C. A. VANDERVELL & CO. December 20th, 1916. (107,340.)
 2,785. ELECTRIC LIFT SYSTEM. WAYGOOD-OTIS, LTD. (OTIS ELEVATOR CO., U.S.A.). February 26th, 1917. (107,356.)
 4,946. CIRCUIT INTERRUPTERS. BRITISH WESTINGHOUSE ELECTRIC & MANUFACTURING CO. (WESTINGHOUSE ELECTRIC & MANUFACTURING CO., U.S.A.). April 5th, 1917. (107,361.)
 3,868. METHOD OF MANUFACTURING PERMANENTLY FUSIBLE AND SOLUBLE SYNTHETIC RESINS FROM NON-FUSIBLE PHENOLALDEHYDE RESINS. L. BEREND. March 15th, 1916. (107,205.)
 5,213. INDICATORS FOR TRAMCARS AND THE LIKE FOR INDICATING STATIONS OR STOPPING POINTS. C. W. MALLINS. April 10th, 1916. (107,024.)
 6,939. GYROSCOPIC COMPASSES. H. L. TANNER. May 15th, 1915. (100,490.)
 10,037. PORTABLE DUST-SUCTION APPARATUS. R. HADDAN (ELEKTROMEKANISKA Aktiebolaget). July 17th, 1916. (Convention date not granted.) (100,953.)
 13,931. ADVERTISING DEVICES. H. FAIRBROTHER (MYSTIC ADVERTISING DEVICE). September 30th, 1916. (107,136.)

1917.

52. APPARATUS FOR RECORDING CO-RELATED LIGHT AND SOUND VARIATIONS. W. B. VANSIZE. Jan. 7th, 1917. (107,167.)

Irish Peat Deposits.—The Fuel Research Board, with the sanction of the Committee of the Privy Council for Scientific and Industrial Research, has appointed a Committee of Inquiry into the utilisation of Irish peat deposits. The terms of reference to the Committee are as follows:—

"To inquire into and to consider the experience already gained in Ireland in respect of the winning, preparation, and use of peat for fuel and for other purposes, and to suggest what means shall be taken to ascertain the conditions under which, in the most favourably situated localities, it can be profitably won, prepared, and used, having regard to the economic conditions of Ireland; and to report to the Fuel Research Board."

Though the inquiries of the Committee will ultimately lead up to the consideration of peat as a source of energy in central power stations, there are sound reasons why this aspect of the problem should be postponed to a later stage. On the one hand, the Fuel Research Board is already organising an extensive inquiry into the problems of fuel economy in connection with power production, and the results of this inquiry will supply the fundamental data and information which will be required when the time comes for the consideration of any wide scheme of development in Ireland. On the other hand, any schemes of development must be based on a more exact knowledge than is at present available regarding the selection of the more favourably situated bogs and the possibilities of winning and transporting partially dried peat to centres at which it may be converted into marketable products. It is obvious, therefore, that the inquiries of the Committee are likely to be most fruitful if they are concentrated on the fundamental problems, for until these are settled no satisfactory progress can be made.

The following appointments have been made to the Committee:—Sir John Purser Griffith (chairman); Prof. Hugh Ryan, Prof. Sydney Young, Mr. George Fletcher, Prof. Pierce Purcell (secretary).

All communications should be addressed to the Secretary, the Peat Inquiry Committee, University College, Dublin.

THE

ELECTRICAL REVIEW.

Vol. LXXXI.

AUGUST 3, 1917.

No. 2,071

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"FROM WHATEVER SOURCE AVAILABLE."

THE British Vice-Consul at Baku has reported upon the large demand there is, and will be, for internal-combustion engines of from 2½ H.P. to 100 H.P., for the oilfields. There is also an increasing demand for engines of the Diesel type for driving electrical power plant. Electrical power is being used on the oilfields more and more each year, both for drilling and for baling the wells, while the whole of the fields are lighted electrically. Electrically-driven pumps, lathes, and fittings for machine shops (not so heavy as the usual British types), and all sorts of other requirements are alluded to by Mr. McDonell. It is recognised both by him and by the Board of Trade, which gives publicity to the matter in its *Journal*, that on account of the difficulties of communication, and restrictions on exports during the war, there is little possibility of anything being done at present *except preparatory work*. "He, however, lays emphatic stress on the importance of such preparation, pointing out that as soon as communications re-open supplies *will have to be obtained at once from whatever source available*." We believe that industrial and trade students who try to avoid taking a narrow view of the outlook see that when fighting ceases, the whole of the nations, whether they have been at war or not, will be scrambling to secure their requirements for replacement and renewal work in industrial operations. We discussed this matter somewhat fully in a leader on "The Demand that will Follow" (ELEC. REV., February 25th, 1916). We then said, referring to the needs of Russia and other purchasers: "Will the character of British products be adjusted to meet their requirements? Will British manufacturing capacity be increased to any large extent? . . . The answer is emphatically in the affirmative, but will the capacity be sufficient to justify other nations in basing international trading policy upon possibilities in this direction? . . . We may be as anti-German in sentiment as the horrors of this war compel us to be, but the fact remains that, if in any country whatsoever other nations cannot suitably meet the requirements of purchasers, the trade will have to go to those who are in a position to do it, and who are not merely in that position from a manufacturing capacity point of view, but are eager to employ every possible means of adaptation and enterprise within their power, to attain that end." It is 18 months since we wrote thus. In that period, engineering manufacturing capacity of all kinds in these islands has greatly increased, but the difficulties in the way of export trade developments, whether for the Russian market or any other, have also increased, and the influences that will eventually control purchasers who experience an imperative demand for goods appear to be the same. German manufacturing facilities, so far as we are able to tell, appear to be pretty much what they were before the war, and immense efforts are being made to secure a renewal of trading relations with former markets.

We have done wonders in this country in many new and extended manufacturing operations, yet Mr. Hirst, at the meeting of the General Electric Co., Ltd., pointed out that the existing British electrical companies had

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LONDON: Gordon & Gotch, Cimitiere Street.	SYDNEY: The Mining & Engineering Review, 273, George Street; Gordon and Gotch, Pitt Street.
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yet to make good a deficiency in output to cover the demand which in pre-war time was supplied by importation. It is clear, then, if our deficiency represented by the amount of our importation is not yet being made up, we have not yet prepared for the extra demand that will follow from the outside markets which will immediately call for electrical and engineering manufactures "from whatever source available." Mr. Hirst says that the re-organisation work awaiting our electrical companies after the war will be a tremendous task. A number of schemes for re-organisation, re-arrangement, co-operative working, and so forth, have been proposed, and some of them are taking practical and financial shape, but it is clear that much more requires to be done if we are to be strong and big enough electrically to do all the things that we aspire to do. We believe with many of our industrial leaders and engineers that the future for British electrical industry is wonderfully bright. Mr. Hirst summarised some of the facts and possibilities of the situation admirably. We hear of other proposals which will assist to make us stronger than we have been or are, and the opportunities that will present themselves will call for a vast amount of new capital to be brought to the aid of electrical manufacturing. The pity of it is that, knowing all of these things well as our leaders do, they find it necessary to tie our hands in many ways, either directly or indirectly, in consequence of war activities or restrictions, or of financial burdens, so that we cannot do things that we desire to do. It is as plain as anything well can be that necessity will dictate many courses of action that present sentiments may not approve because, as Mr. McDonell says, supplies "will have to be obtained at once from whatever source available." He may well lay "emphatic stress" upon the importance of preparatory work. Unfortunately, such preparatory operations are extremely difficult to proceed with amid the prevailing conditions. The directors of the General Electric Co., Ltd., in their report, stated that these conditions "had not enabled them to proceed with the preparations for the developments awaiting the electrical industry after the war." Other manufacturing concerns have been in a similar position, though some have indicated measures that they have been able to adopt. The fact is that the possibilities are so vast that the situation calls for operations of a far-reaching kind, or else we shall only reap a small fraction of the advantage that lies within our grasp, and that might be ours if we only had the kind and size of organisation that seems to be necessary.

H.M. Consul at Ekaterinburg has been reporting lately on the situation in the Urals. At first there was an outcry for British goods, and Russian merchants failed to understand the great difficulties that stood in our way in meeting their demand. They "seemed to think that British goods ought immediately to fill up the gaps left by the absence of German goods," but they were eventually forced to obtain supplies from Japan and the U.S.A. The result was that imports into the Urals from Japan, the U.S.A., and the United Kingdom stood in the proportion of 10, 5, and 2. Urals merchants have been glad to obtain even low-grade goods which they could sell on the empty markets at fabulous prices. For this reason, he adds, "it is difficult to form an idea at present of how the United Kingdom, the United States, Japan, and Sweden will fare in the competition for trade that must arise after the war." The United Kingdom difficulty is the greater, in his opinion, because British representatives have not been able to visit the country during the war to make a study of local conditions, without a knowledge of which successful trade with Russia is impossible. This is one of the measures of preparation that the electrical industry has been trying to

make in a moderate way through existing organisations in spite of the unprecedented difficulties. Mr. Garvin has said lately that if the war were to end now it would be disastrous for us, because we are unprepared for what is to follow. The Government says that it appreciates the possibilities, and recognises that the difficulties that it is bound to put in the way of traders are a handicap, but it must have revenue. The longer the war lasts the more revenue it must have, and some of our measures by way of preparation may be still longer deferred. It is devoutly to be hoped that the nation, especially Labour, will grasp what some of these things mean and what they call for. Whatever the special features of the war settlement may be, the manufacturing character of the German people will remain. Then Russia, the near neighbour, free and democratised, but comparatively short of industrial manufacturing facilities of her own, will, as Mr. McDonell has said, and as M. Gurievitch also indicated in his article which was translated in the ELECTRICAL REVIEW for February 25th, 1916, secure "from whatever source available" those things of which she is in need. She will not impose restrictions purely on the ground of sentiment if they are opposed to her own immediate industrial and economic interests. The sooner that we and the Allied countries, including now the U.S.A., can get ahead with that preparatory work the better will be our chances for being that "available source."

The Role of the Engineer.

FROM time to time the engineer, usually absorbed in his professional work, wakes up, looks round, and realises that there is another world besides that in which he habitually moves—the world, that is, of the "man in the street." With the organisation, administration, purposes, and triumphs of the engineering world he is familiar; in all these phases he plays a part, humble or distinguished as the case may be. But of the other world, the everyday world of the social organism, he reckons little; its construction and operation are not subject to calculation and measurement, its motives are obscure or obviously fallacious, its components heterogeneous and disorderly—in fine, it is not congenial to his trained and ordered habit of mind, he is perhaps not a little inclined to despise it and its ways, and certainly he feels no over-mastering impulse to take part in its affairs.

But is he right in this? Modern civilisation is built up on an engineering foundation. In every department of life the influence of the engineer inevitably makes itself felt, though unrecognised by the vast majority. For lighting, heating, cooking, transportation, both of persons and commodities, water supply, sanitation, housing, agriculture, fishing, fighting ("this is an engineers' war")—the engineer is ultimately responsible, often jointly with his highly esteemed colleague, the chemist, who himself is often half an engineer. The functions of the engineer *quâ* engineer, therefore, are intimately bound up with human affairs; why should he rigidly confine his activities to professional paths? Is he not admirably fitted, by education, training, and intellectual ability, to take an effective part in the management of public business? Yet we very rarely find an engineer as a member of a municipal council, of Parliament, or of other public administrative bodies, which are consequently deprived not merely of the technical knowledge so essential to the conduct of public affairs, but also of the sober judgment and logical reasoning which the successful engineer must necessarily display in his profes-

sional work. This is not by any means the first time that we have touched upon this subject, nor will it be the last. We will not now pursue it further, but we recommend the perusal of the remarks of the President of the American Institute of Electrical Engineers, of which we give an abstract elsewhere in this issue, which admirably state the case for the participation of the engineer in the affairs of the nation, and show that it is not merely his right, but his solemn duty to bear his share of responsibility.

In the course of his address Mr. Buck referred to the formation of the Engineering Council of Civil, Mechanical, Mining, and Electrical Societies, representing some 30,000 engineers, who are thus organised for co-operation in all matters affecting their interests and for the creation of "an engineering public opinion." The importance of this movement can hardly be over-emphasised. The Engineering Council of our American Allies meditates no harm to ourselves, but it must not be forgotten that an equally powerful and, from our point of view, formidable Association has been formed in Germany; we gave particulars of the latter in our issue of May 11th, 1917 (p. 519), which show that the "Union of German Technical Institutions" embraces no fewer than 11 leading societies of engineers and chemists. Have our leaders given due attention to this important movement and to the influence which it may, and probably will, exert upon the course of events when Peace returns? To ignore its existence would be folly—but what are we doing to prepare our defence? Surely we cannot do better than follow the dual example thus placed before us, and lose no time in organising, not only the manufacturing industries of the country, but also the magnificent and unrivalled fund of engineering knowledge and experience at our command. Apart altogether from questions of warfare, military or industrial, the combination of our engineering forces is an object well worth attaining for many other weighty reasons.

In our issue of December 29th, 1916, we referred at some length to the recommendations that had been made by the Federation of British Industries respecting the proposed reform of the consular and commercial intelligence services. It would be interesting to know whether the Government has so far completed its own review of these and other recommendations as to be able to form definite conclusions regarding the measures which ought to be taken for ensuring the co-ordination and efficient operation of such services in the interests of British trade and industry. It has frequently been stated by those best fitted to form a practical opinion on the matter that it is most important that whatever improvements are introduced should be available, if at all possible, before the end of the war. The unwillingness of the Government to announce its policy occasions disappointment and no little disquiet in commercial and industrial minds. All our armour will need to be in fit condition for trade after the war in order that our colonial and international trade may be revived, maintained, and extended. The prospective labour situation on demobilisation will call for abundance of work and good wages for many years, and the financial burdens of the war cannot be carried unless we strengthen our industrial position, and if this Government or any other leaves measures unprepared which might go toward ensuring that state of affairs it will have much to answer for. We hope, therefore, that our leaders will soon feel able to announce that they are doing something along the indicated lines, that that something includes concentrated, in place of scattered, control at home, and an army of efficient industrial

and commercial men located throughout the world as representatives of a strong Government Department. The war has placed heavy financial burdens upon our manufacturing concerns, and in a large measure their normal trade connections are suspended. It is surely due to them that their recommendations concerning things that the State might reasonably do to help them to recover their lost position should be heeded and, if possible, acted upon promptly—not dallied with. At least the reasons, if any, for their non-acceptance could be officially divulged.

ELECTRICITY SUPPLY IN PARIS.

As is tolerably well known, our French Allies are making strenuous and successful efforts in the direction of developing the large resources in water power which still remain unutilised in that country. This attitude is due largely to the necessities created by the war, particularly in view of the comparative scarcity of supplies of coal. Under existing circumstances, the hydro-electric works have been placed at an advantage as compared with the steam generating stations, which have suffered greatly from the shortage and dearness of coal as well as of other materials. A typical instance of the latter class is represented by the *Compagnie Parisienne de Distribution Electrique*, which practically has a monopoly of the supply in the French capital.

The report of the directors of this important company states that the continuation of the war rendered the distribution of electricity in Paris more difficult and more costly in 1916 than in the preceding year. As the demand for motive power on the part of the war industries experienced a considerable increase, the company endeavoured to meet it, as far as possible, in the interests of the national defence, the result being that the total turnover for lighting and power purposes exceeded 127,000,000 kw.-hours in 1916, as compared with 69,070,000 kw.-hours in the previous 12 months. On the other hand, the greatest troubles, among obstacles of every kind, were encountered in procuring coal for the company's two works: frequently only inferior coal was available, which was subject to enormous increases in prices, whilst, at the same time, there was always present the apprehension of a complete exhaustion of the stocks. How serious this matter became on one occasion is shown by the fact that with a daily consumption of 760 tons of coal, the quantity of the stocks distributed between the two generating stations at the end of 1916 did not reach 6,000 tons, or the equivalent of less than eight days' working. The labour question, too, proved to be one of great difficulty owing to the necessity for recruiting, as substitutes for skilled workers who had been called to the colours, a fresh staff of helpers who had to be selected from casual workers and men of foreign nationality, who were so incompetent that no fewer than 3,500 had to be engaged in order to maintain a regular effective of from 400 to 450 auxiliary workers.

The obligations assumed by the company under the concession were to supply and distribute electrical energy in Paris at maximum prices, which were not to vary between January 1st, 1914, and June 30th, 1940, to pay to the Municipal Council a rental in proportion to the gross receipts, and to redeem at the company's expense during the concession the costs of first establishment, which were nearly £8,000,000, and which were to be increased annually by an average expenditure of £68,000 for supplementary works.

Before the concession was accepted, the constituent elements of the cost price formed the subject of a minute analysis by representatives of the company and of the Municipal Council, and the only divergence of opinion related to the question whether the expenses for coal should be estimated at 16s. per ton or 19s. 2d. per ton. But if the fundamental suppositions which determined the agreement eventually arrived at were realised in times of peace down to the end of 1913 the case became quite different almost from the time the present company became the concessionaire. In fact, the war radically modified the situation.

As an illustration of this contention, it is mentioned that

the consumption of energy for private lighting, which exceeded 80,000,000 kw.-hours in 1913, declined to less than 51,000,000 kw.-hours in 1915 and to less than 45,000,000 kw.-hours in 1916, when the undertaking was hampered by administrative restrictions in the second half, whilst the public lighting has also been diminished by more than half the former amount. On the other hand, an augmentation has occurred in the use for power purposes, the growth having been from 10,000,000 kw.-hours in 1913 to nearly 82,000,000 kw.-hours in 1916. During this period the price of coal has gradually risen until it reached an average of £3 per ton in 1916, which has increased threefold the expenses which were provided for under this heading in the concession, without taking into consideration the advance in the other constituents which also share in forming the cost price. It is known that the situation will become graver in the present year, as the recent purchases of coal have only been possible at £4 12s. per ton, and the supply of energy for the national defence consequently threatens simply to result in a loss to the company if the present system is maintained. Under these circumstances of a complete reversal of the provisions made under the concession, the company thought it would be sufficient to appeal to equity in order to obtain compensation from the Municipal Council in some form or other, and without having to take advantage of the principles of law, recently issued by the Council of State, and accepted by a number of French Municipal Councils. A peremptory refusal, however, has been the only result, as the City of Paris, notwithstanding the reversal of all the conditions upon which the agreement was based, claims to be exempt from the consequences of it, and to preserve the right to receive the whole of a progressive rental which proceeds from 10 to 25 per cent. of the company's gross receipts. The directors have therefore felt constrained to institute an action to enforce their rights, and they have full confidence that their application will be successful.

It would appear that, under the circumstances of the present times, all the holders of concessions from the City of Paris have points of dispute with the Municipal Council, the Metropolitan Railway Co., and the Nord-Sud Railway Co. also having differences with this authority. Indeed, as the chairman of one of these companies recently remarked, the City of Paris desires all the advantages without, at the same time, participating in the risks—a point which will, doubtless, be borne carefully in mind in the case of any future concessions in the French capital which may be dependent upon the goodwill of the Municipal Council.

THE GARRETT PATENT ELECTRIC WAGON.

For some time past it has been known that Messrs. Richard Garrett & Sons, of Leiston, were embarking on the manufacture of electric vehicles, and it is with considerable pleasure that we describe and illustrate herewith the first commercial electric wagon turned out by their works, and supplied to the Great Eastern Railway Co.

This wagon has 3½ tons capacity, and is capable of travelling from 35 to 40 miles upon one charge of the battery, the average speed being eight to nine miles per hour.

We understand that the firm also have designs completed for a vehicle of the same description, but with a carrying capacity of 2 to 2½ tons, and a speed of 10 to 11 miles per hour, the mileage on one charge being 35 to 40 miles, as in the larger design.

The wagon illustrated enjoys the distinction of having been both designed and built in an English works, and is therefore somewhat unique. Messrs. Garrett are past-masters in

the art of steam wagon building, and their experience has been turned to good account in this vehicle, in which both weight and friction have been reduced as far as practicable.

The well-known "Ironclad Exide" battery is employed, but the makers are quite prepared to fit any other battery that their customers may fancy; the battery is carried slung below the chassis frame, and is arranged in trays of a convenient size for handling, which can be withdrawn from either side of the vehicle with equal ease.

The chassis is arranged so that any type of body may be fitted, but the standard arrangement is a wooden platform



GARRETT ELECTRIC VEHICLE SUPPLIED TO THE GREAT EASTERN RAILWAY.

supplied with either chock rails, fixed or hinged sides, and tailboard.

A single series-wound 8-H.P. motor is used, having an overload capacity of 300 per cent. for short periods, with transmission by an enclosed silent chain, running in an oil bath, to a countershaft containing the differential gear, and thence to the rear wheels by means of silent roller bearings.

The countershaft is suspended from the chassis in ball and socket joints to obviate any chance of undue friction brought about by possible wringing of the frame when travelling upon very uneven roads. Both axles are of specially treated steel of a kind which Messrs. Garrett have proved by their extensive experience in steam wagon practice to be best suited to withstand road shocks, and the wheels fitted to them are of a minimum weight consistent with adequate strength; furthermore, they are all fitted with Timken roller bearings.

Two independent brakes are fitted, both of which act directly upon the hind wheels. The foot brake, for general use, is of the contracting band type, while the emergency hand brake is of the expanding type. Messrs. Garrett have adopted this system because the general practice of fitting the emergency brake to the countershaft has the defect that, if the chains to the rear wheels snap, the emergency brake is useless.

The arrangement of the speed controller has several unique features. It is of the drum type, rotated by a handle attached to the steering handwheel, and gives six speeds in a forward direction, and four in the reverse. The controller is fitted with Messrs. Garrett's patent trip gear, which is so designed that so soon as either foot or hand brake are applied, the controller, which is carefully balanced, flies back to the neutral position automatically, and is so arranged that it is impossible to start the vehicle without first returning the controller handle to the neutral position and also releasing the brakes. This arrangement prevents damage being done by a heavy rush of current through the battery or motor, owing to the driver omitting to bring the controller handle to neutral before applying the brakes, as the act of applying them does this for him; also, if his brakes are applied, he is bound to release them before he can start to run. Furthermore, it obviates the risk of accidents which have occurred through a vehicle starting forward the moment the brakes are released when the controller has not been in the neutral notch.

Great attention has been paid to the lubrication of the working parts, and lubricators have been fitted at every point where, by doing so, friction can be reduced, and roller or ball bearings have been fitted throughout.

This has resulted in a vehicle that requires only a fraction above a quarter of a horse-power to drive the complete mechanism at average road speeds.

Some data as to the working of this vehicle, recently quoted in the *Commercial Motor*, covers 22 working days, during

which 307 tons were carried on 100 journeys; 965 deliveries of goods were made, over a working time of 215 hours. The all-in cost per ton carried was 1s. 11d., while the cost of horse transport on a similar basis would have been nearly 2s. 9d. per ton.

We are indebted to Messrs. Richard Garrett & Sons for particulars of their vehicle.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING MAY AND JUNE, 1917.

THE official returns of electrical exports and imports for the months of May and June, show, as regards the exports, totals of £346,317 and £367,520 respectively, which compare with £308,511 in April and £404,586 in March, and are quite up to the average. The imports totals for the same months have been:—March, £286,921; April, £235,985; May, £236,799; and June, £186,888, showing a falling off in value. During the last three months machinery export values have steadily improved, while machinery import values have pursued the opposite course; in addition, the importation of glow lamps has dwindled to very small proportions, though an increasing business is being done in imported "arc lamp parts."

The exports for May and June included submarine telegraph and telephone cable to the value of £3,322 and £14,210 respectively; some £2,000 worth only of telegraph cable entered this country from abroad during the above months.

It is unfortunate that the official export figures for the above months contain unenumerated material (electrical goods and apparatus and machinery), representing over 25 per cent. of the total export values given, and one wonders what the effect on values the proper classification of these "unenumerated" species would have.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS AND MACHINERY, MAY AND JUNE, 1917.

	Exports (May).	Imports (June).	Exports (June).	Imports (June).
Electrical goods and apparatus unenumerated ...	£ 62,717	£ 47,244	£ 53,580	£ 35,727
Insulated wire and cable (not telegraphic or telephonic) ...	35,121	2,826	56,404	2,304
Electric glowlamps ...	12,073	444	9,999	1,773
Arc lamps and parts (not carbons) ...	1,442	10,071	14,035	15,967
Meters and instruments ...	4,972	3,749	14,419	3,511
Electrical machinery (including switchboards and transformers) ...	122,270	137,025	134,096	102,663
Batteries ...	13,237	18,256	10,486	17,009
Carbons ...	5,964	11,984	241	5,108
Telegraph and telephone wire and apparatus ...	88,521	5,200	74,260	2,826
Total ...	346,317	236,799	367,520	186,888

AIR-BLAST RECTIFICATION OF HIGH-TENSION CURRENTS.

THAT a partial rectification of a high-tension alternating current occurs on the passage of a discharge from a point to a plate has been known for many years. However, difficulty has been encountered in attempting to utilise this rectification, particularly if any considerable current flows, as a heavy arc then results which rectifies but little.

In the June, 1917, issue of the *Physical Review*, E. R. Wolcott and C. J. Erickson relate the results of an investigation into the effect of a blast of air on this discharge. It was found that complete rectification and smooth operation could be obtained by means of a current of air flowing from the point to the plate under such conditions.

When rectification occurred the discharge was white, rhythmic and snappy, as distinguished from the coloured arc which resulted when no air was flowing. Difficulties were encountered when trying to operate at too low voltages, say, only a few thousand volts, since a certain voltage is required to jump the air gap. Likewise, there is a drop in voltage across the rectifier in actual operation. Satisfactory rectification has been obtained up to 350 kv., and also at frequencies up to 500 cycles per second.

With the point inside a glass tube the discharge is more snappy, but the tendency to surge is greater. In this case aluminium electrodes seemed preferable, a larger plate was necessary, and a greater air pressure was required. With the point outside the tube, satisfactory results were obtained with iron and brass electrodes.

As the air pressure increases from zero during the discharge, the rectification increases to a maximum, the value depending upon the setting of the electrodes and the diameter of the air outlet. A

further increase of air pressure beyond the value which gives maximum rectification produces irregular operation.

In general, the wave of the rectified current follows the wave form of the generator, but as a certain voltage is required to start the discharge, it does not include the whole half wave produced by the alternator. Furthermore, the rectified wave is more abrupt than the original wave.

The experiments were conducted with the apparatus illustrated in fig. 1. A pointed metallic electrode *a* is mounted co-axially

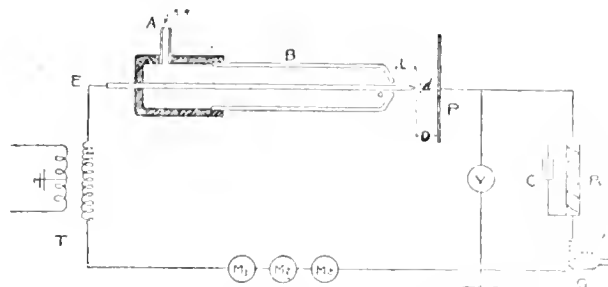


FIG. 1.—ARRANGEMENT OF TEST EQUIPMENT.

within the tube *B*, which is restricted at one end, so that air entering at *A* is blown through the opening *o* toward the plate *P*. Rectification occurs when the point is some distance within the tube, at the opening of the tube, or extending some distance outside of the tube, as shown. In the first two cases, the tube *B* must be made of some insulating material, as of glass; in the last case, it may be of metal.

Mounted for use, this rectifier was connected to one terminal of the secondary of a 2-kw., 40,000-volt transformer *T*, the other terminal being grounded. The positive current flows from the point to the plate, and no discharge results in the opposite direction when the distance between the point and plate, that between the point and air outlet, the air pressure and the voltage are suitably adjusted.

Connected between the other terminal of the transformer and the ground were three milliammeters: *M*₁ was of the electro-dynamometer type; *M*₂ was a direct-current instrument of the D'Arsonval permanent field type; *M*₃ was a hot-wire instrument.

The secondary voltage from the plate *P* to ground was measured by an electrostatic voltmeter. An oscillograph was connected directly in the high-tension circuit between the water resistance *R* and the ground.

The air condenser *C* consisted of 11 plates 8 ft. by 3 ft. (2'44 m. × 0'91 m.) and 8 in. (20'3 cm.) apart. Its capacity was

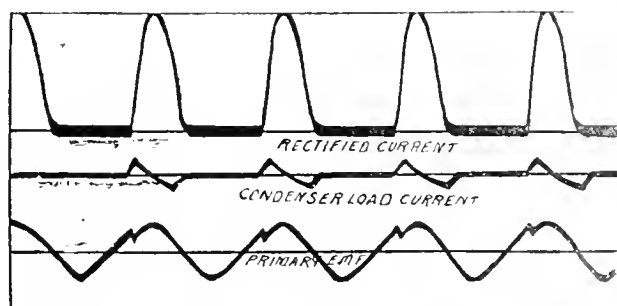


FIG. 2.—RECTIFIED CURRENT OBTAINED WITH AIR-BLAST RECTIFIER AND LOAD OF 104 MILLIAMPERES.

0'00095 mfd., and it was connected in parallel with the water resistance when desired.

The diameter of the plate *P* should be large enough to prevent a discharge from the point to its edges. In the arrangement here described its diameter was 4 in. (10'16 cm.). The diameter of hole *o* in the tube *B* was 0'157 in. (4 mm.); *d*, the diameter of the metallic electrode *E*, was 0'0625 in. (1'57 mm.); *L*, the distance between the opening *o* and the point of the electrode *E*, was 0'375 in. (9'54 cm.); *D*, the distance between the plate and the point, was 0'68 in. (1'76 cm.). The frequency of the alternating current was 60 cycles per second.—*Electrical World*.

Mexican Electrical Taxes.—H.M. Chargé des Affaires at Mexico City reports that Decrees were issued, under date June 5th, by the President of Mexico, imposing special stamp taxes on electric lights and telephones. The tax on electric lights has been fixed at 10 cents (Mexican gold) per month for each light up to 40 watts, and 10 cents extra for each light in excess of that power. Telephones in private houses are to be taxed at 50 cents, and in shops, offices, &c., at \$1 (Mexican gold) per month. These taxes are to be collected through the companies supplying the services.—*Board of Trade Journal*.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Electroculture.

I am glad to see that your recent report of the Board of Agriculture experiments and my article on electroculture have aroused so much interest in a new and, I believe, very important use of electricity. Particularly I wish to thank Mr. Turnbull for his favourable comment on my effort.

A correspondent asked whether the Armstrong hydro-electric machine would not be a useful generator for this purpose. I think this is doubtful; it is true that books of the "Ganot's Physics" type describe this as a very powerful machine developing large quantities of electricity, but it must be remembered that in those days "a large quantity of electricity" was what one got on putting the knuckle near the discharger of a pint Leyden jar. Such a machine is spoken of as giving "a torrent of sparks"; this does not describe the roaring patch of violet light seen between the dischargers of a W.T. set, even when only one or two milliamperes are being supplied to the condenser. The machine does give great potential, but I believe the quantity is doubtful and erratic. The action depends on the steam getting condensed at the right moment, and the nozzles wear under the impact of the particles of water.

Perhaps the most important point against it is the starting-up trouble. The charge is wanted on the wires for a short time once every 12 hours, and therefore the machine would have to be warmed up every time, or else stand-by losses incurred for about 20 hours out of 24. This would put coal and coke firing utterly out of court, and even a paraffin-fired flash boiler has to take up a large quantity of heat into the mass of metal, brick and water before it can begin to give off steam at from 80 to 100 lb. per sq. in. Then it has to deliver only 4 to 5 B.T.H.U., and is shut down for another 10 hours, when it all begins over again!

Mr. Turnbull speaks of static machines, but I think he will find the efficiency low. Makers are very shy about speaking of the output of their machines as regards current—they are emphatic as to their spark length and many excellencies, but under pressure generally admit that the current is "very hard to measure," i.e., is too small for a cheap moving-coil pivoted instrument. Certainly a machine that gives 1 milliampere at a 6-in. spark length—i.e., 100 watts—is a big machine, and takes fully 1 H.P. to drive it.

The limit to the potential given by a static machine is the rate at which the induced charge leaks away over the surface of the plate; this increases rapidly with the potential, and finally equals the rate of increment, when no further rise in potential can take place.

This leakage and the friction, not only due to bearings, but largely windage, make the efficiency very low.

Their fragile construction and sensitiveness to damp are also severe handicaps in practical use.

Perhaps the most telling argument against both types of machine is the need that has arisen in recent years for high-potential generators. In many cases a constant current would be far more suitable than an alternating or intermittent one. Wireless telephony would probably have been in common use by now if a good type of high-potential constant-current generator had been available some years ago. Why were not these machines developed and used? Because, I believe, they could not be made sufficiently powerful and reliable.

A most important point in electroculture apparatus is that the generator should be able to charge the whole network to the full potential. This means a machine capable of dealing with much greater outputs than that actually needed for the discharge, especially as there is always considerable insulator leakage to overcome. Trying to run a small generator up to its limit on this work has been responsible for many failures.

The Writer of the Article.

Recruiting and Dilution of Labour.

Admitting the difficulties attending recruiting and dilution of labour, the two following incidents alone show not only what managers of factories have to endure, but also the incompetence or stupidity of the Government representatives.

We are an engineering firm, controlled, scheduled under protected occupations, doing nothing but Class A and B work, most of which is direct Government work. We have only one electrician left in our factory, and he carries out all the testing, comprising insulation resistance, capacity, copper resistance (bridge and potentiometer methods), and extra-high-pressure by means of a motor-generator and transformer up to 50,000 volts. Moreover, he is responsible for the light and power installations of the factory, amounting to some 300 H.P.

In our returns we rate this man as "skilled." The Dilution Officer, with his superlative wisdom, disagrees with us, the man is to be called to the Colours, and provision for a male substitute is not approved. We were warned that this man would probably be called up, and at our invitation the Dilution Officer visited the works, and was shown the various instruments, the nature of the work, and the names of the Government Departments for which the work was required. At the same time, the serious results of the loss of this man were pointed out—it would mean

shutting down, because no substitute could possibly be obtained. Did the Dilution Officer modify his views? No, he rose superior to such trifling consequences. He could then, he no doubt thought, get more men if the factory had to close. Far-seeing man—bump of perspicacity abnormally developed. We have no doubt as to the result of our appeal.

The second case relates to dilution, and we believe is not uncommon. Amongst substitutes sent us by the Labour Exchange was one to take the place of a married man with one child. This substitute, 26 years of age, unmarried, perfectly healthy, was found, after a few days, to have been imported from Ireland by the Government. The natural result is, of course, that the men are to "down tools" unless this Government nominee is dismissed. He will be in a day or two, and without a blessing. Do we express surprise at such outrages? We live on them—they are meat and drink to us. What should we have to do if the Government officials deprived us of these pleasantries?

Carry On.

Captive Balloons and Lightning.

From time to time I hear of this class of balloon being set on fire, while the non-captive, though not altogether immune, is seldom struck. My object in writing is to ask if any of your readers who heard of the destruction of the kite balloon at Roehampton, reported in the *Daily Telegraph* of July 14th, can give particulars of the accident. Was lightning seen to actually strike the fabric or was the gas (the inlet is, I believe, left open) set on fire by a flash in the vicinity?

Are these balloons connected to "earth" under service conditions?

Killingworth Hedges,

Hon. Sec. Lightning Research Committee.

St. Stephen's Club,
Westminster, July 25th.

The Psychology of Power-House Shift Work.

It is most refreshing to read such a sympathetic article on shift work as that in your issue of this week, more especially as the writer says he was formerly on shift work. Our experience has been that the men who are fortunate enough to leave shift work promptly forget the men they leave to do it; and it is a rare thing for a chief engineer who has done shift work, as so many have, to make any attempt to alleviate the discomforts of the shift worker. If we take the case of two men in the same employ receiving equal salaries and doing equally valuable work, we find that if one of these men is on shift work, in addition to inconvenient hours, he works more hours per week than the man receiving an equivalent salary, but who is in the office or some similar post. Why is this?

We are in full agreement with your writer as to the psychological effects of night shift and long hours, and think that a 48-hour week should be the maximum for shift workers, and no shift should last longer than eight hours.

Your contributor states that now is the employers' opportunity to improve conditions; but, in our opinion, the employer will do nothing to improve the lot of shift men unless pressure is applied. The question then arises, how is the pressure to be applied? If we look at things as they are at present in the industrial world, we find the employers banded together to protect themselves by Associations, Federations, and the like; the workmen are united in their Unions; but the *salaried* staffs of minor officials—such as shift engineers, draughtsmen, and so on—have no joint policy; thus they get what is left—usually small salaries and long and inconvenient hours.

We are not members of any organisation; but we are forced to the conclusion that no improvement in the shift men's lot will be made until they have banded together and shown that they speak as one man.

We can substantiate the statement of your writer as to the loyalty of station staffs, and also as to the unrest among them. They will never strike, of course, but employers should realise that a contented and comfortable staff is a great asset in the conduct of any business, and that unless they see to it that the staff is well treated, the good men will keep away and the business will suffer through the inferior quality of its staff.

The up-to-date employer pays his employees as much as he can afford, and not as little as he is allowed to do, with corresponding results in quality and output of work.

Shiftero.

July 23rd, 1917.

Mr. Arnold's very excellent article (published in your issue of July 20th) on the psychology of shift work, touches a matter of extreme importance to the future of power station work. It is well thought out, and comes particularly opportunely from a man who has himself got clear of that rotation of working hours at once so irritating, and so injurious to one's social life and digestion. There is, however, a reference made to the A.E.S.E., in which he entirely misses the mark. To state that the A.E.S.E. apparently collapsed because "it began to meditate militant tactics, thereby proving the loyalty of shift engineers to their employers," is quite erroneous. The great difficulty of the A.E.S.E. was that it had to cater for two distinct classes of men:—(a) Those who were paid by the hour, and regarded their work merely as a job, expecting nothing better than to get more money; and (b), those who were on the staff, and lived in hopes of a chief engineer's position, or

something approaching it. The former were out for Trade Unionism unadulterated, the latter (usually staff men) held aloof for many reasons, chief of which was that it was *infra dig.* to belong to any organisation whatsoever. Hence the A.E.S.E., refusing to cater for the former element, fell into abeyance for want of support from the latter.

Now, as one who has spent the greater part of his working life on shift work, I may say that the true position to-day is this:—The Trade Union element are fast joining the E.T.U. They believe that nothing short of a pistol at the chief's head in the form of a threatened strike can be effective. They are in receipt of the Committee on Production awards, each four months, to meet the increased cost of living, and for them the E.T.U. is an excellent thing.

Now it is these war wages paid to station men in the E.T.U. that are creating the discontent so rife amongst station men of the *infra dig.* class. They cannot see why they do not get the same consideration as the Union men, and will not see that their employers care nothing about their so-called loyalty.

They have not realised yet that employers are not paying the Committee on Production war wages because they want to, but because they are forced to pay all members of the Trade Unions affected by war conditions, hence membership of the E.T.U. gets it for station men.

It is difficult for staff engineers to join the E.T.U. along with the men working under them, and I would suggest two courses open to them:—(1) They can revive the A.E.S.E., calling it the Association of Electrical *Staff* Engineers, and invite members from all electrical engineering works, private and municipal; or (2), they can invite the E.T.U. to form a section for staff engineers. Organise they must, if they are ever to be considered in the industrial conditions of the future.

A. O. Holt.

Manchester, July 30th, 1917.

Symbols for Electrical Tenders.

The ordinary formula for the present value of an annual expenditure is—

$$x = y [1 - (1 + b)^{-n}] / b.$$

If b is taken to represent the *mean* rate of interest for money borrowed and money invested, this is simply the formula which has received the approval of the Sydney Municipal Council, as mentioned in your "Notes" for July 27th last.

Norman Hockley.

Manchester, July 30th, 1917.

LEGAL.

GAS LIGHT AND COKE CO. v. HACKNEY BOROUGH COUNCIL.

ON Wednesday, July 25th, Mr. Justice Asthury gave his judgment in this case. He said: The question of principle which is raised in this action is one of far-reaching importance to the electric light undertakings of this country and to their customers. One of the principal objects of an electrical undertaking is to utilise its plant to the best advantage, and one method of accomplishing this result is to obtain customers for energy during the day as well as during the dark hours, and in each case to encourage customers whose hours of consumption do not synchronise, so that the diversity between them enables the plant to satisfy a greater number of hours of maximum demand than would otherwise be the case. The proportion of the actual number of units sold to the output capacity of the plant is termed in this branch of industry the load factor of the station, and the ratio between the load actually observed at the station and the sum of the loads at the consumers' terminals is termed the diversity factor. Broadly stated, power users have a better load factor and diversity factor than light users, which accounts for their being usually charged a low rate, because, other things being equal, the higher the load factor the lower the cost per unit of production, and the better the diversity factor the further the undertakers can go in the earning of revenue. An increase of the load and diversity factors; therefore, is of the greatest importance, and tariffs should be framed in order to obtain customers and classes of customers whose consumption contributes to this result. This being so, as a general rule it is obvious that a customer or a class of customers with a higher load factor, due to the taking of a different supply in different circumstances, is entitled in the interests of the undertaking to differential treatment in the matter of charges, as compared with the customer or class of customers whose load and diversity factors are inferior. The sections of the Electrical Lighting Act of 1882 which are in question are Nos. 19 and 20. These sections say nothing about and do not draw any distinction between light, heat, or power users as such. The station turns out only one class of energy, which is measured in Board of Trade units, and the dissimilarity of circumstances and the non-correspondence of supply involved in Sec. 19 must be looked for not in the difference in the energy consumed or in the manner in which it is led into and distributed by wiring and meterage in the customers' premises, but in the circumstances of the customer, in so far as they react on the supply that he takes and on the time, diversity, and quantity of consumption. In other words, the pur-

pose to which the customer puts his energy which he purchases, whether for lighting, power, or heating, is, *per se*, irrelevant. It is in the quantum of and the circumstances in which he takes his supply of the one product that the undertaking offers for sale that the answer to the question as to undue preference must be looked for, and it is only for the purpose of classifying customers according to this test that they are for convenience divided into light, power, and heat classes, such purpose involving, as I have already pointed out, well-recognised differences from the point of view of load factor, diversity factor, and the quantity of units purchased. Customers may therefore be, and are, in practice divided into classes in accordance with those considerations, and they are charged with varying and different rates, and classes of rates, with the object of encouraging advantageous customers, and classes of customers, as well as of attempting to fairly adjust the respective advantages obtained by the station from all of them. This has led to what are termed different systems of supply being adopted, that is to say, for lighting, heating, power, &c., the customers in each case taking the only thing that the undertakers had to sell, but in circumstances which affect differently the load factor of the station in both diversity and quantity. If the different systems of supply are fairly arrived at, and are at the choice of the customer, and a preference prohibited by Sec. 20 as between customers dealing in similar circumstances, and not between customers dealing in different systems of supply, either of which they are free to select, is given, and to the extent that customers under one system benefit the undertaking in the way I have described to a greater degree than customers under another—so they are given a benefit in the scale of charges. In the present case, although the wording of the 1914 circular of the defendants, on which the action was launched, may be ambiguous in the sense that the 20 per cent. for light in the case of the power users was not expressly stated to be limited to factory lighting, this was put right in the circular and scale of charges issued in 1916, before the date of the writ, and in practice the defendants have not allowed a user of the 20 per cent. in question for purposes other than the lighting of a factory or workshop having a power supply, nor had they threatened, or intended, to do so, nor apparently has anybody thought that such was the case, and I allowed an amendment of the pleadings raising the 1916 circular in order that the case might be determined, and it has accordingly been argued, on the true facts. In the case before me, all power users are placed on the same basis if all take one supply at the same rate or price per unit, and they are all allowed to use 20 per cent. of such supply for lighting their factories or workshops, which must be lighted by some means or other if they are to take power supply at all. A similar practice has been sanctioned by Parliament in the case of many power companies, as explained in the evidence: that is to say, Parliament has sanctioned power companies competing with lighting companies in various districts on the terms that one-fifth of the supply taken by the power user may be used for light, this being based on the footing that factory and workshop lighting, as a rule, does not amount to, or exceed, one-fifth of the total amount of the energy taken. For the reasons that I have endeavoured to give, I am of opinion that no breach of the provisions of Sections 19 and 20 of the Act of 1882 by the defendants has been established, and that they have not threatened or intended to supply energy otherwise than in accordance therewith. The action must be therefore dismissed, with costs against the plaintiffs.

HIS LORDSHIP, on the application of MR. PERCY WHEELER for the plaintiffs, granted an extension of the usual time for entering an appeal.

M'ERLEAN v. JOHNSTON.

IN this case, heard at the Belfast Assizes, a soldier sued Stanley Johnston, electrical and general engineer, Belfast, for having exposed his son, J. G. M'Erlean, to unnecessary risk at Inver Bleach Works, Larne, where defendant had an electrical wiring contract, in September, 1916. It was stated that as a result the youth, aged 17, who was an apprentice to electrical engineering, met his death by being caught in machinery.

The DEFENDANT denied that the deceased had at the time referred to been employed by him as an apprentice; that he knew any part of the work he had contracted to do was to be done in proximity to dangerous machinery or that it was dangerous by reason of such proximity; that he ordered the deceased to execute the work, or that he knew, or ought to have known, that the deceased was inexperienced and ignorant of the danger. It was further contended by him that there was contributory negligence, and that, admitting the work was dangerous, the deceased knew the risk and voluntarily undertook it.

HIS LORDSHIP decided in favour of the plaintiff, and awarded £150 damages.

A stay of execution was granted.

First Aid in Factories.—The Home Secretary announces that he proposes to make an Order, which will take effect from October 1st next, requiring that all factories employing 25 or more persons, which belong to one or other of the following classes—blast furnaces, copper mills, iron mills, foundries, and metal works—shall provide and maintain "First Aid" boxes or cupboards. In the case of factories employing 500 or more persons, an ambulance room and ambulance carriage will have to be provided.

WAR ITEMS.

The Rebuilding of Belgium.—We have received from Technical Journals, Ltd., 27-29, Tothill Street, Westminster, a 36-page pamphlet, entitled "The Chance for British Firms in the Rebuilding of Belgium." It has been written by a "Belgian Contractor," and deals thoughtfully and informingly with many of the considerations that need to be borne in mind in connection with the immense reconstruction operations that will one day—may it be soon—have to be carried through in Belgium. Unquestionably, one of the first essentials will be money, and the wholesale devastation and robbery that have afflicted the country will render reliance upon outside sources imperative. The author shows that Belgium looks to this country to furnish the necessary capital. Germany occupied a predominant place in the building industry there before the war, and by close study of requirements, by low prices, and by instalment payment systems, secured a large trade. We shall have to meet German competition on its own basis, and unless we are prepared to thus compete, Germany will again secure a footing, and notwithstanding present Belgian intentions to have no dealings with the enemy which has caused so much misery and ruin, Belgians "will be driven against their will into the hands of German manufacturers supplying materials and plant at the lowest prices, and on the most advantageous terms." British firms are advised to study the specifications governing public works in Belgium for information respecting the materials used in construction. It is pointed out in the author's summary that our merchants and manufacturers who wish to supplant the Germans must not rely upon the quality and appearance of their products, but must, as the Germans have done before them, make their goods exactly in conformity with the Belgian official requirements. Building plant has been destroyed or stolen by the Germans, and the works and factories for producing materials that were formerly made by the Belgians themselves are no longer in existence. Belgian law is stated to provide every protection for British firms supplying goods on credit to Belgian contractors. The matter is surveyed in the following brief chapters:—Finance; Machinery and Equipment; Material Supplies; Construction; Commercial Organisation. In conclusion, the writer believes that British ingenuity and enterprise will be equal to the occasion, but our firms are urged to prepare themselves for the work, and to beware of the insidious commercial and industrial methods of the Germans. For three terrible years Belgium has been in the grip, or under the heel, of the Hun. We trust that the time of deliverance will not be long deferred, but whether that be so or no, it is the Allies' determination that ultimately there shall be restoration. What the future will bring, beyond that great fact, must necessarily be under a cloud for the present, but "Belgian Contractor's" contribution is undoubtedly a timely one, which all who wish to take part in that restoration should thoughtfully study.

An Appeal on Behalf of our Sailors.—An appeal has been issued by H.R.H. the Duke of Connaught on behalf of King George's Fund for Sailors. The safety of our shores and the maintenance of our food supplies, indeed, the existence of the Empire, depend upon the endurance and self-sacrifice of "those who go down to the sea in ships," and the nation has an opportunity of showing its appreciation of their services in a practical manner by supporting this new Fund, which was recently inaugurated at a meeting at the Mansion House. His Majesty has consented to become Patron of the Fund, and the Duke of Connaught is president. Contributions may be sent to King George's Fund for Sailors, Trinity House, London, E.C.3.

Entertaining the Wounded.—On July 18th, a number of wounded soldiers were entertained by the employees of the Siemens Wotan Lamp Works, Dalston, N.E. This is another of the series of events arranged for by the Dalston lamp-makers, at their own expense. On this occasion the committee decided on a brake trip to High Beach, and two representatives of the employees were deputed to accompany the party (in two brakes from the Metropolitan Hospital), so that everything possible could be done for their enjoyment. Snokes were provided, and a substantial meal was served at Rigg's Retreat, High Beach. The following committee were responsible for the arrangements:—Miss Crisp, Miss Payne, Miss Fox, Miss Ashton, Miss Ross, Miss Cole. Mr. Price acted as secretary.

Exports to China.—The "London Gazette" for July 31st contains a further list of bodies and persons in China to whom exports may be consigned.

Exemption Applications.—At Calcutta Exemption Tribunal, in May, the application of Mr. Wingfield, agent for the Calcutta Electric Supply Corporation, on behalf of 51 assistants of the company, was under consideration. Mr. Wingfield withdrew his application on behalf of 12 of the men, but applied for absolute exemption for the rest. He wished to know whether the men would be considered to be under the military authorities and whether they would be liable to be called up at any time. If such was the case, it would interfere with his work, and would perhaps cause a

cessation of the activities of his company. It was pointed out that should a contingency arise it was always open to him to represent the matter. "A member of the Tribunal remarked that the military authorities were not so unreasonable as to take away a large number of his assistants, and so handicap his business. The President assured him that the men while on parade would be under the orders of the military authorities, and at other times under his orders. They were, however, liable to perform guard duty. In the end, 10 were selected for general service, and the applications on their behalf were withdrawn. Thirteen were exempted from all service up to the end of the year. Seventeen were exempted from general service up to December 31st, but are to perform general service training, special arrangements to be made for their drills. Several more were made liable for local service, and the applications of two were struck off.

At Southwark, Coun. T. E. Hewitt, electrical engineer, applied for the exemption of three sheet metal workers and a fitter. He stated that he had again applied for certificates under the protected trades schedule for these men, but had not got them. He had visited the Minister of Munitions, and seen the manager in charge of the badge department, who informed him that they were unable to deal at once with the large number of applications for badges that had been sent in. In one case a firm was asking for 100 cards. His application would be dealt with in due course. A further month's exemption was granted.

At the same Tribunal, Messrs. F. W. Hotton & Co., electrical engineers, applied for the exemption of F. W. Hotton, son of the principal, 26 years old, married, passed for garrison duty at home (C1). They were entirely engaged on work for the Government and controlled firms. His son served his apprenticeship with the firm, and was now in charge of over 20 machines, his wages being £4 a week. The Military Representative thought they had better apply to the Minister of Munitions for a card for him. Mr. Hotton replied that they had already put in an application, but got no reply definitely, only a letter that the matter would have consideration. A month's extension was granted to obtain the card.

Conditional exemption was given at Ramsbottom to an engineer (28), Class A, in sole charge of electrical plant. He served in France, and was discharged in 1915.

At Bury, an electrical fitter, in charge of dynamos, motors, &c., at a paper mill (20, single), Class A, was ordered to report on October 1st.

At Burnley, an electrical fitter, aged 20, Class A, was found to be on work of national importance, and was exempted to September 30th.

Temporary exemption to October 31st was given at Clayton-le-Moors to an electrician, 31, general service, who said he was the only electrician in the township.

An electrical firm appealed, at Burlye, for an electrical fitter. Skilled men, it was urged, were very scarce. The men, who was 29, and B1, was given to the end of September.

At the Burnley Tribunal, last week, the Military Representative asked for the review of the exemptions given to 46 motormen in the employ of the Corporation tramways. The Town Clerk said the cases were in respect of men who recently put themselves out of employment by striking, but they were now back at work. Captain Parker said the application for review had nothing to do with the strike. Twelve men were in category A, nine in B1, and four in C1, and he asked that these 25 should be directed to join the Army, after time had been allowed for them to settle their affairs and for the Corporation to find substitutes. Mr. H. Mozley (manager of the tramways) asked that the cases be adjourned until the full list of tram employes was brought up. The Tribunal decided that the time was not opportune to review the cases, and they dismissed the Military appeals. They would be prepared in the near future, however, to consider the whole list, if necessary.

The cases of 12 employees at the Eastbourne Corporation Electricity Works again came before the Tribunal last week. The Tribunal decided that the exemption certificates of nine of the men should be confirmed, and that the cases of three stokers in high medical categories should be adjourned for three months to see if they could be substituted.

Messrs. Marbro, Ltd., applied to the Fulham Tribunal for the exemption of Mr. W. A. Robertson (39, married, passed B1), their works manager. It was stated that the company was formed in 1914 for the purpose of making electrical switches, &c. A large quantity of these goods was formerly imported from Germany. The directors, it was said, had businesses of their own, and took no part in the management. The firm was engaged on Government contracts. Mr. Robertson, who is a special constable and a member of the V.T.C., was awarded four months' exemption.

A review was made at Watford of the case of J. W. Russell (32, Class A), electrical fitter and engineer. It was urged that this was a one-man business, and, after particulars had been given of work done and in hand, the Tribunal withdrew the conditional exemption as from October 18th.

At Bexhill-on-Sea, Mr. H. T. Squirrell appealed for J. F. Gibbs, electrician, and six months' exemption was allowed.

At Weymouth, continued exemption was sought by Messrs. Brooking & Co., electrical engineers, for H. J. Barrow (34, Class A), wireman, and the firm defended a

military review of exemption held by A. Smith (32), wireman. The Advisory Committee expressed the opinion that the work of an electrical wireman could be done by a joiner or carpenter, and Mr. C. H. Wood (Military Representative) mentioned that the military were in urgent need of electricians. Mr. Escott (for Messrs. Brooking & Co.): Why don't they take on carpenters and joiners? Barrow was exempted whilst in the same occupation, and in the case of Smith, his exemption was varied to September 30th (final).

Rochdale Tribunal has refused exemption to J. Hilton (39, Class A), tramway motor examiner, and he is to report for service on August 31st.

Before the Somerset Appeal Court, Mr. A. J. Howard, borough electrical engineer at Taunton, applied for conditional exemption for W. P. Short (28, B1), ledger clerk and relief switchboard attendant. Mr. Howard presented a card from the Ministry of Munitions, which the Chairman said protected Short from being called up, except with the sanction of the Munitions Area Tribunal. Mr. Howard said that the calling-up notice served on Short did not bear the authority named. The Chairman said that the proper course was to dismiss the appeal, and leave the matter to the Munitions Area Tribunal. Mr. Howard had better notify the Recruiting Officer that he held a protection card, and that the man's notice did not bear the proper stamp.

The Military had a review at Watford of conditional exemption held by Mr. M. G. Connari (37, Class A), electrical engineer. The case was heard *in camera*, and the exemption was cancelled, respondent to join up on September 1st.

At Broadstairs, the cases of four of the staff of the Isle of Thanet Electric Traction & Lighting Co. were gone into, those concerned being a permanent-way engineer and three motormen. Mr. Forde, manager, said that the men were indispensable to the working of the undertaking, and were all in certified occupations. He offered to release higher category men if and when the military authorities could provide him with efficient substitutes. The Military Representative asked if it would be possible to release some men by substituting a 20-minute service for the present one of 15 minutes. Mr. Forde replied that if any reduction of that kind became necessary, the directors would probably close the system altogether. Each of the men was granted conditional exemption.

At Ilfracombe, with the assent of the Military, exemption until October 1st was granted to A. H. Friend (33, Class C3), electrical engineer.

Before the Beds. Appeal Court, the Military appealed against conditional exemption held by E. W. Keech (40, B2), engaged with Messrs. Siemens laying cables from a power house to an aerodrome. The firm claimed the man as being thoroughly good at his work, and the Court granted conditional exemption whilst he remains in Messrs. Siemens' employ or in similar work of national importance.

The Essex Appeal Court heard a Military appeal against exemption held by five motormen engaged on the Leyton U.D.C. tramways. Captain Howard said that none of the men were now in certified occupations. Mr. Schofield (tramway manager) said that he had been trying to get substitutes, but after being in training for a month the men tried suddenly found they could not do the work. If he had another two months he thought that he could find men to replace these. Two months were granted in each case.

The Military appealed at Oxford against three months' temporary exemption granted to A. M. Eldridge (29, general service), electrician. The appeal was allowed, and a month's grace conceded.

At Quarry Bank, Messrs. J. Stevens & Co., of Thorns, appealed for an electrician (27), and three months were conceded.

At East Ham, an appeal was filed by R. Cornwall (22, C2), electrician, who said that, owing to an accident, he had lost the fingers of his left hand, which was practically useless. A member protested against the appellant being called up, and Lieutenant Dundas replied that, as an electrician, he would be useful in the Army. Coun. Mitchell: They would put him on picking up paper, or something worse, whereas he is doing good work in civil life. Conditional exemption was granted.

At Winslow, an electrical engineer, dissatisfied with his classification (C2), asked for leave to go to the Central Medical Board, saying that he could not walk a mile. Captain Green said that applicant need not worry about his inability to march; if he were a skilled electrician the Army would be only too glad of his services in that capacity. The application was refused.

On the recommendation of the Advisory Committee, the Rochdale Tribunal has granted exemption until October 31st to H. Smethurst (36, Class A), overhead wireman, appealed for by the Corporation Tramways Committee.

At Llangollen, in the case of Mr. G. F. Evans, engineer to the Electric Light Co., it was complained that he had not complied with the condition that he should join the V.T.C. The secretary to the company, Mr. I. Thomas, said that the drills were arranged in the evening, when the engines were running. Mr. Evans was the only expert in the locality, no one else could do his work, and he contended that he was better engaged where he was than in the V.T.C. The Tribunal continued exemption on Mr. Evans remaining in his present occupation.

TAR OIL FUEL AND DIESEL ENGINES.

IN the discussion on Mr. GEOFFREY PORTER's paper before the DIESEL ENGINE USERS' ASSOCIATION (*ELUC. REV.*, July 13th), Mr. G. W. F. HORNBY, in a communication, said that, in view of the very small percentage of insoluble matter which existed in the tar oil, it seemed difficult to account for the excessive deposit which took place in the pulveriser. He believed that a resultant-gas analysis would be most helpful, as his brief experience of this class of fuel had led him to think that they must regulate the air supply and relatively adjust the clearance to suit the required compression. At present the air supply was constant, or approximately so; the fuel supply depended upon the load and the action of the governor, and incidentally on the state of the pulveriser and needle valve. When the air supply was right for the amount of fuel to be burned at a certain load, then, it seemed to him, the lighter the load the more the air would be in excess of requirements; hence, an impoverished state of combustion (this characteristic was very noticeable in oil-fired furnaces), and was it not, due to this condition of air supply that the pilot ignition was made use of? The question of storage in cold seasons was an important one; he believed that a simple agitator of the paddle type would be sufficient for storage tanks made from old boilers. Keeping the tanks warm had a decided advantage in maintaining a uniform temperature of the oil in stock, but if the heating was done with the waste gases from the engines, the outside of the tanks would need to be specially treated, as the acids formed in the gases were very active when combined with moisture and in contact with plain metallic surfaces.

Mr. F. W. STRICKLAND, in a communication, said he found that his two engines drove their alternators in parallel as steadily as when burning crude, if the amount of ignition oil was about doubled (the larger amount being 1 gal. per hour for a three-cylinder 150-B.H.P. engine) by advancing the control lever a little, but they were very unsteady with the normal quantity of ignition oil, although when running on the same load separately they appeared to fire perfectly. He had found starting on tar oil most unreliable, and liable to cause very heavy explosions, and now always shut down on crude, so as to prime for the next start.

Mr. J. M. FERGUSON, in a communication, said that the suitability of the fuel seemed to depend chiefly on the insoluble contents. With regard to flash point, his experience was that this might be in the neighbourhood of 90 deg. C. (194 deg. F.) without causing the slightest difficulty. It was found during the course of tests at his works that tar oil could be used as ignition oil with satisfactory results down to 1/4 load. His experience was that the quantity of ignition oil need not exceed 5 per cent. of the weight of ordinary fuel oil used at full load. Possibly under regular running conditions it might be advisable to increase this slightly, say, to 7 per cent. Had Mr. Porter tried running the engine for, say, five minutes on paraffin before stopping, with a view to getting rid of the deposits in the pulverisers and passages? The fuel consumptions given seemed very low, as a consumption of .66 lb. per kw.-hour at three-quarter load on a set of this size would be less than .44 lb. per B.H.P.-hour, which would be a good figure with residual petroleum.

Mr. H. S. RUSSELL gave the result of the further experience which his firm, as manufacturers, had had during the past 18 months. It was regrettable that the price of tar oil had increased lately, and he was afraid that was due, not so much to the demand for the tar oil as to the fact that many different people had approached the tar distillers independently with a view to obtaining the oil, and so had given the distillers exaggerated ideas as to its value. It did not follow that because a particular design of pulveriser gave satisfactory results with a particular class of tar oil, it would be equally satisfactory with other tar oils. Their object with the pilot ignition system was to make it applicable to any standard engine with a standard pulveriser without having to make special alterations to suit varying classes of fuel oils. With regard to specifications of tar oil, he did not agree that it was important to keep the percentage of matter insoluble in xylol as low as German specifications required; a good deal depended upon the constitution of the insoluble matter. The insolubles were merely foreign matter—generally free carbon, dirt, brickdust, scale off boiler sides, &c. These must not be confounded with ash, which was, of course, the unburnt residue after the combustible foreign matter had been burnt. His firm had run engines satisfactorily on tar oil which contained as much as 8 per cent. of free carbon, but would not recommend so high a percentage. He considered Mr. Day's figure of 2 per cent. of matter insoluble in xylol quite a reasonable one, and as much as 5 per cent. might not be objectionable provided it was combustible. He thought Mr. Porter attached too much importance to the question of sulphur. While a high coking residue usually meant carbonising of the piston tops and exhaust valves, this was the only trouble, and it was not necessary to reject oils on this account. Mr. Day's figure of 3 per cent. was probably too low, but it should ensure an exceptionally good oil. Anything in the neighbourhood of 10 per cent. was too high, but the oil would not be unusable. He did not think that the flash point need be much considered, as it was no real indication of the composition of the oil. He confirmed Mr. Porter's

statement that the overall thermal efficiency when working with tar oil was slightly higher than with petroleum fuel oil; this was due to the lower viscosity of tar oil, which meant better pulverisation and quicker burning at the top of the card. In their experiments on the matter they obtained the highest overall thermal efficiency with alcohol. With regard to the choking of the pulverisers, their experience showed that it was only with the tar oils rich in naphthalene that the choking occurred. There were two crystalline bodies in tar oil, naphthalene and anthracene; the latter was in smaller quantities, and mainly present in the high boiling fractions. The effect of both was quite similar, and the two together were responsible for the solidification in tar oils. The disadvantages of using tar oil without pilot ignition were that one had nothing like so wide a choice of oils, and therefore could not depend so much on getting suitable supplies; also to get reasonably good working, it was absolutely essential to have increased compression. With the pilot ignition, one could work with 480 lb. compression, but without it he thought that not less than 600 lb. would be required. It was also usual when running on tar oil without pilot ignition to use hotter circulating water, and this, of course, increased the liability to deposits in the water jackets.

Mr. G. NEVILL HUNTLY said that the water content was frequently distributed very irregularly in the fuel oil, and the sampling difficulty must be met by taking a large sample for this determination. The gross calorific value should always be asked for, and the necessary calculations for the net figure made by the engineer. The gross value was a definite experimental figure, but there were several "net" values in use, based on different definitions. The percentage insoluble in xylol was simply a measure of the suspended matter in the tar oil, and a high percentage of suspended matter was regarded as likely to cause trouble in the pulverisers, as it might form nuclei for the deposition of carbonised material. There seemed no reason from the chemical point of view why naphthalene should cause trouble in the pulverisers. It melted at about 80 deg. C., and would be in solution in the oil at temperatures below this.

Mr. E. A. EVANS agreed that it would be unwise to formulate a rigid specification for tar oil at present. Our knowledge of tar oil as a fuel was far too meagre to make more than very elastic suggestions to guide would-be purchasers of tar oil. Specific gravity should be determined with the aid of a specific-gravity bottle in preference to a hydrometer. Prior to the determination of free carbon the oil should be filtered through fine lawn to remove pieces of wood, &c. The simplest method of testing for free carbon was to examine the oil under a microscope. If the carbon were in a colloidal state it would not give any trouble, but if it were flocculated, or coarse, trouble must be expected. Coke residue was purely an arbitrary figure obtained by a method which had not even been standardised, hence different experimenters were liable to report different results. Consequently, it was advisable to specify the *modus operandi* when submitting a sample of tar oil to a chemist. He agreed that the gross calorific value should be stated. Suppliers would always give the higher value. The differences between the hydrogen content of various tar oils were not great; therefore, it mattered little whether the "gross" or the "net" value was adopted. It was most desirable to keep the ash as low as possible, because any unburnt substances might choke valves, act as abrasives on moving parts, and exert a deleterious action upon the lubricating oil. As tar oil did not usually contain more than 1 or 2 per cent. of sulphur they need not be anxious about this factor. The action of sulphur upon the lubricant was always overlooked, but it should not be. The efficiency of tar oil as a fuel was largely dependent upon the mode of feed, &c. Much trouble was encountered by choking pulverisers. This did not appear to be due to impurities in the fuel, but to chemical action.

Mr. P. H. SMITH remarked that as a result of service trials of over 40 different tar oils which were subsequently analysed, he was inclined to characterise the constituents of tar oil insoluble in xylol, and ash, as undesirable. They should be as low as 0.1 per cent., as a quantity greatly in excess of this appeared to be associated with piston seizures in the larger engines. An oil rich in coking residue generally contained a high proportion of naphthalene. One or both of these elements made for safety, that is to say, allowed of the engine being run at smaller loads than would otherwise be possible without danger. An oil containing coking residue amounting to about 5 per cent. appeared to give best results in service. The difficulties experienced through naphthalene crystals might be satisfactorily overcome by adopting one of several proposals, one of which was an addition of crude oil. In the coldest weather of the past winter a mixture of 25 per cent. crude oil with 75 per cent. tar oil had not, apparently, been attended with the phenomenon of crystallisation, so apparently the proportion of crude could be further reduced. With blended oils the engine operated with greater reliability than on straight tar oil, provided that the tar oil content was judiciously selected. The minimum safe load with engines to which no special adjustments had been made ranged about 0.8 of full rated load. An English invention, not yet fully developed, apparently was "safe" throughout the full range of load of the engine. Two special adjustments appeared to have been adopted to burn tar oil in Diesel engines, whatever

system was adopted. The timing of the opening of the fuel valve had been advanced from 2 deg. to 3 deg., and a slightly smaller flame plate had been fitted. This combination gave a rather peaky card, which had already come to be generally recognised as the most satisfactory for engines working on tar oil. A year or so ago it was generally thought that high compression and high cooling water temperature greatly assisted in burning tar oil without special apparatus. Engines which were working with fair satisfaction under these conditions gave better results with a normal compression of 33 metric atmospheres and an outlet temperature of the cooling water about 100 deg. F. as against 160 deg. F. One such engine was now generating 94 to 95 per cent. of its output on tar oil, and the fuel consumption was barely 6 per cent. greater than on crude. Sleeve pulverisers had been in operation some considerable time, and he had not yet had it reported to him that any had choked.

Mr. C. T. WESTLAKE said that at Guernsey they were troubled with the pulveriser cones and ring choking, and had used sleeve pulverisers to overcome this. These also helped in running on low loads. Their engines ran without pilot ignition, and used a compression of 480 lb.; the cooling water was kept between 100 deg. and 120 deg., as they found no advantage in running at a higher temperature. The chief disadvantage of working without pilot ignition was in not being able to run at low loads. Where engines had to run at low loads it would be quite satisfactory to run with one cylinder cut out. The remaining cylinders would be working more efficiently. He did not believe in stirring the oil to overcome crystallisation. The oil contained impurities which were best left to settle out at the bottom of the tank.

Mr. GEORGE B. VICKERS said that Messrs. Hick, Hargreaves and Co. had put down a large three-cylinder engine purely for experimental use. Experiments were being carried out, and he had every reason to hope that tar oil would be successfully used right down to light load without the assistance of pilot ignition. Until reliable data had been obtained those users who were compelled to change over to tar oil, and who had to run frequently below, say, half-load, were well advised in using pilot ignition. They should aim at simplifying the Diesel engine, and if adjustment for tar oil could be made by a re-designed pulveriser and flame plate which would equally suit tar oil or petroleum oil, he thought that this was the right line of action, rather than an uncontrolled pilot pump, which certainly did not simplify the engine.

Mr. W. A. TURNBULL said that mixing tar oil and crude oil, in his experience, had been most unsatisfactory. He had now been running on tar oil since August, 1916, with perfect satisfaction, without pilot ignition. At first the pulverisers blocked up, requiring a high blast, but now every five hours they ran for 15 minutes on crude oil or paraffin, and the engine ran 300 hours without cleaning the pulverisers; even then it was really not necessary to clean them. From September, 1916, to May, 1917, the Diesel engine plant at Aylesbury generated 369,345 units, with a consumption of 75,248 lb. of crude oil (residual petroleum oil) and 194,000 lb. of tar oil. This corresponded to an average of .73 lb. of fuel oil per unit, as against an average of .69 lb. of fuel oil per unit when crude oil alone was used. On particular tests he obtained a result of .65 lb. of crude oil per unit, and .735 lb. of tar oil per unit. In both these cases the test was carried out at full load.

Mr. NAPIER PRENTICE, in a communication, said that without pilot ignition the consumption of residual petroleum at Felixstowe was only 10 per cent. of the fuel used, and, therefore, compared equally well with pilot jet ignition. Their tar oil had been practically free from naphthalene, and yet they found it advisable to clean the pulverisers after 50 hours' running. With a comparatively poor load factor and small output, they had saved £300 to the end of May by the use of tar oil, and this with no capital outlay.

Mr. PERCY STILL, in a communication, said that the results of tests on samples of tar oil obtained from the same source varied very considerably, and to check some of these results it was decided to send precisely similar samples simultaneously to two laboratories to be tested. Both of these laboratories had had considerable experience in carrying out tests on fuel oils. Particular care was exercised in taking the two samples at the same time and in the same manner from the same bulk of tar oil. These were placed in similar cans, which were then sealed and sent to be tested at the two laboratories. The comparison of the results obtained might be of interest:—

	Laboratory A.	Laboratory B.
Flash point	(Closed) 165° F.	(Open) 197° F.
Sulphur	0.95 %	2.12 %
Water	1.57 %	2.9 %
Coke	13.8 %	8.39 %
Solid matter insoluble in xylol	0.12 %	0.48 %
Ash	0.19 %	0.02 %
Acidity	Nil	Trace
Percentage by weight distilling below 300° C.	57.5 %	73.10 %
Specific gravity at 60° F. ...	1.057	1.053
Viscosity, Redwood No. 1, at 60° F.	76 sec.	70 sec.
Calorific value, B.T.U. per lb.	17,030	16,532

Mr. GEOFFREY PORTER (President) replied in detail to the points raised in the discussion. Incidentally, he drew attention to the enormous discrepancies between the chemical analyses quoted by Mr. Still.

BUSINESS NOTES.

Useful Compositions.—A cement that sets like stone, and can withstand a temperature of 1,100° C., has obvious uses in engineering. These qualities are claimed for "Permanite," an adhesive cement made by the NATIONAL CHEMICAL WORKS, LTD., Stanley Road, South Acton, London, W., which sticks to anything, and resists the action of oil, acid, petrol, &c. It is useful for making oil-tight joints, fixing articles in metal sockets, attaching canvas, &c., to metal, and a variety of other purposes.

A somewhat similar composition made by the same company is "Pulleystone," a "pink paste put on pulleys," which sets hard, and is claimed to double the adhesion of the belts. It is not a belt dressing; it is applied once only, and forms a new and permanent surface, which grips the belt, without wearing it as much as the usual iron surface does. The belt can be run slacker, diminishing the friction loss, and at shorter centres, thus saving space.

Openings in Italian Markets.—List No. 33 issued by the British Chamber of Commerce for Italy (Inc.), Genoa, includes the following inquiries from Italian firms, many of whom formerly did business with German and Austrian houses:—

No. 1,322.—Florence firm would buy for own account (or represent on commission):—Electrical material and lamps, ironmongery, hardware, copper sheets and bars, &c.; F.G.F.

No. 1,401.—Italian firm at Bari wish to represent manufacturers of motors, machinery, and tools, for agricultural, electrical, and building purposes; B.C. & T.

No. 1,401.—Genoa engineers would represent firms manufacturing or exporting: Electrical material, chemicals, also steel, tools, and general machinery and engineering articles; G.P.C.

No. 1,406.—Engineer, manager of a mining company, would represent British manufacturers of industrial machinery in general, especially for shipbuilding; I.A.G.

No. 1,412.—Rome firm would represent on commission or buy for own account:—Electrical articles, lamps, insulators, lampholders, switches, &c.; R.G.B.

No. 1,414.—Party at Venice would represent on commission manufacturers and exporters of:—Machinery, tools, aircraft motors, engineering articles, &c.; V.A.M.

No. 1,415.—Genoa representatives would handle on commission:—Gas and electric stoves and fittings, &c.; G.A.G.

No. 1,419.—Commission agent at Genoa is open to handle:—Metals, belting, engineering supplies; G.L.F.

Dissolutions and Liquidations.—VAUGHAN ENGINEERING WORKS, LTD., 22, Cross Street, Islington, London.—Winding-up order made July 24th.

LEITNER ELECTRICAL CO., LTD., Woking.—August 23rd is the last day for the receipt of proofs for dividend by Mr. G. E. Corfield, the liquidator.

UNIVERSAL CABLE CODE (PARENT) CO., LTD., London.—Liquidator (Mr. H. de V. Brougham) released July 25th.

THEROL FOREIGN PATENTS SYNDICATE, LTD.—A meeting is to be held at Bank Chambers, High Holborn, on September 5th, to hear an account of the winding-up from the liquidator, Mr. H. M. Bayly.

ROBINSON SHIELDS CO., dealers in electrical goods and appliances, Kingsway Hall, Kingsway, W.C.—Messrs. W. Y. Robinson and A. J. Shields have dissolved partnership. Mr. Shields will continue the business under the old style, and will attend to debts, &c.

Bankruptcy Proceedings.—RALPH ROBINSON GREENWELL (otherwise Gordon Granville), a director of the Harvey Electro-Chemical Co., Ltd.—An application was made to Mr. Registrar Mellor at the London Bankruptcy Court on Friday, July 27th, for an order of discharge. The Official Receiver reported that the bankrupt failed in September, 1914, with ranking liabilities £5,020, and assets valued at £203, but which had produced only £31 11s. 4d. In 1912, with money borrowed and still owing, the bankrupt subscribed for £500 shares in the Harvey Electro-Chemical Co., Ltd.; in February, 1913, he became a director of that company, but in February, 1914, a Receiver was appointed. He attributed his insolvency to the depreciation in the value of his shares, to the stoppage of his business owing to the outbreak of the European war, and to a judgment obtained against him by Mrs. Gordon, the petitioning creditor, for £750 paid to him to be expended in the purchase of fully-paid shares in the Harvey Electro-Chemical Co., Ltd. As offences against the Act the Official Receiver reported (1) insufficiency of assets to equal 10s. in the £ on the amount of the unsecured liabilities; (2) omission to keep proper books of accounts; (3) contributing to the bankruptcy by rash and hazardous speculations; and (4) misconduct in having failed to apply to the purpose for which he received it, £750 handed him by the petitioning creditor for the purchase at par of fully-paid preference shares in the Harvey Electro-Chemical Co., Ltd.; also misconduct in failing to attend for the public examination, and to obey an order of the Court in relation to his statement of affairs. The learned Registrar said the serious part of the case was the misconduct of the bankrupt. He received £750 from Mrs. Gordon for the express purpose of purchasing fully-paid preference shares in an electric company; he appeared to have spent £400 in the purchase of fully-paid ordinary shares, and with the balance he purchased preference shares that were only partly paid; he had never handed over to the lady any fully-paid shares, and the result seemed to be either that he had put this money in his pocket, or else he had spent £400 of it according to her instructions, and having acted upon it he had never handed her the shares. Later, being hopelessly insolvent, he had offered her shares which were

not fully paid. He defended the action brought by the lady for recovery of the money, but judgment was given against him, and these bankruptcy proceedings ensued. He was also guilty of misconduct, in that he had absented himself from the Court from February, 1915, until a warrant was issued against him in May, 1917. All the offences reported by the Official Receiver had been established, and the discharge must be suspended for three years. Order entered accordingly.

Catalogues and Lists.—MESSRS. PASS & SEYMOUR, INC. (U.S.A.).—Circular tabulating particulars of Dim-a-lite adaptor lampholders, together with a copy of a report of examination made for the Benjamin Electric, Ltd., by the National Physical Laboratory.

MR. GEORGE ELLISON, Wellhead Lane, Perry Barr, Birmingham.

—List No. 131, dealing with cable fittings, &c., for attachment to ironclad switchgear of the industrial type, with prices, dimensions, and weights. A novel feature of "Ellison" cable adaptors and fittings is a patented cone clamp for the armouring, which can be easily cut on site to suit any ordinary cable. No special drilling on site is required, and the cone clamp affords efficient means of bonding the armouring or other cable covering to the switchgear case for earthing purposes.

MESSRS. ROSE BROS., 25-27, Milton Street, London, E.C.—Priced leaflet describing the R.B. "Admant" electric pipe lighter.

Book Notices.—*Hints on Rectifying Faults in Motor Control Gear.*—Mr. George Ellison, of Birmingham, has sent us a copy of the pamphlet above named, which has been published with the view of assisting electricians in charge of electrical plant, as well as purchasers of protective switchgear. It is one of those excellent manufacturers' specialist publications which, as we have often pointed out, are packed full of practical wisdom and knowledge based upon prolonged experience, dealing with a subject far more fully than any text-book can, and designed expressly to furnish the maximum amount of information to the reader who uses the apparatus of which it treats. Starting at the very beginning—the wording of the order for switchgear—the author shows how numerous are the opportunities for error or omission in describing the requirements of the purchaser; he then passes on to the consideration of the working conditions of starters and controllers, the different methods available for starting motors, causes of failure, the care of switchgear, pressure rises, oil tanks, inching, braking, &c. A few pages of illustrations of the publisher's own well-known and justly esteemed controlling gear are appended. The booklet will be of great value to many besides those for whom it is written.

Preliminary Mathematics. By Prof. F. E. Austin. London: E. & F. N. Spon, Ltd. Price 8120.—This book is intended to form a connecting link between the study of arithmetic and the study of algebra, and should be used as an auxiliary, in conjunction with other text-books; its chief object is to show how to solve problems, and how to apply theory to practice. Hence it consists very largely of worked examples, and problems to be solved by the reader. The author has a very lucid style, and leads the student on by gentle steps from the most elementary ideas up to the use of logarithms, the solution of equations of the first degree, quadratics, progressions, &c. Various actual examination papers are appended, with complete solutions to the problems.

"Production." Monthly report of the British Empire Producers' Organisation. London: Kingsway House.

"Correction Tables for Thermodynamic Efficiency." Calculated by C. H. Naylor. London: E. Arnold. Price 5s. net.

"Heat Drop Tables: Absolute Pressures." Calculated by H. Moss. London: E. Arnold. Price 5s. net.

"Practical Costing." By A. H. Gledhill. London: The Gledhill-Brook Time Recorders, Ltd. Price 3s. post free.

"Proceedings of the American Institute of Electrical Engineers." Vol. XXXVI. No. 7. July, 1917. New York: The Institute. Price \$1.

"The Predetermination of True Costs and Relatively True Selling Prices." By F. A. Parkhurst. London: Chapman & Hall. Price 5s. 6d. net.

"Directions for Designing, Making, and Operating High-pressure Transformers." Second edition. By Prof. F. E. Austin. London: E. & F. N. Spon, Ltd. Price 3s. net.

Holidays.—The works of MESSRS. RHODES MOTORS, LTD., are to be closed from to-night (Friday) until Monday, August 13th, for the annual holidays.

The works and offices of the HOFFMANN MANUFACTURING CO., LTD., Chelmsford, will be closed from noon to-morrow (Saturday), until the morning of Monday, August 13th, but urgent correspondence and orders received between August 7th and 11th will be dealt with.

For Sale.—THE LONDON ELECTRIC FIRM, Brighton Road, Croydon, are offering for disposal a Croydon factory (about 5,000 ft.) with shafting, motors, &c.

Cricket.—At Dagenham, on Saturday last, an interesting game was played between the Sterling and Marconi Lady Cricketers, the home XI winning by 60 and 86 to 39 and 34. The fielding of the visiting team was particularly smart. Mr. Guy Burney, the president of the club connected with the Sterling Works, in a happily expressed speech, gave the visitors a hearty welcome. Mrs. Guy Burney kindly entertained both elevens and friends to tea.

LIGHTING AND POWER NOTES.

Argentina.—The electric light company at Las Varillas (Province of Cordoba) has affixed posters throughout the town notifying that the service will be suspended as from July 1st owing to the accounts for the past four months not having been met.

Another company—the *Compania de Electricidad de la Provincia de Buenos Aires*—is experiencing difficulty in collecting the amounts due to it from several municipal authorities in the Province of Buenos Aires. The total of municipal debts to the company is \$781,342.

The *Compania Italo-Argentina de Electricidad* has entered into an agreement for the supply of electricity to the *Compania de Tramways Eléctricos del Sud*.—*Review of the River Plate*.

Australia.—The Sydney City Council has accepted the offer of the Railway Commissioners to supply electricity up to a maximum of 4,000 kW. for a period of two years, the Council paying the Commissioners £6,000 per annum for the maximum load of 4,000 kW. and 0.3d. per kW.-hour for all power supplied: under this arrangement the payment will be dated from the day on which the converting plant and electrical equipment were completed.—*Tenders*.

Barrow-in-Furness.—The electrical engineer has been nominated a member of the Barrow Coal Supply Committee to interview the Coal Controller, with a view to obtaining coal from Lancashire instead of Northumberland and Durham, as proposed in the new scheme.

The Electricity Committee has agreed to contribute £2 2s. per annum to the work of the Research Committee on the heating of underground cables.

Bath.—PRICE INCREASE.—The Electricity Committee has decided to increase the present charges by ½d. per unit for lighting and 5 per cent. for heating.

Batley.—YEAR'S WORKING.—The annual statement of accounts of the Corporation electricity department, just issued, shows a loss of £186 on the working of the year ended March 31st. These accounts show the first full year's working of the three-phase E.H.T. alternating-current installation, including a turbo-generator of 1,200 kW., two rotary converters, switchboard, and water-tube boiler, which, with extensions of mains and sub-stations, involved an additional capital outlay of between £15,000 and £16,000, and gave rise to expectations of so lowering the costs of production that better profits would be made. These expectations have failed to materialise owing to the increased cost of coal and reduced consumption of current, owing to the war, and the result is a loss of £186, as compared with a profit of £173 in the previous year. Mr. S. Derwen Jones, the borough electrical engineer, in his report, shows that great economy has really been affected by the working of the new plant, and he shows a reduction in working costs (apart from interest and sinking fund) from 1'08d. to 0'975d. per unit. The war, he states, prevented the completion of the cable extensions, and thus some firms who intended to take an alternating supply have been unable to do so; some of the night load also has fallen off owing to the shortage of workpeople in the industries. The fact that the bulk of the present supply is continuous current, necessitating conversion from the alternating current supply, involved a loss during the year of about 11 per cent.—a loss which must be proportionately smaller to the total load as the alternating current load increases. Owing to restricted lighting and the Summer Time Act, the lighting supply fell off 7½ per cent. The traction load increased slightly by 3,594 units, whilst the power load increased by 282,113 units, or 37½ per cent., maintaining the steady increase of the past five years. Mr. Jones advocates that, as the lighting load has tended to become more and more a purely winter load, any contemplated increase in the price of current should be on the lighting only, and that the 7½ per cent. should be raised to 12½ per cent. The consumption of coal has been reduced, and the coal per unit generated has been brought down from 57 to 4'01 lb. The cost of coal on the year, including carting, tipping, &c., had been reduced from 0'54d. to 0'455d. per unit sold.

Birmingham.—PRICE INCREASE.—The Electric Supply Committee recommends that the new scale of charges, which increases the existing charges by approximately 15 per cent., should take effect as from the Michaelmas reading of the meters.

Bournemouth.—PRICE INCREASE.—The Bournemouth and Poole Electricity Supply Co., Ltd., has advanced the price of current, from the date of the Michaelmas quarterly meter readings, by a further 5 per cent., making an increase during the war of 20 per cent.

Bradford.—PRICE REVISION.—The Electricity Committee is recommending the Corporation to increase the charges for current as follows:—Power consumers having maximum demands of under 5 kW., and power consumers on the restricted hour rate, to pay an additional 20 per cent. The accounts of all other consumers which are not subject to adjustment in accordance with the price of coal (with the exception of the tramways department and consumers charged on the flat rate) to be increased by 10 per cent. For heating and cooking, current to be supplied at a flat rate of ½d. per unit, plus 10 per cent. to consumers already taking supplies for other purposes at the premises concerned.

Bristol.—FRINGE ORDER.—Negotiations have been concluded for supplying the Hanham Colliery at a point beyond the supply area, and the B. of T. is to be asked to grant an Order under the E.L. Act, 1909, to enable this arrangement to be completed.

Croydon.—PRICE INCREASE.—In view of a loss of £3,100 (which will be reduced to about £1,100 by retrospective repayments) on the last year's working of the electricity undertaking, and an estimated loss of £4,210 during the present year, it has been decided to increase the charges for electricity by 15 per cent., in addition to the 10 per cent. approved in May, 1916. This will still leave an estimated deficiency of £1,200 at the end of the present year.

Deal and Walmer.—The D. & W. Gas and Electricity Act has been extended for a year.

Derby.—PROPOSED LOAN.—The T.C. has approved a scheme for the supply of electrical energy to additional works proposed to be erected for chemical manufacturing. It has also decided to make application to the L.G.B. for sanction to the borrowing of £90,000, the estimated cost of the new electrical plant necessary.

Edinburgh.—PROPOSED PRICE INCREASE.—The Electric Lighting Committee recommends that an increase should be made in the charge for private lighting from 3½d. to 3d. per unit, and that the charge for power should be increased from the present rate of 1½d. plus 5 per cent. to 1½d. plus 10 per cent. This charge does not affect special agreements. The charges, if adopted, will take effect as from May 15th last. The estimated expenditure of the department for the year 1917-18 is £102,820, and the revenue is £156,290 on the old rates, but if the proposed increases are adopted, an additional sum of £3,000 is calculated upon.

A deputation was received by the Corporation Electric Lighting Committee from the East of Scotland Cinematograph Exhibitors' Association, who complained of the charge made for inspection of their electrical installations. These inspections are ordered by the magistrates, and the electricity department holds that, as it is an ordinary trading concern, it does not fall within its duties to provide inspectors for this public purpose except on reasonable charges. The Committee is to have a meeting with the magistrates regarding the matter.

Heston and Isleworth.—YEAR'S WORKING.—The report of the electrical engineer on the working of the U.D.C. electricity undertaking for the year ending March last—the 12th year of the concern—shows that the total income was £12,015, an increase of £768 over the previous year. The total working expenses were £7,100, an increase of only £68, leaving a gross profit of £4,914. After providing for interest and loan charges, amounting to £4,922, there was a net deficit of £7. There was an increase in units supplied for power of 29,490, and of those for private lighting of 15,180. On the other hand, the units for public lighting have decreased by 116,219, which gave a net decrease in units sold of 71,549. Dealing with the output, he shows that 1,608,588 units were generated, an increase of 41,115, and the number sold was 1,216,822, of which 890,980 were for power. The average price per unit showed a gain of 35d. per unit. The works costs had risen from 1'23d. per unit sold to 1'33d.

High Wycombe.—STREET LIGHTING CHARGES.—The T.C. has decided to lodge an appeal in connection with the recent action for £1,290 successfully brought against the Corporation by the Electricity Co. in regard to street lighting. The Judge considered that he was bound by the decision in the case—*Leiston Gas Co. v. the Leiston R.D.C.*

Ilford.—The Electricity Committee of the Council has instructed its electrical engineer to communicate with the Coal Controller with regard to the utilisation of steam from the destructor. After negotiations the Coal Controller agreed to request the Ministry of Munitions to grant the necessary priority certificate to carry out a temporary steam scheme to make use of the steam now being wasted. It is proposed to transfer a 200-kw. set from Ley Street, and run cable from the destructor to Meads Lane, at a total cost of about £600. At a joint meeting of the Electricity and Lighting and Tramways Committees, the charge for electric current to the tramways for the year ended March 31st, 1917, was fixed at 1½d. net per unit. The Director of Electric Power Supply at the Ministry of Munitions has notified that he is prepared to approve a scheme of extension to certain works. The L.G.B., upon being referred to, requested that when tenders for converters and cable had been obtained, the Board be furnished with a detailed estimate of the cost.

Kingston-upon-Hull.—The extension order has been further extended by a year.

Leek.—SUGGESTED LINKING-UP.—The U.D.C. has received a communication from Stoke-on-Trent Corporation suggesting that the respective electricity committees should meet, with a view to discussing the possibility of supplying electrical energy or the preparation by the respective electrical engineers of a scheme for linking-up the two systems. The Council decided to agree to the suggestion.

London.—L.C.C.—The Finance Committee recommends the sanction of the Council to the borrowing of £1,441 by the Battersea B.C. for the extension of electricity mains; £3,746 by the Bermondsey B.C. for a new electricity main; £1,000 by the Bethnal Green B.C. for house connections; and £3,500 by the Hackney B.C. for mains, transformers, &c.

L.C.C. THEATRE INSPECTIONS.—The Theatre and Music Halls Committee reports that recent inspections of the electrical and mechanical installations at places of public entertainment show a marked falling off in the standard of maintenance and repair, due partly to the difficulty of getting repairs executed and partly to the employment of unskilled men. Owing to the depletion of the Fire Brigade staff, the Committee in 1915 approved of a reduction in the frequency of inspection; but the Committee is now of opinion that in the interests of public safety more frequent inspections are necessary.

L.C.C. AND ELECTRIC SUPPLY DEVELOPMENTS.—The L.C.C., in a letter to Borough Councils owning electricity undertakings, refers to the conference, two years ago, between its Special Committee on London Electricity and representatives of London Councils and London companies, upon the question of electricity supply in London, and states that recent events have given rise to a situation which renders it desirable that a further conference should be held at an early date.

ISLINGTON.—The Electric Lighting Committee recommends that application be made to the L.C.C. for sanction to the borrowing of £53,000 for various extensions to the electricity undertaking. The Government authorities concerned are prepared to support the application.

SOUTHWARK.—The electrical engineer reports that the working of the "Summer Time" Act has made a serious reduction in the output, the lighting demand being practically non-existent after the power load goes off in the evening. The falling off in the consumption of electricity, together with the increase in wages and the continued rise in the cost of materials, makes a further increase in the lighting rate unavoidable. The Committee decided that the following rates shall come into operation from September 30th, 1917:—Lighting, 6d. per unit for the first 1,200 units per quarter; 5d. for the second 1,200 units; 4d. for the third 1,200 units; 3d. for all over 3,600 units. Two-rate (combined lighting and power), 8d. per unit during "restricted" hours; 2d. during "unrestricted" hours.

Meltham.—PROPOSED E.L.—The U.D.C. has under consideration the proposal of the Huddersfield Corporation to apply for a Provisional Order to supply electricity to the Meltham area. The Corporation is to be asked to receive a small deputation from the Council to discuss the matter further.

Plymouth.—The Corporation has decided to apply to the B. of T. for sanction under Regulation B 1 to disconnect classes of non-essential consumers in cases of urgent necessity, in order to enable the supply to be continued to essential users.

Stockton-on-Tees.—YEAR'S WORKING.—The total revenue of the electricity department for the year ended March 31st, 1917, was £10,351; expenses amounted to £6,084; and, after meeting financial charges, there was a net loss of £1,138. A total of 1,717,923 units was sold, while 566,260 units were generated and 1,271,827 units were purchased on bulk supply terms (35d. per unit).

Sutton.—In reference to our note of last week in regard to the enforcing of the minimum charge of 13s. 4d. per quarter, on the present occasion the six summer months are to be regarded as one quarter for this purpose.

Todmorden.—WAGES.—The Corporation employees' application for increased wages is to be referred to arbitration, the men having refused the Council's offer.

U.S.A.—The Senate and House of Representatives have agreed to the conference report on the Bill permitting the present maximum diversion of 20,000 cu. ft. of water on the American side of Niagara Falls. The measure carries an appropriation of \$25,000 for an investigation by the War Department. But for the legislation just enacted, 50,000 H.P. would have been cut off on the American side of the Falls.—*Electrical World*.

West Bromwich.—The T.C., last week, decided to spend £2,300 in extensions to plant at the electricity works, which, it was stated, would enable the department to practically double the output. Last year there was a net loss of £4,696, largely due to the fact that the department was under contract to supply several large consumers at pre-war rates. An agreement has now been arrived at, however, whereby these consumers will help the department to meet the deficit.

York.—PROV. ORDER.—The B. of T. has extended the period for one year for carrying out the York Electric Lighting (Extension) Order, 1914.

YEAR'S WORKING.—The annual accounts of the Corporation electricity department for the past year show a total revenue of £41,737, and expenditure amounting to £24,062, leaving a gross profit of £17,676. After providing for interest, sinking fund, &c., the net profit amounts to £1,941.

Blackpool.—The receipts on the Corporation tramways during the past month show an increase of £1,328 on last year. From April 1st to July 19th the receipts were £29,707, an increase of £2,773 on 1916. The Corporation has now taken over the line between South Shore station and the borough boundary at Squire's Gate, formerly leased to the Blackpool, St. Anne's, and Lytham Tramway Co., but the latter retains running powers.

Chester.—The gross profit on the tramways undertaking for the past year amounted to £5,820, as compared with £5,241 for the previous year.

Continental.—SWISS RAILWAY ELECTRIFICATION.—The electrification of the Swiss Federal railways, which has been advocated for 15 years, is now occupying the serious consideration of the Government, which has created a special department attached to the Direction of the Swiss Federal railways to consider offers of material and equipment for the work. The question of electrification has become acute during the progress of the war, with the serious shortage of coal; the coal imports for the first three quarters of 1916 represented only about half the quantity imported in the immediate preceding years, while the cost was considerably increased. The Federal Railways form the main portion of the Swiss Railway system, and their electrification is simplified by the great store of undeveloped water-power. The time necessary for carrying electrical improvements into effect will depend upon varying conditions, such as the duration of the war, the condition of the money market, and the development of the needs of Swiss industries and transportation companies. The average demand will amount to about 220,000 H.P., and the maximum load to 550,000 H.P.

The total Swiss railway system, Federal and other, amounts to 3,216 miles, of which 1,700 miles are Federal and 1,516 miles are owned by corporations. Of the private lines, 622 miles are already electrified, but only about 50 miles narrow and other gauge of the Federal railways are operated by electricity. Looking to further electrification, the Federal railways have already acquired numerous water properties in the valleys of the Reuss, Leventina, Rhone, and in the Trient, Canton Valais, and elsewhere. In all, 10 hydro-electric plants are projected, with 500,000 H.P. capacity. Two of these, the Amsteg and Ritom works, supply the Gothard Railway from Lucerne to Chiasso.

The first important Federal standard gauge line to be electrified is the Erstfeld-Bellinzona branch of the Gothard Railway on the Lucerne-Chiasso-Milan line. This line was acquired by the Swiss Federal Railways in 1909, and is 68 miles in length, with 28 per cent. of tunnels and a grade of 2.5 to 2.7 per cent. for 25 miles; it was selected for experiment because of its enormous traffic with Italy, which caused a heavy consumption of coal with resulting smoke in the tunnels. The electrification is expected to be finished in three to five years; the line is being constructed on the same system as that of the private company, Berne-Loetschberg-Simplon. In 1911 the Erstfeld-Bellinzona line had a traffic requiring 19,000 H.P. a day; experts foresee a certain increase to 21,000 H.P., and a probable increase to 26,000 H.P.; therefore, in order to meet all emergencies, a limit of 60,000 H.P. is being planned for.

The Commission has decided to install five turbines of 8,000 H.P. instead of three turbines of 13,000 H.P. each. The works at Amsteg develop 26,000 H.P. and at Ritom 32,000 H.P. from the Ritom Lake; for this construction 1,600 yards of pipe line is necessary. Another series of plants developing 70,000 H.P. is contemplated for Eastern and Central Switzerland. The cost of electrification of the Erstfeld-Bellinzona line is estimated at £1,600,000, and the cost of electrifying the entire Federal Railway system is estimated, roughly, at £40,000,000.—*U.S. Commerce Reports*.

Halifax.—WAGES.—The Corporation has agreed to submit to arbitration a demand by the employees for an advance of 12s. per week above pre-war wages. The Corporation granted 8s. per week, which the men do not consider sufficient.

Keighley.—WAGES AWARD.—The award of the arbitrator in the tramway workers' application for higher pay, is that there be no alteration in the minimum rates, but that males of 21 and upwards should have war bonus increased from 5s. to 6s. per week, and those under 21 shall have bonus of 3s. per week. Female employees of 18 years and upwards are to have 3s. 6d. bonus, and those under that age 2s. These rates will operate as from the first pay day after June 30th.

Leeds.—WOMEN INSPECTORS.—In regard to the proposed appointment of women inspectors, the Tramways Committee, after hearing the views of a deputation of workers, unanimously passed the following resolution for submission to the Tramway Workers' Union:—"That the Committee, having carefully considered the matter, resolve that the Union be informed that there is no intention that the females to be appointed shall have any control over the motormen; that the male inspectors shall continue to act as heretofore; and that the Committee, being quite convinced of the necessity of some increase of inspection and supervision, both in the interests of the public and of the female employees, do not consider there is any reason to vary their resolution of June 18th." This means that the Committee will proceed, subject to the City Council's approval, with the appointment of six female inspectors, who will be selected from amongst the women who were the first conductresses. Their duties will be confined to the inspection of tickets and supervision of the conductors, who are almost all females.

TRAMWAY AND RAILWAY NOTES.

Barking.—The lease of the section of the tramways between the Broadway and the Boundary Bridge to the East Ham Council has been renewed by the U.D.C. for three years, at an annual rental of £450.

Leicester.—FARE REVISION.—To meet an anticipated increased expenditure of £22,000 on the tramways during the present year as compared with 1916, the fares are to be revised and all free passes are to be withdrawn, except to blind and crippled persons and wounded soldiers. A site for a building for converting plant has been purchased on the north side of East Park Road, for £200. The estimated cost of the building is £1,580.

London.—L.C.C.—The Highways Department has settled 685 claims against the Council in respect of accidents arising in connection with the working of the tramways, at a cost of about £6,795. In 20 other cases actions were brought against the Council; in 12 of these a verdict against the Council was given, and sums amounting to £603 and costs had to be paid; six actions resulted in the Council's favour, and two were withdrawn. The Committee has approved the settlement for £461 of claims made by the Council in respect of damage to tramways property, and has also received £3,272 from H.M. Government in respect of the repair of damage to tramways property.

The L.C.C. Highways Committee recommends that its chairman and vice-chairman, or in the absence of either, Mr. W. J. Squires, attend the business meeting of the Municipal Tramways Association at Blackpool on September 20th and 21st, which will replace the usual annual conference.

Wolverhampton.—YEAR'S WORKING.—The gross profit on the tramways for the year ending March 31st, 1917, was £26,180; deducting interest and repayment of loans, the net profit was £12,541, from which £6,580 is to be appropriated in aid of the rates. Owing to the impossibility of obtaining labour and material, a good deal of maintenance and repair work is in arrear. There is now £10,660 in hand to meet the cost of this suspended work. During the year 1,162,269 car-miles were worked and 14,913,789 passengers carried, as against 13,296,146 passengers in 1915-16. The sum of £56,645 stands to the credit of the reserve and renewals fund.

York.—YEAR'S WORKING.—The annual report of the Corporation tramways for the year ended March 31st last shows total receipts amounting to £40,197; expenditure, £30,938; and a gross profit of £9,268. After providing interest on capital and contribution to sinking fund, &c., there was a deficit on the year's working of £964, as compared with a surplus of £1,792 for 1915-16. The car-mileage was 826,283 and the electric bus-mileage 76,993, while the car receipts were 10'9d. and the bus receipts 7'98d. per mile run.

TELEGRAPH AND TELEPHONE NOTES.

Argentina.—The Municipal Commissioners of Buenos Aires have received an application for a concession for an automatic telephone service in the city, from a Mr. Alex. Schwimmer, representing three strong financial houses, whose names and nationality are being kept secret. Mr. Schwimmer states that a capital of \$25,000,000 m/n. will be available from this source whenever it is required.

A similar, but independent, application has been presented to the Municipal Commission by a company styled "La Positiva."—*Review of the River Plate.*

Brazil.—The Government proposes to erect a very powerful wireless station near the mouth of the Amazon. It will be in direct communication with the Sayville station, New York.

Round the World in 16½ Minutes.—The *New York Times* recently dispatched a telegram to itself round the world; the circuit, 28,613 miles in length, was traversed in 16½ minutes, the shortest time on record for an ordinary message.

Spain.—A draft scheme has been presented by the Director-General of Communications to the Government of a project to reform the national telephone system. Premising that Spain possesses only one telephone for every 571 of her town populations, while France has one for every 143, England one for every 63, Germany one for every 13, and Denmark one for every 23; and that Spain has one rural office for every 15,000 inhabitants, while Germany has one for every 1,500, Denmark one for every 1,350, France one for every 2,321, and England one for every 3,140 inhabitants, the draft scheme proposes to establish telephone offices in the greater number of town and rural communities hitherto unprovided with these services, which now only exist in 108 of the principal cities and towns. To carry out this project, it is proposed to impose on the provincial Deputations the obligation to contribute up to 20 per cent. of the cost of their respective networks, and call into being a National Telephone Institution with power to raise a fund of 60,000,000 pesetas, the estimated amount which the 40 provincial networks would cost, including the purchase of existing private rural lines. The fund created would be liquidated by the receipts from the telephone service. The scheme has, it is said, been well received in Spain.—*Industria e Invenções.*

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—SYDNEY.—August 22nd. N.S.W. Government Railways and Tramways. Thirty-six induction motors (Specification No. 488). September 19th.—One 225-H.P. synchronous motor (Specification No. 489). Particulars from Electrical Engineer's Office, 61, Hunter Street, Sydney.

MELBOURNE.—October 10th. Department of the Navy. Pumping plant and equipment for the Commonwealth Naval Dockyard, Cockatoo Island, Sydney. Specifications from the Director of Navy Contracts, Melbourne.

Blackburn.—August 4th. Steam coal for 12 months for the Electricity Department. Mr. P. P. Wheelwright, Engineer and Manager.

Keighley.—August 3rd. 12,000 tons best slack and small slack coal for Electricity Department. Six-monthly and twelve-monthly period. Mr. H. Webber, Boro' Electrical Engineer.

London.—BERMONDSEY.—Sept. 7th. B.C. 500-KW. rotary converter. See "Official Notices" to-day.

H.M. OFFICE OF WORKS.—August 7th. Insulated lamps and lampholders. See "Official Notices" to-day.

Warrington.—August 14th. 7,500 tons of slack coal for the Electricity and Tramways Committee during six months from September 10th, 1917, and alternatively for part or whole of 15,000 tons of slack during 12 months. Mr. F. V. L. Mathias, Borough Electrical and Tramways Engineer, Howley, Warrington.

CLOSED.

Barrow.—T.C. Electricity Committee:—

Steam and feed pipes.—Aiton & Co., £115.
Ironwork for boiler foundations.—Stirling Boiler Co., £242.
Motor for chain-grate stoker (exclusive of starting gear).—Electromotors, Ltd., £59 18s.
Sub-station H.T. switchgear.—British Thomson-Houston Co., £342.
Boiler and economiser foundations.—J. Simmons, £319.
Brickwork setting.—Bradley & Lonsdale, £415.
Sub-station foundations.—J. Simmons, £57.
L.T. switchgear.—British Thomson-Houston Co., Ltd., £367.
Renewal of contract for Featherstone washed peas for 12 months at same price as last contract.—O. M. Huarison.

Bath.—T.C. Stoker and fan for boiler at the electricity works: Underfeed Stoker Co., Ltd., £491.

Derby.—T.C. Accepted tenders:—

Two miles of overhead wires for the tramways.—B.I. & Helshy Cables, Ltd., £290.
Coal for the electricity works.—Mr. D. McCarthy.

Gloucester.—The Electricity and Light Railway Committee has accepted the tender of the D.P. Battery Co. for a new battery at the electricity works, with glass cells, at a cost of £933, subject to a satisfactory price being obtained for the old lead cells.

Leicester.—T.C. Accepted tenders:—

Siemens Bros., Ltd.—1,000-kw. rotary converter, £3,100; switchgear, £410.
Glover & Co., Ltd.—Cables, £3,425.

Leyton.—U.D.C. Tudor Accumulator Co.: Maintenance of accumulators at the electricity works.

London.—L.C.C.—The Highways Committee has purchased 42,335 tons of coal and 25 tons of coke for use at the Greenwich generating station, at a cost of about £73,000, during the quarter ended June 30th, 1917.

Supply of tramway fittings, equipment, &c., 1917-18. Accepted tenders:—

Class T 14, items 3 and 4. Baking and air-drying insulating varnish.—Pinchin, Johnson & Co., Ltd.
Class T 15, items 1 and 2. Finishing insulating varnish.—Jensen and Nicholson, Ltd.
Transfer of two rotary converters from Greenwich generating station to Woolwich, £265.—Dick, Kerr & Co., Ltd.
100 driving-wheel axle forgings for tramears, £387 10s.—W. Beardmore and Co., Ltd.
Vulcanised-bitumen cable, £755.—Callender's Cable & Construction Co., Ltd.

STEPNEY.—Electricity Committee. Accepted tenders:—

1,200 tons of Coleorton small nuts.—J. H. Beattie & Co., 27s. 6d. per ton.
2,000 tons of New Hucknall Deep 1½-in. slack.—A. Blackman & Co., 23s. 2d. per ton.

Manchester.—Electricity Committee. Accepted tenders:—
High and low-pressure steam and feed pipework.—Stewart & Lloyds, Ltd.

Stores for 12 months:—

Boiler tubes.—British Mannesmann Tube Co.
Carbon brushes.—Le Carbone, Ltd.; Morgan Crucible Co., Ltd.
Dynamo brushes.—Johnson, Clapham & Morris, Ltd.
Electric wires and cables.—Andrew & Co.; B.I. & Helshy Cables, Ltd.; St. Helens Cable & Rubber Co., Ltd.; C. Macintosh & Co., Ltd.
Special turbine oil.—C. C. Wakefield & Co. (six months).
Air-cooled transformers.—British Electric Transformer Co., Ltd.
Stoker links.—Babcock & Wilcox, Ltd. (three months).

Salford.—T.C. Accepted tenders:—

Mann's Patent Steam Cart & Wagon Co., Ltd.—Five-ton steam lifting wagon for the Electricity Department, £860.
Doulton & Co., Ltd.—Stoneware conduits, schedule of prices approximately £164.

Walthamstow.—U.D.C. Accepted tenders :—

Foster Construction Co., Ltd.—Extension to boiler house at the generating station, £775.
 Fleuning, Birkby & Goodall.—Line material for tramways overhead equipment.
 Frederick Smith & Co.—Trolley wire for same.
 London & Lancashire Fire & General Assurance Association, Ltd.—Insurance of the first Brush Ljungstrom set at an annual premium of £60, less 15 per cent., to cover breakdowns to the extent of £1,250.
 W. T. Henley's Telegraph Works Co., Ltd.—Cables.
 British Thomson-Houston Co., Ltd.—Switchgear.
 British Electrical Transformer Co.—Transformer.

Waterford.—Corporation. Recommended tender : Messrs. Keating & Gaule, installation of an electrical system in the fire station.

Wolverhampton.—T.C. Accepted tenders :—

Drake's, Ltd.—Duplicate drag link conveyor at the electricity works, £350.
 Staveley Coal & Iron Co., Ltd.—Cast-iron pipes, £750.
 Brush Electrical Engineering Co.—Two 300-kw. transformers, £238 each.
 Lea Recorder Co.—Two recorders for measuring steam consumption, £85 10s. each.

NOTES.**National Insurance Acts.—The Umpire has decided**

that contributions are payable in respect of :—
 2,358 X. Gatemen employed in connection with insured trades, and engaged wholly or mainly by way of manual labour—*e.g.*, in such work as opening and shutting gates, taking in and handing out checks, operating a weighing machine, keeping the yard tidy, carrying messages.

This decision modifies decision B, 50 (*Board of Trade Journal* of June 6th, 1912), and subsequent decisions relating to gatemen in so far as they may conflict.

In pursuance of the Unemployment Insurance (Umpire) Regulations, 1912, notice of an application has been given for decision as to whether contributions are payable or not for the following :—

499 X. Workmen described as valvemen, hydraulic main men, tar main men, tar pit men, employed in connection with coke ovens.

Any representation may be made to the Registrar, Office of the Umpire, 47, Victoria Street, London, S.W., 1, on or before August 9th. A decision will be given on or after August 13th.

Russian Electricity Prices : Application for Increase.—

The Russian League of Electric Stations for Public Use has applied to the Ministry of Trade and Industry with a request respecting an increase in the price of electricity. The League explains that the present valuation of electricity will lead to the stoppage of electric concerns, which would, of course, reflect disastrously on the supply of power to industries working for the national defence, and introduce considerable disorganisation into the life of many towns. The only issue from such a position appears to be the granting of a legal order increasing the tariffs for electrical energy. At the same time, the League proposes a strict limitation of the profits of electrical concerns on the following basis :—The net profit of private electrical concerns for public use to be limited to 8 per cent. Half of the profits over 8 to 10 per cent. to be made over to district institutions, and all profits over 10 per cent. to go to the Treasury. The increases in the tariff proposed by the League are as follows :—Tariffs of 5 copecks and under inclusive, to 200 per cent.; over 5 c. and up to 10 c., 150 per cent.; from 10 c. to 15 c., 125 per cent.; from 15 c. to 20 c., 100 per cent.; from 20 c. to 30 c., 75 per cent.; and over 30 c., 50 per cent. At the same time, however, the tariffs shall in no case exceed 60 copecks per kw.-hour (1 copeck = $\frac{1}{4}$ d.). In view of the importance of the request, as it affects the interests of the whole population, a special conference has been called of the Electrical Current Committee to consider the question.

The L.C.C. and Munitions.—Reports recently presented

to the Education Committee of the Council give a short statement of the work accomplished during the past two years. Very soon after the formation of the Ministry of Munitions, efforts were made to utilise the educational resources of the London Technical Institutes to the fullest extent on munitions. As the demand for training students did not tax the whole energies of the Council's organisation, it was decided to detail skilled staff from other branches of the service into certain institutions which could take up the manufacture of gauges, this line being urgently called for at the time by the Ministry of Munitions, and it has been possible to develop this work to a remarkable degree by the utilisation of these skilled workers, with comparatively little interference with the normal activities in technical education. With the special object of avoiding interference with ordinary educational work, the training centres for munitions students were placed at Brixton and Shore-ditch, where engineering instruction is not ordinarily given, and these centres were equipped with machines drawn from handicraft centres, and with more modern tools supplied by the Ministry of Munitions.

During the past eight months efforts have been concentrated on obtaining the most suitable and up-to-date machinery, and, as a result, the equipment of the centres has been brought up to a really high level. An effort has been made to secure such equipment as will not only meet the immediate urgent demand for the output of munitions, but will be of real value afterwards in technical training. It is now very clear that much more attention

must be devoted after the war to instruction in workshop processes and production, and skilled staff suitably qualified will be necessary for this purpose. Fortunately, the line of work which has been successfully developed gauge-making, &c., has placed not only an adequate, but a more than adequate, staff within reach in the Council's service to enable each centre marked out for engineering training to be made a focus of educational activity far beyond anything previously possible.

The value of the machines and equipment provided is approximately £7,000. It is claimed that, jointly, the manufacturing centres are comparable in machine tool equipment with any technical college in the kingdom, so that, given adequate staffing, very great progress in machine shop training will be possible.

The total staff now engaged in these shops on the manufacture of munitions is 205. The output of gauges during the first year's work was 18,091; during the second year's work, up to June 30th, 1917, the output was 30,169; a total of 48,560 in two years. In addition, a quantity of work of less importance has been undertaken. The staff, as a whole, have been working from 64 to 71 hours per week for the past year, and the work done reflects the highest credit on those who have participated.

During the two years ended June 30th, 1917, 8,089 students have been under training as munition workers in the various centres, of whom 6,088 have been certificated on satisfactorily completing their training; 5,751 of these are known to have obtained employment on work of national importance. The total staff engaged on training numbers 95.

Legal.—In the City of London Court, on July 31st, before His Honour Judge Rentoul, K.C., an action was brought by Mrs. Annie Jeffery, of Henley, to recover £1 10s. against Messrs. William Lund & Sons, jewellers, 56, Cornhill, E.C., for damage caused to a musquash seal coat through the defendants' electric heater not being sufficiently guarded. Plaintiff said that she went to the defendants' shop to buy a tortoise-shell bag frame, and was asked to look at one in the window. While she was doing that, her coat was burned by the electric heater, which was on the floor underneath the window. The burned piece of fur had been replaced at an expense of 30s. She bought the coat for £35, and while there had been a great difficulty in matching the fur, a casual observer would not detect the repair. Defendants said that the plaintiff's statement was quite accurate. She must have been short-sighted, and tip-toed to look into the window. Before he could say, "Don't go too near the radiator," she burnt her coat. Of course, they were sorry, but they could not accept the onus for the damage done. The radiator was wired in a proper manner. Judge Rentoul, K.C., was afraid it was not, or the plaintiff's coat would not have been burned. As the defendants invited people to go into their shop to buy goods, they must keep it in a safe condition, so that there would not be anything in the nature of what lawyers called a trap. There must not be anything that would burn a lady customer's coat. If the plaintiff was short-sighted—and she said she was not—it made no difference. It might be that the electricians were in fault in not better guarding the heater. Plaintiff's demand was very modest. If electric heaters were put into business premises, the owners did so at their own peril. The customers must be kept safe. Judgment for the plaintiff.

Electricity on Board Ship.—In a report on marine hygiene, the Assistant Medical Officer of Health for Liverpool insists upon the general introduction of lighting and ventilating by means of electricity, points that can now be dealt with by the standardisation of construction. Incidentally, he mentions that on very large liners one method which has had good results, and allows of several changes of air per hour in the cabins, consists in using four large fans, 5 ft. in diameter, driven by electric motors. These drive the fresh air from the upper deck into shafts suitably distributed. The air is sufficiently heated on entering, by means of steam coils, to allow the temperature of 60° F. to be maintained in the terminal distributing shafts. He proceeds to suggest that the exhaust fans for extracting the vitiated air from the cabins should be of smaller capacity than the blowing fans, to enable a slight internal pressure to be always maintained. It is, he says, very desirable that the lighting of living quarters should be more carefully arranged, and electric lighting has made a great improvement in the larger vessels.

The Supply of Platinum.—In 1916 the crude platinum mined in Colombia, estimated at 25,000 oz., was refined in the United States, and reports received from U.S. refiners show that 28,088 oz. of metals of the platinum group was recovered by them from all sources, foreign and domestic, of which 24,518 oz. was platinum (1 oz. troy = 31.1 gm.).

It is known that the Colombian deposits will be more extensively developed during 1917 than ever before, and it is estimated that at least 30,000 oz. of crude platinum, containing 85 per cent. metal, will be derived from that source. It is hoped that in 1917 deposits in the United States will yield more platinum than heretofore, that platinum derived from all sources other than foreign crude will exceed 7,000 oz., and that the production of crude platinum will be at least 10 per cent. greater than in 1916.

The Russian situation is very difficult, but it is known that there are considerable stocks of crude platinum held in Russia which are available to the Allied Governments. It is believed that the production from Russia in 1917 will be considerably increased, perhaps equalling the 1915 output (124,000 troy oz.).

The available supply of platinum in the United States appears to be adequate to meet immediate needs.—*Metallurgical and Chemical Engineering.*

Electrolytic Zinc.—A pamphlet published by the United States Geological Survey, relating to the output of zinc in the United States during 1916, contains a paragraph on the production of electrolytic zinc. The total capacity at the end of 1916 was not as great as the original estimate of the Survey, and instead of 60,000 tons, the actual rate of output was 40,000 tons per year. This fact was due to the delay in completing several plants. It is stated that when the plants now under construction are at work, the yearly capacity will be 85,000 tons. The actual output of electrolytic zinc during 1916 was 12,916 short tons, of which 1,800 tons was produced by refining prime western spelter, 887 tons was refined from scrap and dross, and 10,229 tons was produced direct from ores by leaching and electro-deposition. The total production of zinc in the United States during 1916 was 667,156 short tons. A table gives particulars of 11 electrolytic zinc plants in the United States. In writing of electrolytic zinc in North America, it is desirable to mention also that one of the most important plants is at Trail, British Columbia.—*Mining Magazine*.

The Engineers' Ballot on Dilution.—It will hardly be possible for the Ministry of Munitions to proceed with their scheme for enforcing dilution on private work in face of the engineers' ballot, which gave 45,000 votes against and only 8,000 for it on a voting membership of about 200,000. It may be expected that the Government will drop this feature of the Munitions Amendment Bill, and concentrate on carrying out dilution on private work, wherever possible, by agreement. The remaining provisions of the Bill, many of which anticipated specific recommendations by the Industrial Unrest Commissioners, will probably be passed into law without further delay.—*Times*.

U.D. Councils' Association and Electricity Supply.—At the quarterly meeting of the Executive of the Urban District Councils' Association, consideration was given to the evidence to be submitted to the Electric Power Supply Committee, and the following resolution was passed:—

That a Sub-Committee be appointed to consider the evidence to be furnished on behalf of the Association, it being the view of the Executive Council (1) that the future electricity supply of the country must be looked at from a national and not from a parochial point of view, the first consideration being a supply of cheap electricity; (2) that it is essential that any scheme for the construction of large stations should secure a satisfactory supply of energy in bulk on fair terms to any local authority authorised to supply and desiring the same; (3) that the profit of any bulk supply undertaking ought to ensure for the benefit of the community; and (4) that if any existing undertakings are taken over they should be acquired on equitable terms.

Volunteer Notes.—COUNTY OF LONDON VOLUNTEER ENGINEERS (FIELD COMPANIES).—Headquarters, Balderton Street, Oxford Street, W.

Orders for the week, by Lieut.-Colonel C. B. Clay, V.D., commanding:—*Saturday, August 4th, to Sunday, August 12th.*—Camp at Esher. During this period the Headquarters at Balderton Street will be closed, and will be removed to the Headquarters at the Camp, Claremont Park, Esher.

Musketry.—The range at Belvedere Road will be open on Tuesday, Wednesday and Thursday, August 7th, 8th and 9th, respectively, from 5.30 to 7.0.

Armlets.—The new issue armlets can now be obtained at Headquarters, and every enrolled man must obtain one without delay, and all old (red) armlets must be returned to the Orderly Room.

(By order) MACLEOD YEARSLEY, Company Commander and Adjutant.

B. of T. Committee on Electricity Supply.—The General Purposes Committee of the L.C.C. has recommended that Standing Order No. 177 be suspended so far as may be necessary to enable the confidential report of July 14th, 1914, by the Comptroller of the Council, the chief engineer, and Mr. C. H. Merz, on the question of London electricity supply, to be submitted in evidence before the Electric Power Supply Committee of the Board of Trade.

Zirconia as a Refractory Material.—The *Transactions* of the Ceramic Society, says *Nature*, contain an interesting article by Mr. J. A. Audley on this subject. The melting point of raw zirconia is in the neighbourhood of 2,000° C., that of the purified material being considerably higher. It can be both melted and volatilised in the electric furnace. It is a "neutral" substance of the same type as alumina, and is said to have a high resistance to the fluxing action of both acid and basic slags. Its heat conductivity is remarkably low, and its coefficient of expansion on heating is nearly as low as that of quartz glass, both of which are very valuable properties. It resists the action of fused cyanides and alkalis.

As a lining for electric arc furnaces the natural product is good enough, its high melting point, low thermal conductivity, and small coefficient of expansion making it particularly suitable for this purpose. Now that it is obtainable at comparatively reasonable prices, it can be used for the manufacture of refractory bricks.

Educational.—CITY AND GUILDS OF LONDON INSTITUTE.—The Department of Technology has issued the programme for 1917-18, containing the regulations for the conduct of classes and examinations of candidates in technological subjects, &c. It is announced that in the event of the continuance of war, it will not be possible to hold the examinations in Grade I and Final in Electrical Installation Work in 1918, and modifications may become necessary in other respects.

Appointment Vacant.—Assistant constructional engineer for the Birmingham Electric Supply Department. See our advertising pages to-day.

Bequest for Research.—The late Sir Charles Holcroft, Bart., ironmaster and colliery proprietor, bequeathed to Birmingham University £5,000 to establish a "Charles Holcroft Research Fund," the income to be applied to promote and encourage research work in Chemistry, Physics, Engineering, Mining, Metallurgy, &c.

Fatality.—The *Times* states that while chasing a crab on Southend Pier, on Tuesday, a boy, aged 11, stepped on the live rail of the electric tramway, and was killed.

Electrical Import Restrictions.—The Import Restrictions Department of the Board of Trade have under consideration, in consultation with the London Chamber of Commerce, Oxford Court, Cannon Street, London, E.C. 4, the granting of a concession allowing the restricted importation of the following goods:—(a) Electric dry cells; (b) arc lamp carbons; (c) searchlight carbons; (d) battery carbons. Firms who were importing these goods last year should communicate with the London Chamber of Commerce, asking for particulars as to the steps which should be taken to obtain licences.

The Ministry of Munitions and Gas.—In view of the paramount importance of meeting the increasing need for by-products obtained from the carbonisation of coal at gasworks, the Minister of Munitions wishes to impress upon those possessing gas-burning appliances the desirability of using gas in preference to any other means of obtaining light, heat, or power. At present an increased supply of gas can be provided without difficulty, inasmuch as during the summer months gas undertakings generally are in a position to manufacture in excess of the ordinary requirements of consumers.—*Daily Telegraph*.

It will be observed that this instruction is addressed specifically to "those possessing gas-burning appliances."

Electricity from Irish Peat.—It is announced that Mr. Keating, M.P., secretary of the Industries Committee of the Irish Parliamentary Party, has received an assurance from the Prime Minister that the representation as to adding to the Irish Committee on Peat a member with electrical experience will receive attention. The name suggested is that of Dr. J. F. Crowley, the Irish representative on the Board of Trade Committee which is investigating the sources of electrical power in the United Kingdom. It is claimed for him that he is possibly the only Irishman who has had extended practical experience of research on a large scale in relation to electrical engineering. An experiment in the production of electricity from peat is now being made, and it is held by expert authorities that in that direction mainly lies the best and most serviceable use of the vast reserve of peat stored in the Irish bogs.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station and Tramway Officials.—Hull Corporation tramways manager reports that Mr. J. CLAPPISON, a member of the staff, has effected an improvement in the soldering irons used by the department. On the manager's recommendation, the Corporation has granted him an award of two guineas.

At the meeting of the Heston and Isleworth U.D.C., the Electricity Committee reported that the exemption of Mr. P. RYEROFT, the electrical engineer, had been withdrawn by the Military. It was granted him as a whole-time official, but for two months he had been engaged partly in the Controller of Mines Department, and on that ground the certificate had been withdrawn. He could, however, the Munition Area Dilution Officer stated, obtain a protection card, Army Form W 3,476b, and the Committee recommended that this be done. A number of members objected to the recommendation. If the engineer was not necessary as a whole-time official he ought to be in the Army, being in Class A. Mr. Hales said that Mr. Ryeroft early in the war declared his willingness to enlist. Let him do so now. Mr. Lobjoit said they had nothing to do with Mr. Ryeroft's wishes. They had only to consider him as the responsible head of a valuable undertaking, where nearly all the rest of the staff had joined up. If a breakdown occurred there was no one who could set things right. Although with the Controller of Mines daily, the engineer could be got at at any moment, and the arrangement was that he was to be spared if absolutely required. The Committee's recommendation was agreed to.

Brighton Tramways Committee has increased the salary of Mr. MARSH, engineer and manager, from £400 to £500 a year, subject to the condition that the amount of the increase shall, during the time that he is acting as an Assistant Director of Shipyard Labour, be reduced by an amount equivalent to the pecuniary benefit derived by him from the allowance for expenses to be made to him by the Government.

The Bolton Electricity Committee has received the resignation of Mr. ROBERT BAKER, superintendent of the fittings department, and passed a resolution expressing high appreciation of his services, and regretting that, owing to ill-health,

he deemed it necessary to retire. Mr. Baker is to continue in a consultative capacity at a salary of £62 10s.

Mr. F. FRENCH, deputy borough electrical engineer of Bridlington, has been appointed O.C. of Vol. R.E. (Signal) Section at Bridlington.

The Derby Electricity Committee has appointed Mr. G. H. LAKE chief assistant engineer, at £250 per annum.

The Highways Committee of the L.C.C. reports that, in connection with the reorganisation of the Council's tramways department, applications were invited for the positions of rolling stock engineer and permanent way engineer at salaries of £1,000, rising to £1,200, and £800, rising to £1,000 respectively, no limit of age being prescribed. In response to the invitations, 32 applications were received for the position of rolling stock engineer, and 39 for the other appointment. After examining the applications, &c., the Committee does not feel justified in recommending the appointment of any candidate to the positions as advertised, and under the circumstances recommends:—

That Mr. W. E. IRELAND, rolling stock superintendent in the tramways department, act temporarily as rolling stock engineer, and that while so acting he be granted, in addition to his salary (£525 a year), a special allowance of £225 a year; that Mr. H. S. MAY, assistant rolling stock superintendent in the tramways department, discharge temporarily the duties of rolling stock superintendent in the rolling stock branch as reorganised, and that while discharging these duties he be granted, in addition to his salary (£325 a year), a special allowance of £75 a year; that Mr. G. W. KNECHT, superintendent of the central car depot, occupy temporarily the position similarly designated in the rolling stock branch as reorganised, and that while occupying this position he be granted, in addition to his salary (£300 a year), a special allowance of £100 a year; that Mr. J. B. WELLING, permanent way engineer in the tramways department, occupy temporarily the position of head of the permanent way branch as reorganised, and that while occupying this position he be granted, in addition to his salary (£600 a year), a special allowance of £150 a year; that Mr. J. R. WIGNAL, technical assistant in the tramways department, act temporarily as a technical assistant to the permanent way engineer, and that while so acting Mr. Wignal be granted, in addition to his salary (£340 a year), a special allowance of £100 a year; and that, until further order, Mr. W. P. FARGUHLARSON, general assistant, do act in the position of chief clerk in the tramways department.

General.—Mr. A. P. TROTTER, Electrical Adviser to the Board of Trade, after 21 years' Government service, is returning to professional practice as a consulting engineer. He is entering into partnership, as from October 1st next, with Messrs. Hancock & Dykes, under the style of Hancock, Dykes & Trotter. The offices of the firm will be at 11, Victoria Street, London, S.W.1. For the next six weeks Mr. Trotter's address will be "Coates Farm, Fittleworth, Sussex." Mr. Trotter, who is a member of the three leading engineering institutions, and president of the Illuminating Engineering Society, as well as vice-chairman of the National Illumination Committee of Great Britain, and chairman of the Joint Committee on Illuminating Engineering of the Department of Scientific and Industrial Research, was electrical engineer to the Government of Cape Colony from 1896 to 1899, when he became Electrical Adviser to the Board of Trade. His lifelong devotion to the study of illumination problems has placed him in the front rank of authorities on that subject; he was the originator of the dioptric type of glass shade, which at the time, unfortunately, could not be commercially manufactured, but now, in modified forms, is a very popular and highly efficient device, and, besides inventing various photometers and other scientific apparatus, he has made valuable contributions to the literature of light. As custodian of the Board of Trade electrical standards, Mr. Trotter was justly proud of their well-known precision, and the work done in the meter-testing department under his supervision was of the highest order. He was also responsible for the Electricity Supply Regulations of the Board of Trade, and in that capacity bore the brunt of the criticism which Government regulations invariably provoke. He did his utmost to smooth the way of applicants for leave to erect overhead mains, and himself developed the theory and effected valuable improvements in design. Few men in the electrical world possess a more genial personality or are more deservedly popular in the profession than Mr. Trotter, and his many friends will heartily join with us in wishing him every success in his new sphere of labour.

The marriage took place at Blackburn, last week, of Mr. JAS. HEYS, electrical engineer, of Invergordon, where he is engaged with the Admiralty, and Miss Lizzie Bedford, of Blackburn.

Roll of Honour.—Captain C. CECIL ELLISON, West Yorkshire Regiment, eldest son of Mr. C. H. Ellison, telegraph superintendent of the N.E. Railway, was admitted to a base hospital in France on July 24th, suffering from gas-shell poisoning and severe wounds, but he is progressing favourably.

Private J. C. GOLD, formerly in the gutta-percha department of the India-Rubber Co., Silvertown, and Driver G. SPRINGALL, formerly in the general office of the same company, have both been wounded in France.

An evening paper states that Wireless Operator J. H. HOLDENSHAW, R.F.C., has been awarded the D.C.M. for erecting wireless apparatus when it had been shot down by the enemy.

Private E. W. R. CLARKE, Middlesex Regiment, killed in action, was employed by the Ediswan Co., Enfield, N.

Private W. H. PRITCHARD, North Staffs. Regiment, who was engaged at Messrs. Siemens Dynamo Works, at Stafford, is reported killed in action, after being missing.

Corporal R. DAVIES, King's Shropshire L.I., who was an articulated pupil at the Shrewsbury Borough electricity works, has died of wounds received in action at the battle of Loos in September, 1915.

Staff Sergeant-Fitter E. F. HAMMERSLEY, R.C.A., who has fallen in action, was on the staff of the Potteries Electric Traction Co., Stoke-on-Trent.

Gunner P. L. CORE, Howitzer Battery, who has died of wounds received in action, was with Messrs. Williams & Robinson.

Captain W. DOWNEY, Staff D.A.A. of Ordnance, reported missing and believed to have been drowned, was, before the war, connected with the electrical engineering department of the Dublin Corporation.

Gunner G. MOORCROFT, R.F.A., who has had to have both feet amputated, and who is 21 years of age, was employed at the Southport Corporation electricity works.

The death is officially reported of Private J. WRIGHT, of the Loyal North Lancashire Regiment, who was employed in the offices of Messrs. Dick, Kerr, at Preston.

Temporary Lieutenant (acting Captain) R. G. BEER, R.E., who was before the war with the Chelmsford Electric Lighting Corporation, has been mentioned in General G. F. Milne's dispatch for distinguished service with the Salonika Force.

Corporal G. F. EDEN, Royal Marine L.I., who has been killed in action, was an electrician at the Hotel Metropole, Leeds.

Private J. HOWARTH, Durham L.I., who is reported killed, was employed as an electrician at Warrington.

Lieutenant AUSTIN VIVIAN D'ANDRIA, R.E., who has been awarded the Military Cross for gallantry, was an electrical engineer. He was in Constantinople at the outbreak of the war, assisting in the erection of a new works by an English firm.

Corporal E. JACKSON, of the West Riding Regiment, who has been granted the D.C.M., was an electrician at the works of Messrs. R. F. Winder, Leeds. He was awarded the Military Medal four months ago.

Second-Lieutenant A. E. W. BUTLER, Royal Berkshire Regiment, reported killed after being missing for a year, served his apprenticeship with Messrs. Fraser & Chalmers, or Erith, and later was on the staff of Callender's Cable and Construction Co., Ltd.

First-Class Stoker G. DEWELL, who was lost in H.M.S. *Vanguard*, was an employé of Messrs. Johnson & Phillips, Ltd., of Charlton, S.E.

Will.—According to the *Times*, the late Mr. MATTHEW GRAY, of Lessness Park, Abbey Wood, Kent, and of the India-Rubber, &c., Co., of Silvertown, who died intestate, left £37,033.

NEW COMPANIES REGISTERED.

Voltalite, Ltd. (148,069).—Private company. Registered July 24th. Capital, £3,000 in £1 shares. Manufacturers of and dealers in self-generating electric cycle lamps, and other electric, cycle, or engineering appliances, manufacturers, importers, exporters, and shippers of and wholesale and retail dealers in games, toys, cycles, and fancy goods, &c. The subscribers (each with one share) are: H. O. Farrell, 99, Meadow Street, Moss Side, Manchester, electrical engineer; A. Lowe, 388, Manchester Road, Droylsden, cashier. The first directors are: H. O. Farrell and A. Lowe. Registered office: 91, Beverley Street, Moss Side, Manchester.

Enterprise Manufacturing Co., Ltd. (148,059).—Private company. Registered July 24th. Capital, £5,000 in £1 shares (2,500 pref.). Electrical merchants, suppliers on sale or hire of electric lamps and fittings, &c. Agreement with C. H. Roberts and H. Ashdown. The subscribers (each with one share) are: C. H. Roberts, 23, Acacia Road, Norbury, S.W., electrical engineer; H. Ashdown, 16, Landseer Road, Bow, E.3, electrical engineer. The first directors are: C. H. Roberts and H. Ashdown. Registered office: Gun Street Electrical Works, Bishopsgate, E.1.

Wedmore Engineering Co., Ltd. (148,050).—Private company. Registered July 23rd, by Johnson, Weatherall & Sturt, 7, King's Bench Walk, Temple, E.C. Capital, £100 in £1 shares. To acquire (by permission of the Board of Trade) the business of a company of the same name (the books and documents of which are liable to inspection under the Trading with the Enemy Act), and to carry on the business of mechanical and electrical engineers, founders, smiths, &c. No share may, without the consent of the Board of Trade, be held by or on behalf of any (present) enemy, nor may the directors, without such consent, allot or register the transfer of any shares which would cause more than 40 per cent. of the total issued capital, or more than 25 per cent. of the voting power, to be held by or on behalf of foreigners, foreign corporations, or foreign-controlled corporations. The subscribers (each with one share) are: S. G. Beaton, Branscombe, Woodcote Green, Wallington, engineer; G. H. Beaton, 41, James Square, Holland Park, N.W.11, engineer. The first directors are S. G. Beaton and G. H. Beaton. At least three-fourths of the directors, including the chairman, must be British subjects, resident in the United Kingdom. No (present) enemy may be a director or alternate director.

Cosmos Lamp Works, Ltd. (148,045).—Private company. Registered July 23rd, by Jenkins, Baker & Co., 17, Grosvenor House, Old Broad Street, E.C.2. Capital, £50,000 in £1 shares. To acquire (by permission of the Board of Trade) the undertaking of the Brimsdown Lamp Works, Ltd. (the books and documents of which are liable to inspection under the Trading with the Enemy Act), and to carry on the business of manufacturers of and dealers in electrical lamps, fittings, and appliances, &c. The articles of association contain provisions relating to British control, similar to those in the case of the Wedmore Engineering Co., Ltd. (q.v.). The subscribers (each with one share) are: A. Winterbottom, Donwood, Alder Avenue, New Malden, Surrey, accountant; F. E. Clarke, Bourne, Fwell Road, Surbiton, Surrey, accountant. The first directors are: N. B. Dickson, F. A. Lang, W. W. Blunt, G. Layton, and J. H. Tearle. Registered office: Westinghouse Building, Norfolk Street, W.C.2.

CITY NOTES.

**Pernambuco
Tramways
and Power
Co., Ltd.**

Mr. F. HOLT, presiding at the annual meeting recently, said that the company had a net increase of 10 per cent. in earnings, notwithstanding that the gas works were under reconstruction, that the tramways were being converted to electrical working, and that prices of coal and all materials were very high. During the year the exchange had been very much against them, but their result was not altogether unsatisfactory on the whole. The exchange was now better, and earnings continued to show steady improvement. If nothing unforeseen happened this year, they would be able to establish the renewal fund and, possibly, go a step further, but they must proceed cautiously in these difficult times. They had only touched the fringe of the electric light and power supply possibilities. During next year they hoped for good results from the development of that department of the business.

**Indo-European
Telegraph
Co., Ltd.**

The company's through telegraph service continued interrupted during 1916. Telegraphic receipts were limited to traffic traversing the eastern sections of the company's system. The new arrangement between the company, the Indo-European Telegraph Department, and the Eastern Telegraph Co., under which there would be secured to the company a sufficient sum, after payment of all expenses, to provide a dividend of 7 per cent. on the share capital, came into operation on August 1st, 1916. It would lie with the directors to recommend any additional dividend by drawing on the equalisation of dividends fund, but this was not called for in respect of 1916. The revenue from message account and other sources was £162,274, against £204,190 for 1915; a decrease of £41,916. The expenses on commercial and general account were £55,519, and on maintenance account £19,810, making a total of £75,329, a decrease of £6,889. After deduction of income-tax, and adding the amount brought forward, £80,073 is available, and out of this £40,000 is put to investment fluctuations, the interim dividend requires £10,625, the final dividend of 22s. 6d. per share (making 7 per cent. for the year) absorbs £19,125, and £10,323 is to be carried forward. With the final dividend mentioned, a distribution of 30s. per share was paid out of interest received, making a total for the year 1916 of £3 5s. per share, free of income-tax.

**London United
Tramways,
Ltd.**

On July 25th, at an adjourned meeting of the first mortgage debenture stockholders, Mr. M. W. MATTINSON, chairman of the Committee of Debenture-Holders, made a full statement concerning the Committee's work. In addition to investigating the present position, they had tried to look farther ahead and to estimate the position of the company in the period after the war. Many things had been investigated, and they required the assistance of a person skilled in tramway construction and running to give his professional opinion to aid them. Such advice should be obtained without any avoidable delay. The Committee had been considering whether a solution of the future of the company, and their interest as debenture-holders therein, might not be found in some permanent arrangement with the Underground Co. or its associated companies. That was the only possible solution, but it was one first to be explored and considered. They had hoped to secure election to the board of two gentlemen nominated by the debenture-holders, but the board declined the request, although renewing their assurance to give every information that the Committee required. The Committee recommended that the bond-holders should authorise them to incur all necessary expense in obtaining professional and other advice. They would do their best to obtain expert assistance and such report as might be necessary upon the position and prospects of the system. The Committee was not a committee of investigation, and they did not propose to make any inquisition as to where the responsibility of the past lay. They were a committee of reconstruction, and their mission would be limited, as far as possible, to the rehabilitation of the company. A resolution was passed by the meeting authorising the employment of competent expert assistance. LORD REVELSTOKE, who presided, said that an opportunity might be taken to convey to the board an expression of the debenture-holders' opinion, inviting them to elect two gentlemen as representatives of the debenture-stockholders to join the board.

**Yorkshire
Electric
Power Co.,**

Satisfactory progress is reported for the half-year ended June. The revenue has increased and, notwithstanding the higher cost of coal and labour, the net profit is larger. The net profit, after payment of bank and other interest, for three June half-years has been: 1917, £17,617; 1916, £13,550; 1915, £9,873. The half-yearly dividend on the 6 per cent. cum. pref. shares is to be paid on August 1st, but in view of the financial conditions arising out of the war payment of a dividend on the ordinary shares is deferred until the accounts are made up for the year. The new 6,000-kw. turbo-alternator will shortly be running on load. In consequence of increased demands for current, it

has been found necessary to place on order a further unit of the same size, for which space was provided in the new engine house at Thornhill. Of the recent issue of £71,640 of 6 per cent. cum. pref. shares, £42,845 has been taken up, leaving £28,795 still available. Numerous applications have been received during the past half-year.

**British
Thomson-
Houston
Co., Ltd.**

Mr. H. C. LEVIS presided at the annual meeting, on Monday. He said that the total number of employés who had enlisted was 1,309, and, quoting the figures given in the report as to those who had fallen or had won distinction, he said that the company had a fine record in this matter. They did not recommend the payment of dividends, as it was deemed wise to use the surplus profits for further depreciation of the goodwill and plant accounts. The goodwill was brought down by a further £40,000, leaving it at £60,000. They had expended £88,535 on plant. The total writing off from plant for the year was £116,000. Holdings in shares and debentures of other companies were valued very conservatively. Their profit for the year involved heavy payments to the Government, but they were glad that circumstances were such that their contribution could be so large. Last year they made a reserve of £25,000 to take care of possible depreciation in raw material, but this year they wrote it back, and used it for other depreciations, because it was not required, and as it was proposed under the Finance Bill that they would have two years within which to liquidate their stock of raw material, there was little danger of making a loss in that connection. The loan from the General Electric Co. of New York had increased by £57,000.

**Marconi's
Wireless
Telegraph
Co., Ltd.**

The net profits for 1916, including the balance brought forward, after providing for expenses of management, depreciation, and all other expenses, were £625,980. After paying 12 per cent. on the preference shares and 15 per cent. on the ordinary shares for the year, £412,576 remains, of which £32,470 is to be transferred to general reserve account, and £380,106 is to be carried forward. The general reserve account will now stand at £1,000,000. Larger dividends are not recommended as, in view of the demands for apparatus and material likely to be made upon the company on the cessation of hostilities and the uncertain financial outlook, the directors deem it prudent to strengthen its financial position. Shares in associated companies and patents are taken into account at their cost price, as usual, and they stand at £1,403,923, an increase of £20,266. The par value of the shares now stands at £2,487,451, exclusive of shares which have no capital denomination. Owing to unfavourable rates of exchange large sums of money have been invested temporarily or placed on deposit abroad. The loss represented by the rates of exchange calculated on December 31st, 1916, has been written off against profit and loss account. In the event of ultimate realisation without loss, the amount so written off will appear as profit in another year. The company is still without any remuneration or compensation from the Government for the use since the beginning of the war of the company's high-power stations and for other relative services. Moreover, the company has not yet been afforded an opportunity of considering any proposal as to the basis upon which either remuneration or compensation is to be calculated. For the third year in succession, therefore, it has been impossible to include any sum in respect of these matters in the accounts. A number of orders have, however, been received by the company from Government Departments in respect of which payments have been duly made. The four heads under which considerable sums are payable by the Government were set out in the directors' report last year, as follows:—

1. Remuneration and compensation by the Post Office in respect of the use of the company's high-power stations since the beginning of the war, the staffing and management of those stations, and other services in connection therewith.

(Under the above claim the company has been repaid part of its out-of-pocket expenses, but the expenditure incurred is considerably in excess of the payments received.)

2. For the use of the company's patents by the Admiralty since the expiration, on March 31st, 1914, of the Admiralty agreement of 1903.

(Shareholders were informed last year that the company had received the assurance that the matter would be dealt with as quickly as possible. This assurance has been repeated.)

3. In respect of the use of the company's patents by the War Office, without agreements, during the whole time wireless telegraphy has been used by the War Office.

(The War Office has informed the company that this matter cannot be dealt with until after the war.)

4. For compensation by the Post Office in respect of their withdrawal from the contracts for the Imperial chain of stations.

(There have been repeated negotiations with a view to a settlement of this matter, which are still proceeding.)

The Marconi International Marine Communication Co., Ltd., has continued to show a substantial development in its business and increased profits. Dividends for the past year amounting to 15 per cent. have been declared. The company has taken steps to increase its authorised capital to £600,000.

The Russian company, the Société Russe des Télégraphes et Téléphones sans Fil, has continued to do a large business, and a dividend at the rate of 17 per cent. for 1916 has been declared.

The French company, La Compagnie Française Maritime et Coloniale de Télégraphie sans Fil, has declared a dividend for 1916 at the rate of 12½ per cent. on the ordinary shares and 140.62 francs on the founders' shares.

The Amalgamated Wireless (Australasia), Ltd., has paid a dividend of 5 per cent. in respect of the year ending June 30th, 1916.

The net income of the Marconi Wireless Telegraph Co. of America for 1916 was \$259,888, as compared with \$177,316 for the previous year, and the total surplus now carried forward amounts to \$801,776. The very large orders now being executed on behalf of the Government of the U.S.A. have necessitated the construction of considerable additional factory accommodation. The American Trans-Atlantic stations which were expected to constitute the principal source of revenue have remained idle in consequence of this company's stations continuing to be employed by the Government. A very satisfactory telegraph service was being conducted from the Pacific Coast across the Pacific Ocean to the Hawaiian Islands and Japan up to the time the United States entered the war, when the Government took possession of the stations. Negotiations were immediately opened, and are progressing rapidly towards settling the basis of the payments to be made to the company, and final agreement is expected to be reached promptly.

Since the last report submitted to the shareholders, the action brought by Messrs. O. Locker-Lampson and Peter E. Wright has been discontinued. In view of the unconditional withdrawal by the plaintiffs of all charges, the company and its directors agreed not to look to them for the payment of their costs, which will be borne by the company. Mr. H. W. Allen and Mr. W. W. Bradfield, who have been associated with the company since its inception, have been elected to the board. Mr. M. A. Bramston, a director of associated companies, has joined the board. Annual meeting: August 9th.

***Austrian Companies.** The Hungarian Siemens-Schuckert Werke report gross profits of £177,000 for 1916, and net profits of £24,000.

The directors of the *Vcr. Telefon und Telegraphen Fabriken A.G. Czeija, of Vienna*, recommend a dividend of 12 per cent. for 1916, as contrasted with 9 per cent. in the previous year.

The report of the *Gesellschaft fur Elektrische Industrie, of Vienna*, states that the works were fully occupied in 1916, particularly in the production of machines and transformers, owing to the growing demand for direct and indirect war orders. An extraordinary increase in the cost of raw materials, wages, and general expenses took place, especially in the second half of the year, and it was becoming visibly accentuated. It was only possible in a few cases to raise the sale prices of manufactures to a corresponding extent. The net profits are returned at £28,000, as against £16,000 in 1915, and a dividend of 10 per cent. is proposed, as in the preceding year.

The *A.E.G.-Union Elektrizitats Gesellschaft, of Vienna*, states that the shops were crowded with work in 1916, and many orders remained unfilled. Apart from contracts for the Army authorities, the collieries and ironworks, and the munition factories, numerous orders were received for the chemical industry in connection with the cyanamide works in course of erection. The gross profits are reported to amount to £200,000, as compared with £183,000 in 1915, and the net profits to £75,000 and £46,000 respectively. It has been decided to distribute 8 per cent. on the increased share capital of £833,000, as against 6 per cent. on £666,000 in 1915.

The *Oesterr. Siemens-Schuckert Werke A.G., of Vienna*, report that the great technical requirements for the war had converted the company's departments on the whole into electrotechnical war shops, and had almost entirely excluded works for peace purposes. Most departments were engaged on urgent orders throughout 1916, but operations were hampered by the scarcity of trained and expert workmen, and the length of the shifts had consequently to be extended, and to be supplemented by night shifts in so far as it was technically possible. As a consequence, the customary careful overhaul of the machinery and plant had to be restricted, and a considerably greater depreciation took place. The gross profits amount to £780,000, as compared with £611,000 in 1915. After meeting general expenses and other charges, and placing £104,000 to depreciation, as against £68,000, the accounts show net profits amounting to £126,000, as contrasted with £118,000 in 1915. It is proposed to distribute 7 per cent. on share capital of £1,333,000, the same rate as in the previous year.

London & Suburban Traction Co., Ltd.—It is not proposed to pay an interim dividend on the preference shares for the half-year to June 30th.

Hong-Kong Tramway Co., Ltd.—Dividend, 9 per cent., less tax (interim).

National Gas Engine Co., Ltd.—Interim dividend at the rate of 5 per cent. per annum, less income-tax, on the preference shares, and 7½ per cent. per annum, less income-tax, on the ordinary shares for the June half-year.

North London Railway Co.—Interim dividend, 2 per cent. for the half-year.

Bristol Tramways & Carriage Co., Ltd.—Interim dividend at the rate of 5 per cent. per annum for the June half-year on the ordinary shares.

Metropolitan Railway Co.—Interim dividend at the rate of 1 per cent. per annum on the ordinary stock. Interim dividend on the Surplus Lands Stock at the rate of 2½ per cent. per annum.

Charing Cross, West End & City Electricity Supply Co., Ltd.—Interim dividend on the ordinary shares of the West End undertakings for the June half-year at the rate of 4 per cent. per annum.

Westminster Electric Supply Corporation, Ltd.—Interim dividend at the rate of 8 per cent. per annum, less income-tax, for the half-year ending June 30th.

Russia.—The Wolframite Co.'s statutes have been approved. It will operate in Transbaikalia. Capital, 200,000 roubles.

The Russian Regional Electrical Stations Co., capital 4,000,000 roubles, closed its (1916) working year with a profit of 523,263 roubles. It will pay 4 per cent., as in the previous year.

The statutes of the Russian Accumulator Co. have been approved, capital 2,700,000 roubles. This company was formed to take over the Russian "Tudor" Accumulator Factories, Petrograd.

France.—The Mediterranean Electrical Co. (*L'Energie Electrique du Littoral Méditerranéen*) is increasing its capital, owing to the development of war requirements, from 38 to 60 million francs (from £1,520,000 to £2,400,000). Formed 17 years ago to develop and supply electrical energy in the Mediterranean region of France, its operations have been greatly expanded under the stimulus of war. Its earnings, which in 1914 amounted to 7,583,000f., rose to 11,032,000f. in 1916, and this year are expected to reach 13,000,000f. The dividend last year was 6 per cent.—*Times*.

A new company has lately been formed in Paris with a capital of £6,000, and the title *La Société du Secteur Electrique de la Rue d'Angouleme*. *La Société Hydro-Electrique de la Maurienne*, of Paris, has also recently increased its capital to £400,000.

STOCKS AND SHARES.

TUESDAY EVENING.

STOCK EXCHANGE business has not given any sign of revival from the quietude into which it dropped when the Russian crisis became acute. Cheerfulness is shown by Brazilian issues in consequence of a brisk rally in the Rio rate of exchange. Industrials still command the greater part of what business there is in the markets. The Marconi Co. has raised its dividend from 10 per cent. to 15, but the shares are unchanged.

It is inevitable that memories should dwell just now upon the changes wrought by exactly three years of warfare on the colossal scale. The Stock Exchange is naturally looking up its 1914 records and prices. Some of the latter we quoted here last week. Electric Railway stocks have shared in the general depression which Home Railways have been unable to escape during the period, depression broken by few and brief spurts of strength. Most Mexican bonds and stocks have fallen very heavily, those of the electrical power companies with the rest. It would not be fair, of course, to lay all the blame for this weakness at the door of the war, although without a doubt the war has been a prominent factor.

Electricity supply shares are lower on balance. The companies have had peculiar penalties to pay as their share of the war, the Daylight Saving Bills and the lighting restrictions being two of them. We ring some of the changes that have occurred during the three years in this table:—

Share.	July 27, 1914.	Now.	Rise or fall.	Share.	July 27, 1914.	Now.	Rise or fall.
Brompton ..	94	6½	-28	Kensington ..	7½	5½	-2½
Brush 1st deb. ..	54½	61	+6½	London ..	1½	1	-½
Ditto P. Lien ..	82½	77	-5½	Metropolitan ..	3½	2½	-1
Charing Cross ..	5½	3½	-2	Notting Hill			
Ditto pref. ..	4½	3½	-1	pref. ..	9½	8	-1½
Chelsea ..	4½	2½	-2	St. James's ..	9½	6½	-3
City ..	16	12½	-3½	South London ..	3½	2½	-1
County ..	12	11½	-½	South Met. ..	1½	1½	0
Edmundson's 1st				Westminster ..	8½	5½	-3
Deb. ..	83½	69½	-14	Ditto pref. ..	5½	3½	-2

South Metropolitan ordinary shares have more than doubled in price, but the two preference issues are down, and the 4½ per cent. debenture stock has dropped from 98½ to 81, a fall of 17½ points.

The Marconi report shows the company to be in a strong financial position, and, as already mentioned, the dividend is to be raised from 10 per cent. to 15 per cent. Some disappointment is felt, however, at the absence of any Government payment even yet for the services rendered by the company since the outbreak of war, though it is taken for granted that information on this head will be forthcoming at the eagerly-awaited meeting. Meanwhile, the shares remain at 3½, and the speculative investor is said to be quietly picking them up.

Mr. McKenna's recent threat of a further advance in the income-tax has diverted fresh attention to securities upon which the dividends are at present distributed net. Underground Income bonds have accordingly recovered a point of their last week's drop of 4. India-Rubber shares put on 10s.,

the yield still coming to the equivalent of over 10 per cent., less tax. Eastern Telegraphs are up 2, and Eastern Extensions 2s. 6d. Other cable issues are mostly strong. Oriental Telephones have gone back $\frac{1}{2}$ after their too rapid rise. Chile Telephones are better to the extent of the ex dividend marking last week.

Brazilian Tractions have responded to a spurt in the Rio rate of exchange. At 50, the price shows a fall of 16 as compared with July 27th, 1914; this is a small shrinkage, having regard to the fact that in those latter days the company was paying 6 per cent. on the shares. British Columbia stocks are flat, the $\frac{1}{2}$ per cent. debenture being $2\frac{1}{2}$ lower on the week, and $4\frac{1}{2}$ down since three years ago. The preferred ordinary at $30\frac{1}{2}$ has fallen no less than $75\frac{1}{2}$, and the deferred 79 $\frac{1}{2}$, since the outbreak of war. Mexico Tramways Firsts are 48 points to the bad; all other Mexicans have suffered severely.

London and Suburban Traction preference are weak at 6s. 6d., the board having decided to pass, or postpone, payment of the interim dividend due now. The dividend is cumulative. An interesting report is just published by the Indo-European Telegraph, the company whose direct line crosses Germany. Net profit has fallen away by £27,000, to £59,100, and the dividend would be reduced to 7 per cent., as against 13 per cent., were not the latter rate maintained by the addition of 6 per cent. from interest received. The dividend has now been 13 per cent. for 13 years.

Manufacturing shares are steady. Babcock at 3 $\frac{1}{16}$ are $\frac{1}{16}$ up; the price was $2\frac{3}{4}$ three years ago. British Insulated have risen $2\frac{3}{4}$ in the war period; British Westinghouse preference 10s., Callenders $2\frac{1}{2}$, Henleys £1, and India-Rubbers £4. Curiously enough, Telegraph Constructions at $38\frac{1}{2}$ show no net change at all.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.					
	Dividend	Price	Rise or fall	Yield	
	1916. 1916.	July 31, 1917.	this week.	p.o.	
Brompton Ordinary	10 9	6 $\frac{1}{2}$	—	£6 18 8	
Charing Cross Ordinary ..	6 6	8 $\frac{1}{2}$	—	7 2 10	
do. do. do. $\frac{1}{2}$ Pref. ..	4 $\frac{1}{2}$ 4 $\frac{1}{2}$	8 $\frac{1}{2}$	+ $\frac{1}{2}$	6 13 4	
Chelsea	4 3	2 $\frac{1}{2}$	—	5 4 4	
City of London	8 8	12 $\frac{1}{2}$	—	6 5 6	
do. do. 6 per cent. Pref. ..	6 6	10	—	6 0 0	
County of London	7 7	11 $\frac{1}{2}$	— $\frac{1}{2}$	6 4 6	
do. do. 6 per cent. Pref. ..	6 6	10	—	6 0 0	
Kensington Ordinary	7 10	6 $\frac{1}{2}$	—	6 11 7	
London Electric	3 8	1	—	NH	
do. do. 6 per cent. Pref. ..	6 4	8 $\frac{1}{2}$	—	6 6 8	
Metropolitan	8 8	2 $\frac{1}{2}$	—	6 0 0	
do. do. $\frac{1}{2}$ per cent. Pref. ..	4 $\frac{1}{2}$ 4 $\frac{1}{2}$	8 $\frac{1}{2}$	—	7 4 0	
St. James' and Pall Mall ..	8 8	6 $\frac{1}{2}$ xd	—	6 0 9	
South London	5 6 $\frac{1}{2}$	2 $\frac{1}{2}$	—	7 5 6	
South Metropolitan Pref. ..	7 7	21 $\frac{1}{6}$	—	6 10 3	
Westminster Ordinary	7 7	6 $\frac{1}{2}$	—	6 1 9	

TELEGRAPHS AND TELEPHONES.					
	Dividend	Price	Rise or fall	Yield	
	1916. 1916.	July 31, 1917.	this week.	p.o.	
Anglo-Am. Tel. Pref.	6 6	97 $\frac{1}{2}$ xd	—	6 2 9	
do. do.	83 $\frac{1}{6}$ 1 $\frac{1}{2}$	22 $\frac{1}{2}$	—	6 16 4	
Chile Telephone	8 8	7 xd	+ $\frac{1}{2}$	6 14 4	
Cuba Sub. Ord.	6 6	8 $\frac{1}{2}$	—	6 17 8	
Eastern Extension	8 8	14 $\frac{1}{2}$	+ $\frac{1}{2}$	*6 11 4	
Eastern Tel. Ord.	8 8	143 $\frac{1}{2}$	+2	*6 11 6	
Globe Tel. and T. Ord. ..	7 7	12 $\frac{1}{2}$	—	*6 9 10	
do. do. Pref.	6 6	10 $\frac{1}{2}$	+ $\frac{1}{2}$	5 15 8	
Great Northern Tel.	22 24	86	—	6 13 4	
Iado-European	13 13	52 $\frac{1}{2}$	+1	6 3 10	
Marconi	10 15	3 $\frac{1}{2}$	—	4 15 10	
Oriental Telephone Ord. ..	10 10	2 $\frac{1}{2}$	-1 $\frac{1}{2}$	3 13 5	
United R. Plate Tel.	8 8	6 $\frac{1}{2}$	-1 $\frac{1}{8}$	*6 0 9	
West India and Pan.	6d. 6d.	1 $\frac{1}{2}$	—	1 12 0	
Western Telegraph	8 8	14 $\frac{1}{2}$	—	*6 10 4	

HOME RAILS.					
	Dividend	Price	Rise or fall	Yield	
	1916. 1916.	July 31, 1917.	this week.	p.o.	
Central London, Ord. Assented	4 4	61 $\frac{1}{2}$	—	6 10 1	
Metropolitan	1 1	22 $\frac{1}{2}$ xd	—	4 9 0	
do. do. District	NH NH	15 $\frac{1}{2}$	—	NH	
Underground Electric Ordinary	NH NH	1 $\frac{1}{2}$	—	NH	
do. do. "A"	NH NH	6 $\frac{1}{6}$	-3d.	NH	
do. do. Income	6 4	81	+1	*4 19 0	

FOREIGN TRAMS, &c.					
	Dividend	Price	Rise or fall	Yield	
	1916. 1916.	July 31, 1917.	this week.	p.o.	
Adelaide Sup. 6 per cent. Pref.	6 6	5	—	6 0 0	
Anglo-Arg. Trams, First Pref.	6 $\frac{1}{2}$ 6 $\frac{1}{2}$	2 $\frac{1}{2}$	—	9 11 4	
do. do. 2nd Pref.	6 $\frac{1}{2}$ 6 $\frac{1}{2}$	2 $\frac{1}{2}$	—	—	
do. do. 6 Deb.	6 6	68	—	7 6 6	
Brazil Tractions	4 4	50	+ $\frac{1}{2}$	—	
Bombay Electric Pref.	6 6	10	—	6 0 0	
British Columbia Elec. Ry. Pfce.	6 6	50 $\frac{1}{2}$	-2	9 19 0	
do. do. Preferred	NH NH	80 $\frac{1}{2}$	-1	NH	
do. do. Deferred	NH NH	27 $\frac{1}{2}$	—	NH	
do. do. Deb.	44 44	55	-2 $\frac{1}{2}$	7 14 7	
Mexico Trams 5 per cent. Bonds	NH NH	36	—	NH	
do. do. 6 per cent. Bonds	NH NH	30	—	NH	
Mexican Light Common	NH NH	14 $\frac{1}{2}$	—	NH	
do. do. Pref.	NH NH	24 $\frac{1}{2}$	—	NH	
do. do. 1st Bonds	NH NH	39 $\frac{1}{2}$	—	—	

MANUFACTURING COMPANIES.					
	Dividend	Price	Rise or fall	Yield	
	1916. 1916.	July 31, 1917.	this week.	p.o.	
Babcock & Wilcox	15 15	31 $\frac{1}{2}$	+1 $\frac{1}{2}$	4 17 10	
British Aluminium Ord. ..	7 10	30 $\frac{1}{2}$	—	6 13 4	
British Insulated Ord.	17 $\frac{1}{2}$ 20	12 $\frac{1}{2}$	—	7 15 0	
British Westinghouse Pref. ..	7 $\frac{1}{2}$ 7 $\frac{1}{2}$	2 $\frac{1}{2}$	—	5 17 2	
Callenders	20 20	11 $\frac{1}{2}$	—	7 0 6	
do. 5 Pref.	5 6	4 $\frac{1}{2}$	— $\frac{1}{2}$	6 1 8	
Castner-Kellner	22 22	8 $\frac{1}{2}$	—	6 10 2	
Edison Swan, fully paid ..	—	1 $\frac{1}{2}$	—	NH	
do. do. 4 per cent. Deb. ..	1 4	70 $\frac{1}{2}$	—	5 13 6	
Electric Construction	7 $\frac{1}{2}$ 7 $\frac{1}{2}$	4 $\frac{1}{2}$	—	8 0 0	
Gen. Elec. Pref.	6 6	10 $\frac{1}{2}$	—	6 0 0	
do. do. Ord.	10 10	15 $\frac{1}{2}$ xd	—	6 9 0	
Henley	25 25	16	—	7 16 8	
do. do. $\frac{1}{2}$ Pref.	4 $\frac{1}{2}$ 4 $\frac{1}{2}$	4	—	5 12 6	
India-Rubber	10 10	18	+ $\frac{1}{2}$	*7 13 10	
Telegraph Co.	20 20	38 $\frac{1}{2}$	—	*6 6 2	

* Dividends paid free of income-tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, August 1st.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/6	..
a Ammoniac Sal	per ton	£76	..
a Ammonia, Murate (large crystal)	..	£54	..
a Bisulphide of Carbon .. ..	..	£28	..
a Borax .. ..	..	£38	..
a Copper Sulphate .. ..	..	£61	10 $\frac{1}{2}$ dec.
a Potash, Chlorate	per lb.	2/6	..
a Perchlorate .. ..	..	2/-	..
a Shellac	per cwt.	205/-	..
a Sulphate of Magnesia	per ton	£16	..
a Sulphur, Sublimed Flowers ..	..	£35	..
a Lump .. ..	..	£26	..
a Soda, Chlorate	per lb.	10 $\frac{1}{2}$ d.	..
a Crystals	per ton	120/-	..
a Sodium Bichromate, cakes ..	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2" to 12" basis)	per lb.	..	..
c " Tubes (solid drawn) .. ..	..	..	..
c " Wire, basis .. ..	..	..	..
c Copper Tubes (solid drawn) ..	per ton	1,7 $\frac{1}{2}$ to 1/8 $\frac{1}{2}$	Ad. dec.
g " Bars (best selected) .. ..	..	£160	£5 dec.
g " Sheet .. ..	..	£160	£5 dec.
g " Rod .. ..	..	£137	£5 dec.
d " (Electrolytic) Bars .. ..	..	£162	£5 dec.
d " " Sheets .. ..	..	£145	£5 dec.
d " " Wire Rods	per lb.	1/5 $\frac{1}{2}$	Ad. dec.
f Ebonite Rod .. ..	..	3/-	..
f " Sheet .. ..	..	2/6	..
n German Silver Wire .. ..	..	2/3	..
h Gutta-percha, fine .. ..	..	6/10	..
h India-rubber, Para fine .. ..	..	8/3 $\frac{1}{2}$	1 $\frac{1}{2}$ d. inc.
i Iron Pig (Cleveland warrants) ..	per ton	Nom.	..
l " Wire, galv. No. 8, P.O. qual. ..	..	£42	..
g Lead, English Pig .. ..	..	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small ..	per lb.	6d. to 8/-	..
e " " " medium .. ..	..	8/6 to 6/-	..
e " " " large .. ..	..	7/6 to 14/- & up.	..
d Silicon Bronze Wire	per lb.	1/9 $\frac{1}{2}$	Ad. dec.
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English) .. ..	..	..	..
n " Wire, Nos. 1 to 16	per lb.	8/6	..

Quotations supplied by—

a G. Boor & Co.	g James & Shakespeare.
c Thos. Bolton & Sons, Ltd.	h Edward Till & Co.
d Frederick Smith & Co.	i Bolling & Lowe.
e F. Wiggins & Sons.	l Richard Johnson & Nephew, Ltd.
f India-Rubber, Gutta-Percha and	n P. Ormiston & Sons.
Telegraph Works Co., Ltd.	r W. F. Dennis & Co.

American Copper Output.—It is estimated that the copper refineries of the United States turned out about 185,000,000 lb. of copper during the month of May. This was through maintenance of about the same basis as in April, when the yield was 180,000,000 lb., allowing for a 3 per cent. increase on account of the extra day. There has been no close approach to the December record of 200,000,000 lb., which was the result of combined efforts of the country's refining plants in the closing month of last year. New refinery capacity has been gradually completed, and much of the expansion programme among the various plants has yet to be carried out. Despite the fact that capacity will be somewhat in excess of 200,000,000 lb. monthly, it will be largely a "paper" capacity with equipment held in reserve against delays that may occur at other portions of plants. During the past two years there has not been a bit of idle equipment, and the result has been that, under forced pressure and operation for such a long period, there will have to take place considerable replacement work. In the opinion of some of the refinery officials the country's refined copper yield will range in the future between 180,000,000 and 190,000,000 lb. monthly, and, upon occasion, possibly 200,000,000 lb. With the lower estimates fulfilled, the refineries will be caring for every pound of raw product that will have been shipped from the mines.

Interruptions to mine operations in the winter months, reflected by smaller receipts at refineries 60 to 90 days later, will be offset in the summer months by extreme heat at the refineries, making impossible full operation.

Another factor in keeping down the yield from refineries continues to be found in the inefficiency of labour. The highest wage scale ever paid, instead of making better workmen, has the opposite effect among the refinery employes, and it now takes 30 hours to perform work ordinarily handled in 24.—*Electrical Review and Western Electrician.*

A New Insulating Material.—A new patent insulating material, which it is claimed, is hard, almost incombustible, and non-absorbent, can be moulded and wrought, and is suitable for replacing porcelain, marble, slate, and vulcanised substances, has been described in *Industria e Inveniones*. It is composed of pulverised asbestos, 52 per cent.; sifted mica, 11 per cent.; "mineral caoutchouc," 20 per cent.; rubber solution, 10 per cent.; sulphur, 3 per cent.; and resin, 1 per cent. These proportions are approximate, and may be varied.

THE POSITION OF THE ENGINEER IN NATIONAL AFFAIRS.

At a special meeting of the AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, the President, Mr. H. W. BUCK, delivered an address on this subject. The following abstract is based upon the *Electrical World* report:—

The change and improvement in the engineer's position in the world in recent years have been so rapid as to surprise even those who were the optimists in the under-dog days of the engineering profession. The engineering profession is coming into its own. A flood of scientific and technical accomplishment has swept over the face of the earth, revolutionising life, commerce, and international destinies.

In all this development period of the engineering profession during the last century the engineer has worked his way along alone and in silence, so to speak, seeking his reward rather in the joy of accomplishment and in the realisation of his dreams than in worldly recognition and accumulation. The very inherent greatness of the pioneers who have laid the foundations upon which we now build prevented them in a way from acquiring a more worldly position in affairs. This tradition, however, is not a virtue beyond a certain point, and the engineer by nature is too willing to give way to others. The time has come when he should take a more worldly position in the world which he himself has created.

In our general relations to intellectual development we may consider that we are just emerging from a classical period where tradition, custom, prejudice, ignorance, and dogmatic religion were the controlling forces. Movements which took place in world affairs were largely political, following the paths best suited to the advantage of the ruling classes. There was little real progress, because there was no development of scientific knowledge and its application in engineering. Scientific truth held no standing. The worship of tradition caused a powerful reaction against any scientific discovery which might necessitate a readjustment of established habits of thought and life.

A constant change in point of view, which is so largely brought about through developments in scientific knowledge, seems to be necessary for progress in civilisation. Our civilisation to-day differs from that of a century ago in proportion to the scientific and engineering evolution which has taken place during the period through its reactions on life in all of its phases. Such discoveries in science as the law of gravitation, the evolution of species, the laws of electromagnetic induction, &c., have probably had a more profound effect upon the development of the human race than any other acts in history.

The engineering profession has passed through the preliminary stages of its growth, and has reached a position where the engineer should work and act, not only with proper attention to his work itself, but with full consciousness of the important relation of his work to human affairs in general. Among the early pioneers in engineering were many notable instances of men of great breadth of view. Of recent years, however, under the stress of commercial development and economic conditions, increasing specialisation has taken place and the engineer has become obliged to compass his mind with an ever-narrowing horizon. This specialisation produces extraordinary proficiency in particular fields, but has the objectionable effect of narrowing the character and outlook of the man, and of reducing his value as a citizen. We must take care lest commercial considerations and the modern mania for efficiency in the narrow sense force our engineers to lose sight of the world around them in their concentrated attention to the part rather than to the whole. This excessive specialisation is a danger which threatens the future standing of the engineer.

It is interesting to recall in this connection the results of a recent canvass made by a joint committee on education on the qualities which, in the opinion of about 5,000 leading men, engineers and others, best fit a man for a successful career as an engineer. As a result of this vote, only 13 points out of 100 were assigned to purely technical knowledge as an essential, the other 87 points being allotted to broader qualifications, such as judgment, character, human understanding, &c. This is merely a quantitative statement of the many general demands now being made of the engineer, and it illustrates how his work has broadened out. It is an interesting and encouraging symptom.

A most significant movement of recent times in the engineering world has been the development of co-operative action among engineers of all classes, and this tendency will, I believe, serve to offset the evils of specialisation. It is the growing recognition of the fact that all branches of engineering are interdependent. We electrical engineers, I believe, are well aware how much we need the assistance of other branches of engineering for the successful fulfilment of our purpose.

This co-operative movement has quite recently been given tangible expression in the formation of the Engineering Council, an act, I believe, of far-reaching consequence. Under this organisation, as a beginning, the Civil, Mechanical, Mining, and Electrical Societies, together with the United Engineering Society, are tied together for co-operative action through a joint body of 24 representatives. This body will

meet at frequent intervals, and will deliberate on matters of general interest to engineers. It is an encouraging beginning toward universal co-operation among engineers in all branches of work.

In this Engineering Council we have for the first time an engineering body, representing about 30,000 engineers, of sufficient scope and standing to create an engineering public opinion. Its influence is likely to be far-reaching in building up the prestige of engineers in both technical and civic affairs. A further development which has reached full recognition only in recent times is the mutual appreciation which has grown up between the engineer on the one hand and the worker in pure science on the other.

The engineer looks to the scientist to provide him with raw materials of knowledge with which to work out his applications, and the scientist must look to the engineer to make his discoveries so fruitful that the full effectiveness of his work on the frontier of research can be sustained. Both are working together in order to unfold nature in the most effective way for the benefit of man.

All of the important movements taking place at the present time which centre around the engineer and his work mean, I believe, that the engineer is soon going to leave his position of isolation in independent fields of work and realise that he owes an obligation to the community broader than his daily engineering work, and will contribute to the general welfare his talents and experience. It matters not whether the problems before him are political, sociological, industrial, or technical; I believe that the engineering type of mind, if the proper breadth of view has been acquired, is best fitted to undertake them.

It is not necessary, perhaps, in important administrative positions to have civil, electrical, or mechanical engineers as such, but we do need men in those positions who have had training of the type which engineering gives, with the mental balance, the power of analysis which such a training develops, the resourcefulness and the faculty of recognising and properly apportioning the various elements in a problem. There is a quality of mental honesty which engineering experience highly develops which is sorely needed in public life. The scientific and engineering professions should rise up and furnish such men from their ranks for the welfare of the country.

I believe that we can confidently look forward to a new era for the proper fulfilment of the destinies of the engineer. Out of this world chaos we now see men of engineering and scientific training rising to positions of commanding prominence on all sides. It is simply the working of the inevitable law of the survival of the fittest.

In this great movement not only must the individual engineer play his part, but the great engineering societies must realise the power of influence which they are developing in an ever-increasing degree in the community at large, and the obligations which devolve upon them.

And so I hope that the American Institute of Electrical Engineers, as it passes along from one administration to another, will acquire an increasing realisation of its duty, not only in furthering the growth of science and engineering, but in furthering the influence of the engineer in the affairs of the country and of the world.

A NEW INDUSTRIAL LEAGUE.

(Concluded from page 81.)

MR. GEORGE H. ROBERTS, M.P., said that the greatest of all the problems that would have to be dealt with after the war would be the problem of the relationship of employer and employed. The war would have had a tremendous effect on the whole of our system of society. We should have dissipated tremendous wealth; should have lost even more in flesh and blood than in material things; and we should have to face great problems of recuperation, reconstruction, and trade expansion if our country was to retain its hold on the markets of the world. The great question before us was: "How is our country to maintain its commercial position of eminence?" In his view, if the old disputations remained, if employers and employed were ranged in conflicting camps, the ravages of war would not be repaired, reconstruction would be impossible, and as sure as night followed morn, so would the decline and fall of the British Empire set in unless they were able to solve the great question then under discussion. He had always been an agitator, but he felt that if his views ought to be modified in any way, he claimed that human quality of courage to express such modification. He had come to the conclusion that many of the things he hoped for in the days of his youthful enthusiasm were not going to be achieved merely by the hoping. Those great human problems were not going to be solved by the application of any heavenly alchemy. Human problems had to be worked out by human beings, and therefore mistakes would always be made; but they must risk those mistakes in order that they might gradually grope their way to a better and more perfect state of things. Those who had been associated with their movement had recently been immensely heartened. He

had something to do with the setting up by the Government of a sub-committee of the Reconstruction Committee to deal with the problem that mainly concerned them—the relationship of employer and employed. They rejoiced to know that men of varying views, men who, before the war, could never have agreed on any one subject, had agreed to sit round a table to discuss this problem, and had submitted recommendations. Holding diverse views, they had unanimously submitted recommendations in accord with the fundamentals of the movement. They recognised that after the war there would be a great need for industrial harmony. They perceived that unless the employer and the employed worked together in friendly co-operation the history of the British Empire must be cut very short. Men with extreme labour views had joined with employers of orthodox opinion, and, if acted upon, their recommendations would do a great deal towards rehabilitating our country, and helping to promote a friendly feeling and clear understanding between the various industrial classes of the community. They desired to further the recommendations of the Whitley Committee. He had no illusions. The interests of employers and employed would never be identical any more than the principle of nationality or the interests of buyer and seller would be identical, but up to a certain point there was a community of interest. They proposed to develop the movement which was represented in the Industrial League. They believed that by its development they would be conferring a substantial advantage on the country, and they were going to develop as from that night. He would like to see a Director of Industrial Harmony appointed. He wanted to impress on employers and those who had influence with them the need of recognising that mere expressions of sympathy were not going to tend to the pacification of the working classes. They had to produce substantial results. The working classes were impressed with the belief that they got plentiful promises but no substantial results. If they wanted to establish industrial harmony in this country they had to show that, by that policy, substantial results would accrue not to one but to every class in the community. He was certain that if they pursued that policy then, just as before the war there was industrial chaos, so in the days when peace was restored they would be able to say that industrial cosmos had emerged.

Sir ARCHIBALD DENNY remarked that he entirely sympathised with the idea of getting the employers and employed together. In the old days the works were smaller, and they knew their own men much better. The principle of his own firm was that those who came to rule in the works must have served their time through the works. When he began his time they had payment by results in the iron trades; his elder brother introduced payment by results. That system had continued ever since, and he thought theirs were the only works in the kingdom where piecework in the joiners' shop of a shipbuilding yard was practised before the war. In 1877 they wanted to introduce the system into the carpenters' shop, but the men would not have it, and they struck. They were afraid that their rates would be cut as soon as their output was discovered. That was quite a natural fear. After the strike had lasted some time the men said that if they would give them an assurance that rates would not be cut they would accept the system. They did that, with the result that the system was continued ever since, and had been perfectly satisfactory. He had great faults to find with employees. It was very difficult for the employers to deal with the trade union leaders, because they were never quite sure whether they could deliver the goods. That difficulty arose from the fact that, either from force of circumstances or from their own management, there had been created a power inside the unions which seemed to dominate the situation. Their leaders had always to take a vote before anything could be decided, and that was not very useful. The leaders were quite strong enough to carry their points in discussion with the employers, and were a good deal cleverer, therefore they ought to be able to deliver the goods. Credit was a great thing, and if they shook it, then there would be neither money nor anything else. They had to produce the goods as cheaply as they could. If there was a rise in wages and no rise in production, then they would not be a bit better off. They had to produce things more cheaply than they had ever done before, and then they would be in that state of comfort which they all desired. No one approved of low wages. Why did we pay them? Because we had competition, and competition with the foreigner was as hard as it could be, but there was also competition amongst ourselves in this country. He was not speaking as a syndicalist. It was cheap things they wanted to produce, and then they would all be as comfortable and happy as the day was long.

The Rt. Hon. F. HUTCH JACKSON, the next speaker, said that, personally, he entirely supported the recommendations of the Whitley Committee, but the execution depended upon the goodwill and the co-operation of the employer and employed. So far as he could see at the present moment, that co-operation was by no means such a certainty as he should wish it to be. He had been associated with another movement which had objects similar to those of the movement represented there that night. For what they were worth they were perfectly willing to co-operate with any other movement which had the same object in view, and to co-operate in the most whole-hearted manner for the achievement of the end which was so much desired. He very strongly deprecated any idea of

competition between this movement, their movement, and any other movement for promoting more amicable relations between employers and employed. It would be a national disaster if they had organisations which, while having the same object in view, were working on different lines, and he therefore hoped (and he felt perfectly certain of it as far as his movement was concerned) that the spirit of co-operation would be present. They wanted co-operation, not competition.

Mr. G. WARDLE (Acting Chairman of the Labour Party) said that if he were to focus in a sentence what was the result of the present meeting, he would say that they felt that something must be done to prevent an industrial war after the present war. He was not going to blind them to the fact that there was a considerable amount of underlying suspicion which hit the labour people as hard as it hit the employer. He was anxious for the sake of the future of the country, and for the sake of the workmen, as well as the employers, that something should be done to stop what was going on now. It could not be stopped by force, but it could be stopped by convincing the worker that the next step, whatever might be the ultimate step, was to secure co-operation between the employers and employed in order to bring about a better state of affairs. Everyone worked for mixed motives, but if their motive was unselfish within reason it could be done. That meeting might be historical, but the thing would not have to stop there, and they would not have to deal with Labour leaders only; they would have to go down to the men. They would have to get the men together. It was not always the fault of the men that there was no co-operation. They did not get the chance. Let them understand what was at stake. He could see what was happening—they could not. He could do his bit, but only at great risk and under great suspicion. If they wanted to destroy the seditious spirit that was abroad amongst a certain section in the country the only way they could do it was by absolute frank openness between themselves and their employees.

Mr. BLAIN proposed a vote of thanks to the Chairman. Mr. W. A. Appleton (secretary of the General Federation of Trade Unions) seconded, and Mr. Lee Murray briefly responded.

ELECTRIC VEHICLES IN SHEFFIELD.

IN the discussion on Mr. PRIESTLEY's paper (ELEC. REV., July 20th, p. 55), before the INSTITUTE OF CLEANSING SUPERINTENDENTS, for a report of which we are indebted to *The Surveyor*, the author remarked that they might assume that a horse cost 13s. 6d., and that a motor vehicle would replace two horses without any additional rent. If they had horses and two drivers replaced by one vehicle and one driver, it was a paying concern. His experience had shown that so far as Sheffield was concerned the best point for electrics for refuse collection was a total journey from dépôt to dépôt of about three miles. If the journey was less than that distance they thought that horses could do the work slightly cheaper than electrics.

The PRESIDENT (Mr. TERRY) said that Nottingham corresponded almost exactly with Sheffield in its local conditions, and the figures obtained from the working were almost identical, but he differed somewhat from Mr. Priestley with regard to the three-mile limit. The first two vehicles which Nottingham obtained were three-ton vehicles, and they had some journeys covering five miles. He presented some figures to his Committee in March last, and worked out the whole of the working cost, and the total amount of refuse collected, and compared the average cost per ton with the average cost per ton of horses worked throughout the city. Taking the two farthest distances and the two nearest distances, he thought that the cost showed a fair average for the city, and, compared with the average cost for horses' work, these figures for three vehicles from October, 1915, to February last showed an average cost per ton of 4s. 4.7d., and for four vehicles an average cost of 4s. 1.4d., while the average cost per ton of the horse vehicles was 5s. 1.3d. per ton. That was showing a considerable saving in favour of electrics.

Ald. W. ROBERTS (Liverpool) said that, as the members knew, he always believed in horses. But he had had the opportunity of reading Mr. Priestley's paper on electric vehicles, and evidently, from the figures, these vehicles had worked remarkably well. In Liverpool they had a large number of horses, between 300 and 400, and a number of petrol-driven vehicles, for their engineer believed that they could run a petrol-driven vehicle much cheaper than an electric. For certain distances he believed that horses were more economical, but there seemed no doubt that for long distances the petrol vehicle, or the electric, could beat the horse. Everything depended in connection with these petrol-driven or electric-driven vehicles on getting them loaded quickly and lightened quickly. They must always keep them working to make them pay.

Mr. W. GREIG (Glasgow) said Mr. Priestley told them that in Sheffield each man and horse cost 13s. 6d. a day. He thought that was extremely low. In Glasgow it cost 16s. 6d., but, on the other hand, in Glasgow they got more work out of their horses. In the next table, about electric vehicles,

Mr. Priestley said that he was guaranteed a 10-years' life for the vehicle, and he went on to say, "One half the cost of the vehicle is represented by the battery, and this is guaranteed to give 100 per cent. of its original efficiency after eight years' continuous service, and any defects due to misuse are made good by the makers during such period." In Glasgow they purchased an Edison battery vehicle, and they were only given a guarantee of four years on 40,000 miles, with 90 per cent. for the next year, and 80 per cent. on the remaining year, so that he thought the estimate here should have a five years' life instead of ten. But, notwithstanding this, the cost of electric vehicles in Glasgow for collection and haulage was 3s. 10d. per ton, and for horses 4s. 2d. per ton.

Ald. C. C. ELLIOTT (Newcastle) said that he had had 25 years' experience of haulage with steam and petrol wagons. There was nothing to challenge the electric vehicle for intermittent work and varied loads, and the house-to-house deliveries to a distance of three miles. Take an electric car to carry two miles, however, and they would find that a petrol car worked out cheaper than the electric. They were also doing short work, and loading about a mile and a half, and the cost of the horse cart compared with the petrol, or the electric, or the steam vehicle, was higher. But he did not think that they could lay down a general law. For long distances over six miles they could not beat the steam wagon for loads of five tons and upwards. The horse would always have its place in the very short distances.

Mr. R. DIGGLE (Accrington) said that in Accrington they had had one of these vehicles for about two months, and the distance they had to carry their stuff was within a radius of two miles. He could assure the conference that the electric vehicle had come to stay, and that if they could get another they would have one next week. The vehicle was bringing in about 20 loads a day. It had had the advantage of being in competition with the horse, and the horse had been doing more work because of the competition. They had reduced the cost per ton by 1s. Besides that, they had a system of bonuses; the men had been earning more money, and were quite satisfied. In the short distances the electric vehicle would compete very favourably with the horse.

Mr. T. STAKE (Stoke-on-Trent) had seen a three-tonner and a two-tonner on the previous afternoon, and was very pleased with the ease with which the thing was manipulated; but he thought that the body was built far too heavy to carry two tons of house refuse. These bodies would be quite capable of carrying anything from five to seven tons of any kind of material.

Mr. H. HOPKINSON (Portsmouth) said he had not the slightest doubt about the accuracy of Mr. Priestley's figures. He foresaw a big extension of this business, and although he was a horsey man, and had many horsey men on the committee, they had changed their policy. They had got almost *carte blanche* now. His committee was perfectly satisfied that they had beaten the horse off the face of the earth as regarded the collection of refuse.

Mr. PRIESTLEY, in reply, said with regard to the cost of bringing in a motor when it broke down with a load, he had had a good deal of experience, and he considered that it formed an infinitesimal proportion of the cost. To know that he had got four years more guarantee on his battery than Mr. Greig had been able to get for his delighted him. One or two references had been made to the question of the three-mile limit. Referring to the conditions which obtained in Sheffield in the collection of bin refuse, their experience was that they loaded and got away rapidly—where the refuse was already out in the street—and the figures for loading showed that the electric could beat the horse at any distance. No time was lost in charging. The vehicles were charged in the depot at night between the day and the night service, and when they came in for meal times, either during the night or during the day, if necessary. He did not agree that the weight of the body was in excess of what was required. The tire wear depended on the conditions of the district. Their tire wear was very much in excess of the tire wear in Nottingham. Mr. Terry had had his vehicles at work since October, 1915, and had only recently renewed. In Sheffield they had renewed more than once, but they had an arrangement with the tire manufacturers to work them on bare maintenance cost, and the prices that were given per mile were what they were paying for the maintenance of their tires.

artistic design of wall plug and socket suitable for use in private houses. With the introduction of portable electrical apparatus into factories this problem has assumed difficult proportions, and with the publication of the Home Office Regulations governing the use of electricity in factories, the problem has been still further complicated.

To comply fully with the requirements of the Home Office Regulations, and also with the requirements of factory engineers, it has been necessary to design a wall socket and plug which, while being of thoroughly sound mechanical construction, provides that:—

(a) The wall socket must be combined with a multipolar switch, by means of which the tubular contacts in the socket may be rendered "dead."

(b) The plug must be so interlocked with the switch and socket that it is impossible to insert the plug while the switch is "on" and the tubular contacts "live," and it must also be impossible to withdraw the plug unless the tubular contacts are "dead."

(c) The multipolar switch must break contact on each pole.

(d) The apparatus must be efficiently earthed, and it must be impossible to break the earth unless all the contacts are rendered "dead."

(e) The plug having been withdrawn, it must be impossible for anyone to turn the switch on and thus make the tubular contacts in the socket "live."

(f) The apparatus must be so constructed that when necessary it can be rendered absolutely water-tight, and it should also be so constructed that when necessary it can be rendered flame-proof for use in mines.

MESSRS. DONOVAN & CO., 17, Cornwall Street, Birmingham, have recently designed and patented a unique type of wall socket and plug, which, while possessing great mechanical strength, fulfils all the above requirements.

The socket and switch are enclosed in a cast-iron case, which can be rendered water-tight and flame-proof. The switch is of the multipolar type acting on each plug contact, and is so arranged that when the plug is withdrawn the contacts are "dead," and cannot become "live" unless the plug is inserted.

The mere act of inserting the plug does not operate the switch, as has been the case in all previous designs. In the design under

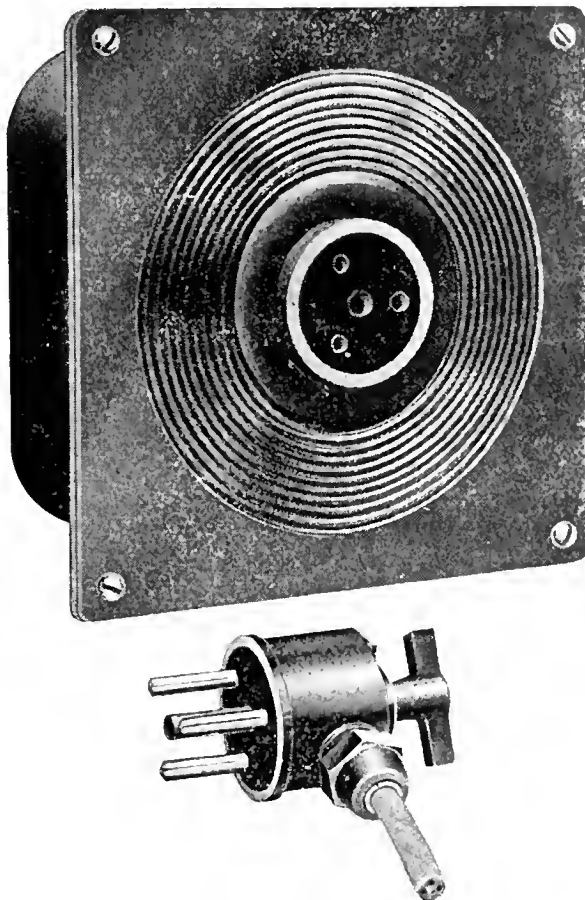


FIG. 1.—DONOVAN WALL SOCKET AND PLUG.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Donovan's Patent Combined Switch, Wall Socket, and Plug.

The problem of connecting portable apparatus to a permanent source of supply has occupied the thoughts of electrical manufacturers for a number of years, but their principal efforts have been directed towards the production of a convenient, small, and

notice the plug is provided with a key, which operates the switch by turning to the right or left, and the plug is so arranged that it cannot possibly be withdrawn unless the switch is in the "off" position, and, further, if the switch and socket were removed from the case, and the switch were put on before being returned to the case, it would be impossible to insert the plug.

The switch is of the quick-break rotary type, with absolutely free handle arranged so that the switch cannot be held in semi or partial contact. Both the socket and plug are each made of a solid block of ebonite, thoroughly shrouded in a massive metal case. It is claimed that the whole of the apparatus is, in addition to being a perfect electrical device, a thoroughly sound mechanical article, which immediately appeals to the trained engineer.

This type of apparatus is specially suited for use in factories, shipyards, ironworks, motor garages, coal mines, and on steamships, and no doubt it will also be largely used in theatres in connection with stage lighting and heating.

A Handy Motor Ladder.

We are indebted to Mr. L. L. Horrell, assistant electrical engineer to the municipality of Pretoria, for the photograph here reproduced, showing a "motor ladder" outfit which the electricity department is using. Pretoria is one mile wide and seven miles long, and has 4,600 consumers, all of whom, with the exception of a few in the centre of the town, are fed off overhead bare-copper mains run on 36-ft. steel poles. S. V. MOSELEY.

This motor ladder is used for getting to the consumers quickly for disconnecting, connecting, and attending to "All lights out." Since the outfit was put in commission, seven months ago, it has

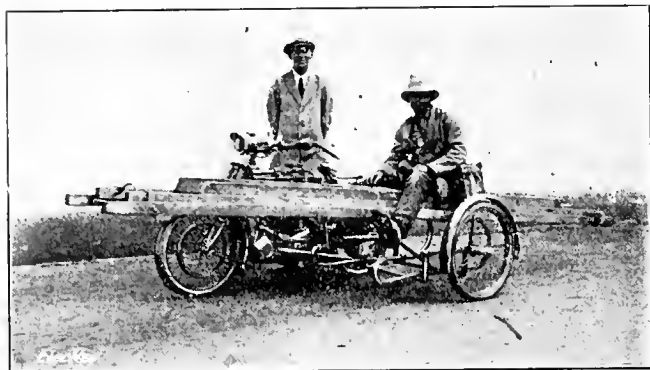


FIG. 2.—MOTOR-CYCLE LADDER.

averaged 1,000 miles per month, and has saved the department in wages alone over £70, besides giving a better service.

As will be seen, the chassis is attached to a 6-H.P. Royal Enfield motor-cycle. The weight of the load on the chassis is 260 lb. The bicycle takes the hills without the least difficulty, and runs well. The department has had no expenses besides ordinary running costs: the whole outfit cost £120, and will therefore pay for itself in the first year.

A Telephone Battery Economiser.

With telephones of the newest and most economical type, with respect to battery consumption, the loss from 20 listening telephones is not less than 84 watts, and as this energy comes from dry batteries, the loss is equivalent to burning about thirty 25-watt Mazda lamps on 10-cent current, not counting the cost of installing the batteries in the telephones.

It is not uncommon to find telephones fitted with older transmitters where the cost of the current waste, because of one receiver off the hook, exceeds that of burning three 25-watt lamps at 10 cents per kilowatt-hour.

THE KELLOGG SWITCHBOARD & SUPPLY CO., of Chicago, is advising telephone companies that it has a remedy in a battery saver that is new and certain in service, is purely mechanical, can be installed by anyone on any Kellogg telephone, and is the final solution of battery waste. Furthermore, the cost of installing the battery savers is nominal. The battery saver consists of one piece and one attaching screw.—*Telephone Engineer.*

The R.B. "Adamant" Electric Pipe-Lighter.

This device, which has been put on the market by MESSRS. ROSE BROS., of 25-27, Milton Street, E.C., is the outcome of efforts to produce an electric pipe-lighter that will stand up to the every-day usage of the smoke room to which these lighters are subjected. The name "Adamant" has been given to it owing to the burner (patented) with which the lighter is fitted. This burner looks like a disk of stone, which is set in the end of a metal tube. The burner becomes red-hot in about four seconds after switching on the current, the consumption being 1.2 amperes. The burner will not burn out whilst one watches it—on the contrary, it will run for hours: hence continual replacements are not necessary. It will work on either direct or alternating current, the standard voltages ranging from 100 to 250 volts. It is small and compact, having an outside diameter of only half an inch, enabling it to reach down readily to the bottom of a pipe. The lighting of a cigar or cigarette offers no difficulty. The lighter also has the further advantage of not presenting a great volume of heat near the face of the user.

The "Adamant" pipe-lighters are made in two classes, the wall set and table set, and are connected by flexible cord to a plug for a wall socket or an adapter for a lamp.

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

- 10,242. "Rotary electric switches." A. A. BECK. July 16th.
- 10,243. "Electric heaters." A. A. BECK. July 16th.
- 10,246. "Sound filters, telephone receivers, gramophones, &c." C. TEASDALE, BUCKELL. July 16th.
- 10,269. "Electric circuit breaker or interrupter." H. SOUTHON. July 16th.
- 10,279. "Electrical apparatus for detecting and indicating position of submarines." M. B. PARKER & S. H. PARKER. July 16th.
- 10,317. "Illuminating devices containing electric incandescent lamps." BRITISH THOMPSON-HOUSTON CO. (General Electric Co., U.S.A.). July 17th.
- 10,321. "Signalling by means of vibrating matter." W. WILCOX. July 17th.
- 10,325. "X-ray localisation." SIR J. M. DAVIDSON. July 17th.
- 10,332. "Electric recording apparatus for controlling boats." R. SPIRA. July 17th.
- 10,335. "Electric hot-plates for use on ships." F. P. FLETCHER. July 17th.
- 10,354. "Portable dry-battery electric torches." M. H. GLADSTONE. July 18th.
- 10,357. "Winding of armatures for electric generators, motors, &c." P. C. JONES. July 18th.
- 10,363. "Ignition plugs and manufacture of same." W. A. CLARK, H. G. LONGFORD, W. W. LONGFORD & SPINX MANUFACTURING CO. July 18th.
- 10,365. "Electrical heating elements for cooking, &c., apparatus." A. F. BARRY. July 18th.
- 10,372. "Thermo-ammeters." WESTON ELECTRICAL INSTRUMENT CO. July 18th. (U.S.A., July 27th, 1916.)
- 10,379. "Extracting zinc by the electrothermal process." E. S. BERGLUND. July 18th. (Sweden, September 5th, 1916.)
- 10,389. "Method of preventing tramcar trolley leaving overhead wires." A. RICHMOND. July 19th.
- 10,403. "Accumulators for miners' portable electric lamps, &c." C. H. JOHNSON & SONS AND S. SALT. July 19th.
- 10,410. "Pocket lamp or torch." C. WEST. July 19th.
- 10,423. "Cord grips for electrical conductors." C. G. M. BENNETT. July 19th.
- 10,443. "Device for guiding trolley pulley of electric car into contact with overhead wire." E. B. MOYSE. July 20th.
- 10,448. "Electric radiators." SIMPLEX CONDUITS, LTD., & L. M. WATERHOUSE. July 20th.
- 10,472. "Magnets." L. SATCHWELL AND A. WEST & CO. July 20th.
- 10,511. "Electric induction furnaces for heating and melting electrical conducting materials." J. K. EXTER. July 21st.
- 10,525. "Radio-controlled torpedoes." A. E. ERICSON. July 21st.

PUBLISHED SPECIFICATIONS.

1914.

- 14,441. TELEPHONIC RECEIVER AND TRANSMITTER BOXES WITH PHONOGRAPHIC STYLES. Seclau & Newman. September 1st, 1913.

1916.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

- 6,079. ELECTRIC SWITCHES. P. L. DAVIES & J. H. WOOLLSROFT. April 28th, 1916. (107,397.)
- 7,392. ELECTRIC IGNITION OR SPARKING ARRANGEMENTS. Siemens Bros. and Co., W. A. BRISTOW & H. W. F. IRELAND. May 24th, 1916. (107,399.)
- 8,907. MOTOR HORNS. A. F. I. FORBES. June 24th, 1916. (107,408.)
- 9,165. MEANS FOR CONTROLLING SPEED OF AN ELECTRIC MOTOR. Marconi's Wireless Telegraph Co. & G. M. WRIGHT. June 29th, 1916. (107,425.)
- 9,183. PRODUCTION OF CYANOGEN COMPOUNDS. A. R. LINDBLAD. June 29th, 1916. (107,426.)
- 10,096. SPARK GAPS FOR USE IN WIRELESS TELEGRAPHY. E. GIRARDEAU AND J. BETHENOD. July 21st, 1915. (100,957.)
- 10,174. DYNAMO-ELECTRIC MACHINES. British Thomson-Houston Co. (General Electric Co., U.S.A.). July 19th, 1916. (107,439.)
- 11,623. ELECTRIC FURNACES. D. F. CAMPBELL AND SOC. Electro-Metallurgique Française. August 16th, 1916. (107,465.)
- 11,684. SUBMARINE ELECTRIC LEAKAGE TELEGRAPHY. Signal Ges. March 16th, 1915. (Addition to 13,919/13.) (101,223.)
- 12,016. ELECTROMAGNET SWITCHES. British Thomson-Houston Co. (General Electric Co., U.S.A.). August 24th, 1916. (107,472.)
- 12,352. AUTOMATIC TRAIN-CONTROL SYSTEMS. W. V. TURNER. April 1st, 1916. (105,324.)
- 13,487. GALVANIC BATTERIES. J. E. PRESTON. September 22nd, 1916. (107,485.)
- 13,545. INTERLOCKING MECHANISM OF RAILWAY SIGNALS AND AUTOMATIC INDICATORS WORKING IN CONJUNCTION THEREWITH. J. T. ROBERTS. September 25th, 1916. (107,489.)
- 13,767. ELECTRIC SWITCHES. V. HOPE. September 28th, 1916. (107,493.)
- 14,293. MEANS FOR SUPPORTING LENGTHS OF WIRE, PARTICULARLY APPLICABLE TO LINE INSULATORS. Bullers, Ltd., & G. V. TWISS. October 7th, 1916. (107,497.)
- 15,597. COMMUTATORS FOR DYNAMO-ELECTRIC MACHINES. V. M. ALLEN. November 1st, 1916. (107,512.)
- 15,829. ANCHORAGE FOR TRAMWAY RAILS. J. GORDAN. November 6th, 1916. (107,517.)
- 16,192. SPARK GAPS. L. A. KUNTZMAN. November 17th, 1916. (107,520.)
- 17,061. RESIDUAL PIVOTAL CONNECTION BETWEEN AN ALTERNATING-CURRENT ELECTROMAGNET AND ITS ARMATURE. ART. GES. BROWN, BOVERI ET CIE. January 1st, 1916. (103,641.)

1917.

- 930. AUXILIARY APPARATUS FOR TELEPHONES. F. C. C. V. NAST & N. A. J. LILLENDALH-PETERSEN. January 20th, 1916. (103,190.)
- 2,161. INSULATION OF ELECTRICAL MACHINERY AND OTHER APPARATUS. C. H. KLYNE & C. J. BAKER. February 13th, 1917. (Addition to 7,186/16.) (107,544.)
- 3,657. ELECTRIC MOTOR CONTROL SYSTEMS. British Westinghouse Electric and Manufacturing Co. March 13th, 1916. (105,329.)
- 3,568. TRANSFORMATION OF SINGLE-PHASE ALTERNATING ELECTRIC CURRENTS INTO POLYPHASE CURRENTS. British Westinghouse Electric & Manufacturing Co. March 13th, 1916. (105,330.)
- 4,017. OZONE GENERATORS. DODGE, LTD., & E. L. JOSEPH. March 20th, 1917. (107,556.)
- 6,945. HEATING APPARATUS. N. E. BROOKES (GEO. ALLEN & CO.). May 30th, 1916. (Divided application on 7,645/16.) (107,571.)

The Channel Tunnel.—Mr. Arthur Fell, M.P., Chairman of the House of Commons Channel Tunnel Committee, has addressed a letter to the Prime Minister enclosing a request signed by over 110 members of all parties in the House of Commons, asking him to afford an opportunity for ascertaining the opinion of the House upon a motion standing in his name with regard to the Channel Tunnel.

THE ELECTRICAL REVIEW.

VOL. LXXXI.

AUGUST 10, 1917.

No. 2,072.

ELECTRICAL REVIEW.

Vol. LXXXI.]

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THE ENGINEER AND THE NATION.

FOLLOWING closely upon the call of the President of the American I.E.E. to the engineer to take his rightful place in national affairs, upon which we commented last week, we find in *Industrial Management* a spirited appeal by Mr. C. E. Knoeppel to every industrial engineer to do his part in the national crisis. The author recognises the immense importance of the rôle that the United States is called upon to fill in the winning of the war; he quotes Mr. H. E. Coffin, of the Council of National Defence, as saying:

"Who is there better fitted by technical training and by life experience for leading the way to this new era of Universal National Service than American engineers? Will vision come to them? Will they translate vision into action—and will they *do it now?*" and after referring to the nation's debt of gratitude to those engineers who have so far given freely of their time, he says:—"The time has now arrived, however, for the Industrial Engineers of the country to step forward, and, in this crisis, as well as during the *post-bellum* period, take their appointed place in the direction of large affairs both governmental and industrial."

Last week we drew attention to the formation of the Engineering Council, which is intended to enable all American engineers to co-operate with the greatest efficiency; Mr. Knoeppel points out that on May 26th the Society of Industrial Engineers was organised, as the outcome of a national conference held to consider the question of industrial preparedness, and he claims that the steps then taken will not only make history, but will put the United States in a better position to wage a decisive and victorious war. The new Society was organised to serve a two-fold purpose: (1) To provide a vehicle whereby the best minds can be enlisted to aid the Government in its present hour of need; (2) generally to promote efficiency and industrial management.

The programme of work which the author subsequently outlines is practically identical with that which has been imposed upon this country, and he remarks, in accord with the Executive Committee of the U.S. National Chamber of Commerce, that these things will have to be done quickly. If any one of various possible eventualities should compel the European Allies to abandon the struggle, the United States would have to bear the brunt of the fighting on her own shores, single-handed, and she "would have to win, or the world would be a worse place to live in than Hell itself." Speedy action is therefore imperatively necessary. But, says the author, "the opportunity before the industrial engineer is not narrowed to the industrial field by any means. *He is needed in the conduct of governmental affairs.*"

We need not follow the details of the new organisation; our aim is to focus attention upon the vast movements in progress in the United States, the complete change of attitude towards the rest of the world, the adoption of new ideas and motives of action, as typified in these great movements in engineering circles, and to suggest again that there is a lesson to be learnt by us from them. British engineers have rendered priceless services to their

country and the world in this great crisis; but have they done all that they could have done if they had been better organised? Assuredly not. The difficulties which have been experienced by individual engineers and scientists of the highest standing in securing opportunities to utilise their knowledge for the benefit of the nation are notorious, and even now our engineering resources are not fully developed. Efficiency should be our watchword, co-ordination and concentration of effort our method of attaining it; we need a national engineering organisation which shall not only assist the Government in every possible way during the war, but which also shall promote industrial efficiency after the war. It rests with our leaders to lead.

Reasonable Recruiting. WE have heard many complaints from men in the engineering profession as to the methods in which they have been posted haphazard to any unit, irrespective of their qualifications. We have always believed in the policy of the right man in the right place, and we can only see a loss of efficiency in the Army if men of technical or administrative qualifications are posted without regard to those qualifications. There should be room for technical men in technical posts, and men who have done administrative work are surely men who are fitted to be officers. A friend of ours, an M.I.E.E., &c., &c., spent many months, as he termed it, "muck-shifting," and only his own perseverance brought his technical training to light—or, rather, recognition—and raised him to the rank of Captain in the R.E. That is one case of many where talent has been wasted. There seems to be an impression that the ordinary Officers' Training Corps—such as the Inns of Court and the Artists' Rifles O.T.C.—are no longer open to recruits. This is not so; we have heard of several of our friends who have joined these Corps recently, and they tell us recruiting is going on at the rate of several hundred a month. These are the Corps which those should join who have during the past three years been holding the responsible posts in manufacturing munitions, but who are now able to get released by their various employers. Had they been able to leave two years ago, they might now have been holding commissioned rank, and doing sterling work, instead of being liable to find themselves drafted off to positions where their talents are wasted, though they are eminently fit for commissioned rank.

Reconstruction. In our opinion, the appointment of Dr. Addison as Minister of Reconstruction is one of the most important steps that the Government has taken to prepare for the after-war situation. During the past year or two there has been no end of inquiry and investigation work done by committees and departments, and the material collected must reach considerable proportions in the mass. Some of it, no doubt, has been well sorted out and sifted already, but it is quite the right thing to appoint a whole-time Minister to guide the Cabinet and the nation concerning the measures which may reasonably be required to emerge. Dr. Addison has been so closely in touch with industrial matters during his period at the Ministry of Munitions that his appointment as Minister of Reconstruction may be regarded as a satisfactory one. He knows as well as anybody how great has been the disorganisation of industry during war-time, and he may be credited therefore with a correct appreciation of the great problems that will arise as demobilisation of industrial workers under coming conditions takes place. His address at a conference with leading representatives of the chemical industries of the country last week shows that he appreciates fully the immediate

need of essential raw materials when Peace comes (he indicated a possible shortage even before that event), and the necessity for our increasing the product of all our industrial plants. He is not blind to what the enemy is doing by way of preparation, and he recognises that unless we take time by the forelock we may find ourselves short of essential materials. He asked for the co-operation of the chemical industries, so far as they are concerned in the matter, in taking the necessary steps in time. He proposes to get to work to examine the problems of reconstruction fairly and squarely, utilising the information already gathered together by committees, in order that steps may be taken to mitigate the evils of the reconstructing period by putting some British industries on a much firmer and more scientific foundation. Manufacturing methods must be brought up to the highest pitch of perfection, and better understandings with Labour will make possible the introduction of the improved methods needed to secure that end. We do not think that Dr. Addison will find industry slow to co-operate with him in the great task that he has undertaken.

War Effects on South African Trade. THE report recently issued by the Board of Trade from the pen of H.M. Trade Commissioner in South Africa (Mr. W. G. Wickham), although described as dealing with trade in that territory for the years 1915 and 1916, contains much of interest and value relative to present conditions and future prospects. The portions of chief interest to the electrical and allied trades are summarised in another column. Mr. Wickham rightly points out that it is an open question at least whether annual reports which are merely chronicles of past facts are of value, except in so far as inferences can be drawn and advice extracted for the guidance and increase of future trade. In Mr. Wickham's report, however, it is possible to do a great deal in this direction.

In interpreting the statistics of South African shipments, it must be kept in mind that the high prices offered for commodities, particularly from the United Kingdom, have given an inflated appearance to exports in relation to values of previous years, and they may have provided inducement to export in lines where there was no surplus, and even lines in which there had been little or no production before the war. And as regards imports to South Africa, Mr. Wickham considers that while the high prices ruling have given an appearance of normal or even abnormally large importations, in reality many factors have been at work to cause the market to absorb considerably less in quantity than usual—namely, difficulties in getting freight space, abnormally high freight rates in addition to high prime cost, prohibition of exports from other parts of the Empire, and dear and scarce money, resulting in postponement of public works and private enterprise. On the other hand, of course, the war has created an artificial demand for certain kinds of supplies for public purposes, to the obtaining of which, as necessities for war, there was no official obstacle.

In Mr. Wickham's view, it will be some time before Japan is looked to as a supplier of iron and steel and machinery, but he expects to find that enormous strides have been made during the war as the result of supplying a large proportion of Russia's war needs. This view is, of course, supported direct from Japan itself, although, as yet, it is only in the lighter descriptions of electrical goods that its competition on the world's markets has made itself at all keenly felt. As regards Japanese trade in South Africa, the machinery for development was already established in the form of agencies and branches of merchant houses from Japan. The diversion of Japanese liners from the Suez

Canal route to the Cape provided direct steamer communication.

On the subject of competition and future trade generally, the note that the Trade Commissioner strikes is one that has been frequently sounded in these pages, viz., that even if producers are so busy on work of greater and more immediate national importance that they cannot make goods, or even show samples and catalogues for overseas trade, it is nevertheless imperative that they keep their goodwill alive and have their export organisation ready primed for quick and active operation directly Peace is declared.

The I.M.E.A. and Electricity Supply.

ONE or two items in the proceedings of the recent annual meeting of the Municipal Electrical Association served to focus the attention of interested circles on the attitude of the ruling members of this guild in regard to the great question of electricity supply reorganisation on a national basis. We referred to this matter at the time, when it was urged that the Council of the I.M.E.A. should come out into the open and place its views on the future of electricity supply and the rôle of the municipal authority in connection therewith before its members—a resolution to that effect being adopted.

We do not know that there was any suggestion that the Council had not made up its mind on the subject, but those who are well able to judge have felt that the important interests represented by municipal supply authorities were likely to suffer if some definite pronouncement as to the views and policy of the Association was not very quickly made.

In this connection, the circular letter which has just been issued by Mr. H. Faraday Proctor, the hon. secretary of the Association, and which appears elsewhere in this issue, is no doubt intended to clear the atmosphere. It contains a synopsis of the views of the Council, expressed in general terms, which include the appointment of a Central Board of Control, subject to Parliament alone, composed of whole-time officers, to exercise the present functions of the Board of Trade, Local Government Board, Home Office, and other departments which at present have a finger in the electricity pie; also the supply of electricity from large power stations controlled and operated by District Boards consisting of representatives appointed by the present statutory undertakings, both local authorities and companies, the distribution remaining with the present undertakers. For the rest, the report of the Lancashire and Cheshire Linking-up Committee, which we note "will be published within a few days," may be expected to shed some light on the working details of the scheme as applied to one of the most important industrial areas of the country.

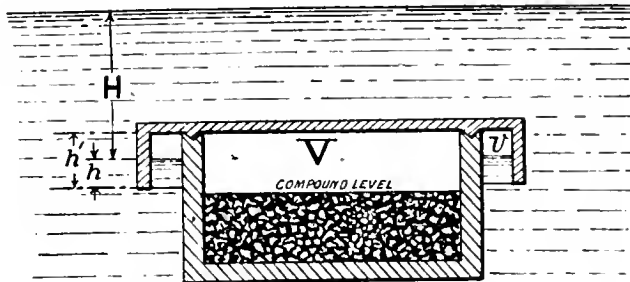
Meanwhile, we share with the Council its regret that full information cannot be imparted at the present time owing to the withholding by the Government of the report of Sir Charles Parsons's (Electrical Trades) Committee and the interim report of the Coal Conservation Sub-Committee; why the former is wrapped in mystery we do not know, but the latter, at any rate, has passed beyond any particular claim to secrecy. We welcome the plain statement of its views by the I.M.E.A. Council, and the prospect of studying the suggested application of the principles outlined by it to the Lancashire and Cheshire area. It is not so much in the general features of reorganisation on broad lines that divergencies of opinion occur as in the details, and the carefully prepared scheme of the Lancashire and Cheshire engineers—both municipal and company—should carry far more weight in responsible circles than a settlement arrived at by a Government Committee which is shrouded in secrecy.

SOME NOTES ON DIVING-BELL COVERS FOR DISCONNECTING BOXES.

By G. W. STUBBINGS.

THE diving-bell cover for disconnecting boxes is a most useful device, combining, as it does, a high degree of safety with the maximum of convenience for disconnecting. The time spent in removing nuts from a cover of the bolted-down type is considerable, and, in times of trouble, the advantage in this respect of a diving-bell lid, which has simply to be lifted off, and, after disconnecting, as simply put back, is incalculable. A properly designed diving-bell cover should, moreover, be quite watertight, and thereby escape the uncertainty that always attaches to bolted-down joints for box covers. Cases have from time to time been met with of the failure of diving-bell covers owing to the seal being insufficiently deep, and it will, therefore, be useful to investigate the criteria to which the dimensions of such covers must conform to be successful in given conditions.

For purposes of calculation, a box of simple shape, such as that shown in the diagram, may be taken. If u be the difference in level of the water in the pit and in the sealing



SECTION OF BOX WITH DIVING-BELL COVER.

space of the cover, h the height to which the water has risen in the bell, h^1 the depth of the sealing space, A the atmospheric pressure expressed as a head of water, and the joint be watertight—

$$h/h^1 = A/(A + H),$$

and, whatever the pressure of the submerging water might be, the water in the bell would never reach the joint. The joint, however, is not watertight, and will not be able permanently to sustain a difference of pressure between the interior of the box and the upper part of the sealing space, and the water will accordingly rise in the bell to a considerably greater height than given by the above expression.

Calling the volume of the air space in the box v , and the volume of the annular sealing space v^1 , the new conditions can be stated—

$$A(v + v^1) = (A + H)\{v + v^1(h^1 - h)/h^1\},$$

which finally reduces to—

$$h = h^1 H (v + v^1)/(A + H) v^1.$$

There is, however, a further factor to be taken into account. The most dangerous and trying conditions to which disconnecting boxes can be subjected, are undoubtedly those of sudden storm after a spell of very hot weather. In these circumstances, a pit may be flooded with very cold water, and the temperature of the box, which may have been considerable, will be suddenly reduced. Such a reduction in temperature will cause an appreciable lowering of the air pressure inside the box, causing the water to rise higher in the bell than otherwise.

Calling the absolute temperatures of the box before and after flooding T_1 and T_2 respectively, the conditions can now be stated—

$$A(v + v^1)/T_1 = (A + H)\{v + v^1(h^1 - h)/h^1\}/T_2.$$

Putting $T_1 - T_2 = t$, this finally reduces to—

$$h = h^1 (v + v^1) (T_1 H + t A)/(A + H) T_1 v^1.$$

The writer selected at random from the catalogue of a good manufacturer of cable accessories, a line diagram of a four-way box, and scaled off the dimensions. The interior of the box is approximately 20 in. \times 14 in. \times 4 in., the

sealing space being $1\frac{1}{4}$ in. wide by 2 in. deep. Assuming h to be 12 in., T_1 20° C., and t 10° C., the above expression gives a value for h of $\frac{7}{8}$ in., a result that can be considered satisfactory.

For given conditions, v and r remaining constant, it is seen that $h = b h^1$, the distance between the level of the water in the bell and the joint is $h^1 - h$, and calling this distance h_2 ,

$$h_2 = h^1 (1 - b).$$

This margin of safety h_2 is therefore proportional to h^1 , r remaining constant. It therefore follows that it is better to have a deep and narrow seal than one shallow and broad, as inaccuracies of levelling the box will be of smaller importance. The matter of correct setting is one of considerable importance, as the sealing effect of the bell does not commence until the lower edge is completely immersed; and with a wide and shallow seal and a large box inaccurate levelling might lead to serious trouble.

Referring to equation—

$$h = h^1 (v + r) (T_1 H + t A) / (A + H) T_1 r,$$

the worst conditions to which the box will be subjected may be assumed, and the equation may be rewritten—

$$h/h^1 = c (v + r)/r,$$

enabling the relation between v and r to be calculated for a given proportional rise of water in the bell. Putting $h/h^1 = m$, this equation becomes—

$$m = c (v + r)/r,$$

and finally—

$$v/r = (m - c)/c,$$

giving the relation between v and r and m for any given conditions. For the purposes of a numerical example, the former values of H , T_1 , and t may be taken, the corresponding value of c will be 0.0633. If it be considered that under these circumstances the water should not rise more than halfway in the bell—

$$v/r = (5 - 0.0633)/0.0633 = 7 \text{ approximately,}$$

and the volume of the air space in the box should not be more than seven times the volume of the annular sealing space.

The above reasoning shows further the importance of setting the box accurately level, as inaccuracies will not only, as before pointed out, diminish h^1 , but will also diminish r , this volume, of course, being calculated as lying above a horizontal plane touching the highest point of the bottom of the bell. The writer has calculated the effect of $\frac{1}{8}$ in. out of level in setting the four-way box already referred to, and finds that this inaccuracy will diminish the safety margin from $1\frac{1}{8}$ in., as before calculated, to $\frac{7}{8}$ in.

JAPAN'S PROGRESS IN THE ELECTRICAL INDUSTRY.

BY MALCOLM CHALMERS.

Prior to the war Japan used to import considerable quantities of electrical machinery, apparatus, and materials, the total value of which in 1913 amounted to about £790,000. The war has, however, given Japan her opportunity, which she has not failed to put to account. She has turned her attention to the manufacture of this class of goods, with the result that her imports in 1916 were no greater than £320,000, a decline of 60 per cent. Even this does not represent the full facts, for in 1916 there was a special import of submarine cables valued at £132,000, as compared with £5,000 only in 1913. Leaving this out of account, we find that the imports of other electrical goods were valued at £188,000 in 1916, as compared with £785,000 in 1913, a decrease of 76 per cent. This year the decline has been maintained, the imports for the four months ended April being valued at only about £72,000 in all. The following statement gives the details for the various classes of goods in 1916 as compared with 1913:—

	1913.	1916.
Materials for suspending electric lines	£4,000	—
Submarine cables	5,000	£132,000
Insulated wire, other than cables	206,000	2,000
Meters:—		
Amperemeters and voltmeters	21,000	7,000
Wattmeters	27,000	13,000
Other kinds	16,000	9,000
Accumulators	25,000	1,000
Telegraph and telephone instruments	8,000	6,000
Dynamos, electromotors, transformers, converters, and armatures	374,000	40,000
Dynamos with motive machinery	65,000	45,000
Filaments for incandescent lamps	8,000	63,000
Incandescent lamps	30,000	2,000

Turning now to the export trade, we find that in 1913 Japan exported electrical goods to the value of less than £80,000, whilst last year her exports in this line were valued at no less than £421,000, or over five times as much. In the first four months of this year, moreover, the increase was more than maintained, the exports for that period being valued at £260,000, or at the rate of over three-quarters of a million sterling per year. The details of the exports so far as available in 1913 and 1916 are as follows:—

	1913.	1916.
Insulated wire...	£26,000	£115,000
Electrical machinery	48,000	147,000
Telephones	5,000	92,000
Incandescent lamps	—	67,000

Perhaps the most noteworthy feature shown by the above figures is that relating to incandescent lamps. In 1913, Japan imported £30,000 worth of these lamps and exported none, whilst in 1916 her imports were practically nil and her exports were valued at £67,000. In the four months January-April, 1917, the exports of electric lamps were greater than during the whole of last year, being valued at £84,000, or at the rate of £250,000 per annum.

It will be interesting to see, when peace is concluded and the manufacturing nations now at war are able to compete once more, whether Japan will be able to hold the position she is fast building up for herself in the manufacture of electric lamps. Everything points to the fact that she will, for some excellent modern factories have been erected, and with an abundance of cheap labour and of cheap power derived from the numerous waterfalls of the country, she should be well able to hold her own in the matter of price. Possibly the principal deciding factor will be the question of filament. As will be seen from the fact that £63,000 worth of filament was imported in 1916, Japan has hitherto been dependent on outside supplies for this material. Efforts are being made, however, by Japanese manufacturers to make the country independent of foreign supplies in this respect, and it would appear that they are succeeding in their efforts, for during the first four months of the present year, when more lamps were exported than during the whole of 1916, the imports of filaments were only valued at £17,000.

COAL CONCRETED FROM DUSTS OR ASHES.

IN a second paper read before the Society of Architects on this subject (see ELECTRICAL REVIEW, June 29th), Mr. R. Goulburn Lovell said that the process of manufacture would be demonstrated, and that the analyses of the component parts and the resultant fuel would be shown.

There were three methods of making the fuel, which might be called A, B, and C. A and B might be termed dry processes. In this case they took as aggregates ashes and coal dust. After sifting the fine dust, which was of little or no value, the coarse aggregate was composed of all between $\frac{1}{4}$ and $\frac{1}{8}$ in. mesh. This was dried, sprinkled with a special sugar-waste solution, and again dried. The fine aggregate was taken from the coal-cellar dust, only that which passed $\frac{1}{8}$ -in. mesh being used. These two bases should be intimately mixed with the matrix or binder.

Up to this point A process and B process were exactly the same. Process A was employed wherever the sun had much value, or where the heating chambers were available. The mixed aggregates and binder had in some cases a small quantity of creosote oil added, it was then placed in moulds and allowed to concrete, the time varying with the amount of heat available. The fuel, when cold, was emptied out of the moulds, broken up, and hardened by exposure to the atmosphere.

With process B, the small quantity of creosote oil, if used, was placed in a boiler or an iron saucepan, the mixture of bases and matrix was added, and placed upon a fire and stirred until a temperature of about 120° F. was obtained, when the whole was emptied into any mould, such as an old pail. In a short time it was cold, and was broken up and allowed to harden.

Process C was a wet process, in which there was no need to dry the aggregates. They were mixed as before, but with a different matrix mixture; the creosote oil, if used, was added and well mixed, the whole was then moistened with the solution until a consistency of mortar or concrete was obtained. It was then emptied into shallow moulds, or between sheathing boards, and dried by exposure, but with protection from the wet.

In all three processes the character of the matrices varied with the character of the aggregates, and the different aggregates had to be treated by different methods. It was usually found that in most cases the smoke of the resultant fuel could be diminished by an increase of the remaining ashes; in the case of furnace fuels the clinkering could by this means be diminished. This method of concreting fuel dispensed with any kind of pressure beyond a slight tamping into the moulds. For low-grade coals, coals, or bar ashes process A was the best method.

Process B was suited for any form of rotary asphalt plant, either fixed or movable. For all materials high in carbon but low in volatile matter, process B was the best method.

Process C was the cottager's process of producing coal in his own back yard. It would be better for a community to send its ashes and dust to a central depot, and there have it done under proper supervision, but there was nothing to prevent an isolated individual or firm from utilising their waste materials by this process. For high-grade coals, high-grade bituminous coals, or a mixture of the latter with ashes, peat, sawdust, &c., process C was the best method.

The analyses of seven different types of fuel made under the three processes, together with the calorific values of their component parts, were given showing for coal dust fuel from 10,000 to 12,570 B.T.H.U., and for ashes and coal dust, &c., from 5,000 to 9,000 B.T.H.U.

The percentage of raw material in the resultant fuel was from 91 to 99.58 per cent.

Samples of the resultant fuel were shown in each case; they would light from the sticks, incandescence, and flare.

There were many collieries where fine coals were produced in abnormal quantities, due to unusual friability; as, for instance, the Kent coal. It was there demonstrated that by their process fuel could be economically made equal in value to the large coal worked in the same seams.

The briquetting method of utilising coal slack required costly machinery and plant, and the slack had to be transported to the briquetting factories. The concreting process, on the contrary, enabled the simple machinery and plant to be taken to the dumps of slack, thus saving handling and transportation. The concreted fuel was manufactured *in situ*. Further, it was submitted that a better fuel was produced.

USES OF MAGNETIC SEPARATOR PULLEYS.*

Magnetic separator pulleys have been put to work in an increasingly large number of industries during the past 10 years. They are useful wherever it is desired continuously to remove the magnetic content from non-magnetic bulk material. For example, they are used with success in removing pickheads, coupling pins, &c., from coal passing to a crusher which would be damaged by the entrance of such material. They are used for similar purposes at phosphate rock mines and quarries. In the production of sulphite fibre paper stock, they are used to remove scrap iron and steel from the wood chips before these are delivered to the sulphite tanks. They

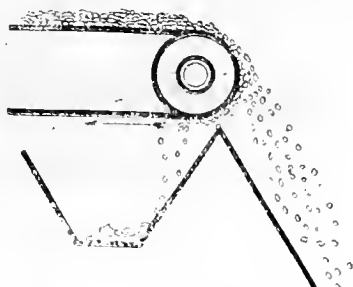


FIG. 1.—PRINCIPLE OF MAGNETIC SEPARATOR PULLEYS.

are also used in the production of cement, gypsum, limestone, clay for terra-cotta manufacture, as well as in the freeing of grain, spices and tobacco from bits of iron or steel before grinding. They also find employment in city refuse-disposal plants, for removing tin cans, horse-shoes, nails, &c., from the worthless material.

Magnetic separators are in use in a large number of sugar plants to remove iron rust or iron oxide from animal charcoal, which is collected by it while passing through the ovens and being baked. This baking process is necessary to eliminate from the

charcoal the impurities which it has absorbed from the sugar. The magnetic material is especially prevalent after the retort has been repaired. Under ordinary conditions, the magnetic pulley is energised only part of the time, two weeks out of a month or so, this being sufficient to keep the iron oxide out of the bone charcoal, so that trouble with iron colouring in the sugar is prevented.

The use of powdered or pulverised fuel has been extended, and this has led to the need of magnetic separators in cement plants, steel plants, power houses, and many other kinds of plants. Coal, as delivered to the milling plant, always contains an astonishing amount of iron in the form of bolts, nuts, rivets, nails, bar iron, railroad spikes, mule shoes, &c. Any of these materials entering the crusher or pulveriser might result in damage to the machine, with consequent delays in operation.

This foreign magnetic material can be entirely eliminated by the use of a magnetic separator located at some point ahead of the crusher. When the material passes over the separator pulley, which contains the magnet, the magnetic material is attracted and held firmly against the belt, and remains in contact with the belt until it leaves the magnetised zone, which is at some point beyond the under side of the magnetic pulley. The iron drops from the belt after it leaves the pulley, and is delivered to suitable boxes by means of a chute, the coal continuing on its course.

The pulley is magnetised by passing direct current through windings in the interior of the pulley.

In a letter to the editor, Mr. A. C. Daman states that in Colorado hundreds of tons of tungsten concentrates and middlings are annually treated over the Wetherill magnetic separator. In some cases, concentrates have been increased from 10 to 65 and 70 per cent. tungstic acid, and where pyrite is associated with ferberite, magnetic separation is indispensable.

During the last three or four months the writer has tested hundreds of tungsten ores magnetically, and success was obtained on practically all of them. It was proved that the magnetic separation was a commercial success, and in several instances the only salvation in saving the values.

ELECTRIC SMELTING OF IRON ORES.

A RECENT issue of the *Jern-Kontorets Annaler* reproduces in a slightly abridged form a Memorandum drawn up by Mr. J. A. Leffler, in which he investigates a proposal put forward in March, 1916, by the Committee appointed by the Administration of the Association of Swedish Technologists to install electric furnaces in the North of Sweden for smelting pig-iron. The Committee recommended the installation of four plants, with six furnaces in all, to produce 65,000 to 70,000 tons of pig-iron per annum, using from 110,000 to 120,000 tons of ore and about 25,000 tons of charcoal.

In his investigation the author makes, among others, the assumption that to smelt one metric ton of pig-iron from the Luleå or Gellivare ores, 1.6 ton of ore and 0.4 ton of charcoal are required, and 0.272 kw.-year of electrical energy. As explained by him in detail, such a low consumption of energy can only be attained by installing four furnaces of a total of 9,000 kw., one as a stand-by and three working continuously, as this would make it possible to utilise 92 per cent. of the purchased power, while with one furnace only the useful percentage would only be 83 per cent., which is the average result attained during the three years' working in 1913-15 at the *Jern-Kontorets* experimental plant at Trollhättan. There must be, however, a misprint in the figure given for the output of this plant for 1915: it should be 7,502 tons, instead of 7,052 tons, to make the author's calculations correct. The capital outlay at Luleå would be about £85,833 for the plant itself, and about £20,833 for dwellings for officials and workmen, while for Gellivare the corresponding figures would be £94,444 and £23,333 respectively. There would be 6 officials and 75 workmen, with their foremen, and the assumed output at each place would be 30,000 metric tons per annum. For the cost of production of one metric ton of electric pig-iron, the author submits the following estimates:—

	At Gellivare.	At Luleå.
1.6 metric ton of ore*	£0 18 3	£1 1 7
Limestone	0 0 8	0 0 5
0.4 metric ton of charcoal	1 0 10	0 18 1
0.272 kw.-year	0 14 5	1 0 1
Electrodes	0 1 10	0 1 8
Repairs and upkeep	0 3 8	0 3 4
Wages	0 6 6	0 5 5
Management and sundries	0 2 3	0 1 11
Royalty	0 1 5	0 1 5
Sinking fund	0 3 7	0 3 3
Rents	0 5 9	0 5 5
Carriage to Luleå	0 1 10	
Total cost	1 4 0	1 2 10

* 50 per cent. of ore and 50 per cent. briquettes.

The freight from Luleå to Gävle, and unloading the iron into railway trucks, would cost another 4 kr., say, 1s. 6d. per ton. It would thus be seen that the northern pigs would cost at Gävle about £4 8s. per ton, and, therefore, could not compete with the pig-iron obtainable there from the blast furnaces at 65 to 70 kr. (about 72s. to 77s. 6d.) per ton for basic, and at 70 to 75 kr. (about 75s. 6d. to 83s.) per ton for acid open-hearth pig-iron.—*Iron and Coal Trades Review*.

THE SPRING LAKE MARINE RAILWAY.

IN the *General Electric Review*, Mr. JACOB A. HARMAN, chief engineer, Elliott & Harman Engineering Co., Peoria, Ill., gives an account of the Spring Lake Marine Railway, which is a system designed to serve the same purpose as a marine lock, but to cost less, and to be maintained at a lower expenditure.

The railway, located in the Illinois River valley about 30 miles below Peoria, was built by the Spring Lake Drainage and Levee District, an authority organized under the Laws of Illinois, for the purpose of reclaiming about 14,000 acres of land that was subject to overflow by the Illinois River. The district, as organized, included a body of water known as "Spring Lake," which was shut off from communication with the Illinois River by the levee or dike constructed by the Drainage District.

It was at first contemplated that a lock should be constructed for the purpose of communication between the river and the lake, but the cost of the construction and maintenance thereof would have been burdensome, and approval was obtained for the construction of the marine railway. The electric power for operating the mechanism is supplied from the power plant of the Canton Gas & Electric Co., at Canton, Illinois. The transmission line, about 20 miles long, is a 13,000-volt line, and also supplies electric current for the Banner and the Spring Lake Drainage Districts pumping plants. The railway and the pumping plants were designed by and constructed under the supervision of the Elliott and Harman Engineering Co., consulting engineers.

In general, the marine railway consists of an incline track leading up each slope of the levee to a turn-table located on the summit of the embankment. A cradle, or boat carriage, is

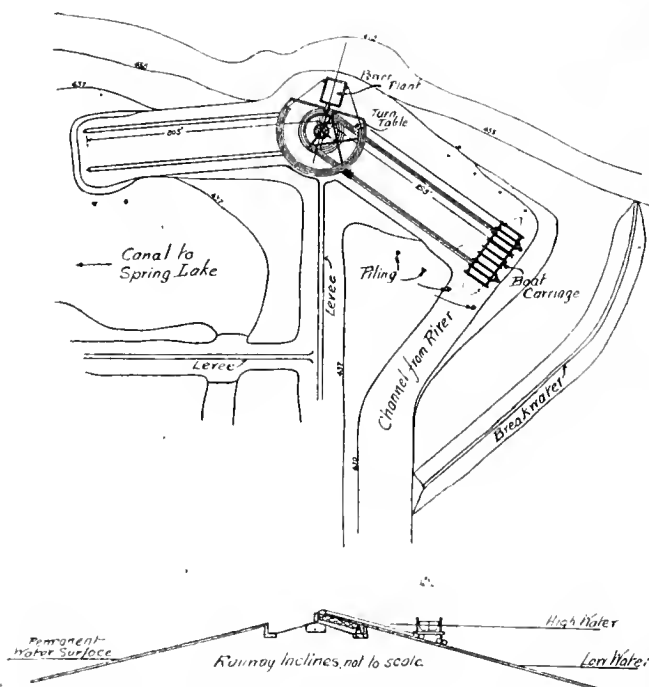


FIG. 1.—PLAN AND ELEVATION, SHOWING LAY-OUT OF MARINE RAILWAY.

mounted on wheels so that it can be lowered on these inclines into the water to receive the boats, raised to the turn-table, rotated thereon, and lowered to the water again on the opposite side of the levee, keeping the boat in its natural position throughout all these operations. An electric hoisting engine for hoisting and lowering the boat carriage, and an electric swinging engine for rotating the turn-table, are housed in a reinforced concrete building alongside the turn-table.

The marine railway mechanism is designed on the basis of handling as a maximum load a flat-bottom barge, or power boat, 24 ft. wide, 120 ft. long, and having a draught of 3 ft. 6 in.; the cradle, however, as designed is sufficiently wide to accommodate shorter boats of a maximum width of 28 ft. Smaller boats, barges, and launches can also be handled. Each incline consists of two standard gauge railroad tracks, laid parallel, and spaced 50 ft. centre to centre, the gradient of the tracks being 10 per cent. These tracks extend from the turn-table down into the water on each side of the levee to a depth sufficient to have 4 ft. of water over the floor beams of the boat carriage at the low-water stage. The rails used for all tracks are 120-lb. standard T-rail sections, and are laid on cross-ties. The circular rails on which the turn-table moves are mounted in a concrete pit, 115 ft. in diameter, upon a heavily reinforced concrete foundation of the slab type.

The cradle, or boat carriage, is a steel structure mounted

on wheels. The trusses are 80 ft. long and 10 ft. high, with a clear opening between them of 30 ft. The fixed floor beams are arranged in pairs, and between each pair is mounted a heavy movable beam which can be adjusted to fit up snugly against the bottom of the barge or boat in its natural position. These movable floor beams are hung on heavy threaded rods, which extend upward through the upper chord of the truss, at which point the rod is suspended from the top of the truss by means of a split nut with four handles resting on a short coil spring. There is also provided a winch adjustment for each of these rods for raising the beams rapidly to position, after which the split nut is closed and the beam is brought up close by the use of the nut. This boat carriage is supported on two specially constructed eight-wheel trucks of a heavy type, the mounting being arranged so that the

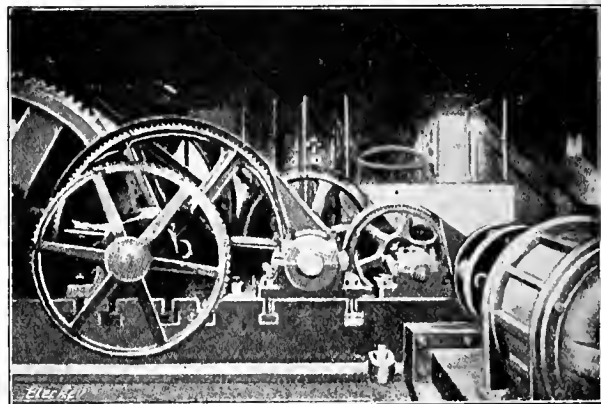


FIG. 2.—INDUCTION MOTORS DRIVING A HOIST AND A SWINGING CABLE DRUM.

floor of the boat carriage is always in a horizontal position. Each of these trucks is provided with special draw bars, to which are attached the steel haulage cables used for raising and lowering the boat carriage on the inclines. Each truck is also provided with a system of brakes which may be set by hand, and which are so constructed as to be set automatically by a coil spring whenever the tension of the haulage cables is released.

The power and hoist equipment consists of two electrically-driven hoisting drums, one for raising and lowering the boat carriage on the inclines, and the other for rotating the turn-table. The main hoist drum is driven through a train of spur gears by a 75-h.p. (intermittent rating), 600-R.P.M., 440-volt, 3-phase, 60-cycle, slip-ring type induction motor with a reversible drum type controller mounted on the operating platform. The travelling speed of the main haulage cables is approximately 16 ft. per minute. The brake drum is 10 ft.

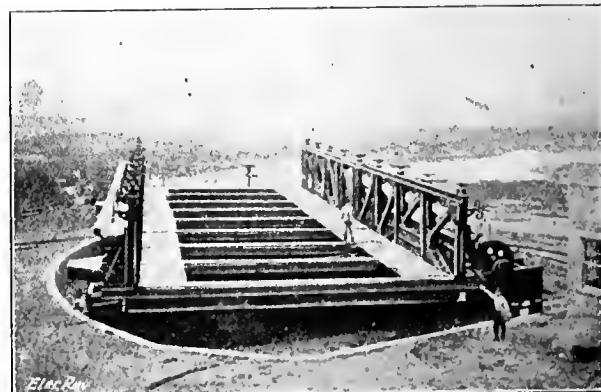


FIG. 3.—BOAT CARRIAGE ON TURN-TABLE.

in diameter, with a 14½-in. face. This brake is applied by means of a system of heavy weights and levers, and is released by raising the weights with a drum and wheel hoist mounted on the operating platform. A pawl and ratchet device on this hoist keeps the brake mechanism in the released position after the weights have been lifted by the hoist. This pawl and ratchet device may be tripped, thus applying the brake on the main drum, by four independent agencies: (1) By means of a foot trip, mounted on the operating platform; (2) by means of a ratchet device, which engages the teeth of the large gear when the cable starts to unwind, thus automatically setting the brake; (3) by a centrifugal governor, which automatically sets the brakes should

the speed of the boat carriage exceed the predetermined speed of 16 ft. per minute; and (4) by an electric solenoid device, which automatically sets the brake in case the supply of electric current should be interrupted. Device No. 2, which automatically sets the brake when the cable starts to unwind, is made inoperative when lowering the boat carriage by means of a foot pedal on the operating platform.

The turn-table swinging engine consists of a drum driven by an 18-h.p. induction motor with a reversible drum-type controller mounted on the operating platform. The brake on this engine is operated by a hand lever mounted on the operating platform, and the travelling speed of the cable, which is hitched to the outer trucks of the turn-table, is 20 ft. per minute.

There are three special indicators to aid in the operation of the apparatus.

In conclusion, the following data concerning the marine railway will be of interest:—

Maximum lift of railway, 27 ft. vertical.

Estimated maximum weight of boat carriage and boat, 800,000 lb.

Largest boat that it is calculated to carry, length 120 ft., width 24 ft., draught 3½ ft.

Distance between centres of incline tracks, 50 ft.

Slope of tracks, 1 ft. in 10.

Estimated maximum pull on haulage cables, 100,000 lb.

Speed of boat carriage, 16 ft. per minute.

THE ELECTROLYTIC TREATMENT OF ZINC ORE.*

At a recent meeting of the AMERICAN CHEMICAL SOCIETY a paper was read by Mr. E. E. WATTS on this subject. He said that the war had given a great impetus to the zinc industry, and much attention had been directed to the treatment of complex ores by hydrometallurgical and electrolytic processes.

In 1912 and 1913, at the School of Mining, Kingston, the writer experimented with zinc ore from the Sullivan Mine, of Kimberley, B.C. The ore was a dense complex sulphide.

Tests were conducted to determine if it was possible to obtain metallic zinc by the electrolysis of solutions of zinc bisulphite. The deposition of the sulphur and zinc sponge, and the evolution of hydrogen sulphide made this electrolysis impossible. Attempts to obtain metallic zinc by electrolysis of solutions of zinc sulphate to which zinc sulphite precipitate was periodically added showed that in the presence of sulphurous acid or zinc sulphite successful electrolysis was impossible.

Tests were conducted in which the zinc sulphite precipitate was first roasted to oxide before charging at the anodes in a zinc sulphate electrolyte. Successful results were obtained. The zinc deposited in a good plate, and the electrolyte was maintained by the addition of the roasted sulphite. To free the bath from particles of precipitate that might attach themselves to the deposit, to place the roasted precipitate at the point in the bath where the sulphuric acid was regenerated by the electrolysis, and to decrease, if possible, the decomposition voltage by allowing the roasted precipitate to act in part as anode, the crude zinc oxide obtained by roasting the zinc monosulphite precipitate was placed in bags at the anodes of the electrolytic cell.

From the foregoing experiments the following conclusions were deduced:—

Lead forms a satisfactory anode, and copper, zinc, and aluminium form satisfactory cathodes.

With current densities of from 2.5 amps. per square decimetre to 4.5 amps. per square decimetre, a current efficiency of approximately 100 per cent. can be maintained.

Depending upon the current density, the voltage varies from 3.5 to 6 volts.

The extraction of zinc from zinc oxide varies from 95 to 100 per cent.

The process, as outlined, was patented, and was developed for the treatment of high-grade zinc ore. The process has been referred to as the Watts Process.

The high-grade zinc product for charging to the electrolytic cells may be roasted zinc concentrate, impure or refined zinc oxide, or zinc dust. The advantages of such a treatment are:—

1. The solution is kept small in bulk and the solution and tanks serve at once for leaching the ore and for electrolysis.

2. The acid generated at the anode is immediately used up at the point at which it is generated, and at the point where it is most concentrated, and hence most active. Thorough extraction is thereby obtained.

3. The bath is automatically kept at constant composition and purity, zinc goes into solution with the relative exclusion of impurities.

4. The zinc content of the solution is kept constant, and high-current efficiency is therefore maintained.

5. The conditions are fulfilled for obtaining a good cathode deposit.

6. The residues from electrolysis may be further treated for the recovery of other metals.

The writer became connected with the Weedon Mining Co., and in August, 1915, work was started on an experimental plant at Welland, Ont.

With two anodes per tank, with the compartments surrounding the anodes, and with a current of 950 amperes per tank, corresponding to a current density of 12.5 amperes per square foot, good results were obtained.

Several expedients were tried for keeping the solutions cool when employing higher currents, but the heat resulting in part from the electrolytic resistance and in part from the chemical reaction at the anode, made higher currents impracticable with this form of tank.

Considerable difficulty was also experienced with the compartments, for the canvas used as a diaphragm material developed into a serious weakness, and required constant attention and repairs.

In general, the laboratory experimental results were attained, but the operations did not permit of a sufficient margin for profit. The company did not see its way clear further to perfect the details of the process on a large scale, so the plant was closed in August, 1916.

When producing zinc at the rate of 8,000 lb. per month, the cost of producing zinc was as high as 18 cents per lb. plus the cost of the ore. On the basis of a steady production of 60,000 lb. per month, the writer estimated that the cost of producing zinc electrolytically should be 4 cents per lb. when power was available at \$14 per horse-power year.

In a large plant the above costs would be considerably reduced. About 30,000 lb. of zinc were produced, which averaged 99.95 per cent. zinc.

The work showed that it was possible to operate upon a commercial scale, but that weakness existed in the diaphragm material, and that many of the mechanical details could be improved. The process possessed advantages over other processes with respect to extraction, current efficiency, and necessary purity of the electrolyte, for good results were obtained in solutions in which ordinary electrolysis is impossible. With a satisfactory diaphragm it seemed probable that a higher acid electrolyte could be used with a correspondingly high current density, and that future development would be along this line.

THE THERMOCOUPLE NICHROME-CONSTANTAN.

DURING the course of an investigation by R. W. WOODWARD and T. R. HARRISON, at the BUREAU OF STANDARDS, of the temperature distribution in cooling rails of various sections, it became necessary to use thermocouples under unfavourable and peculiar conditions. These required that the couples should be small and remain constant in their calibration while enclosed to a depth of 4 in. in holes of 6 mm. diameter in steel at 1,000° C. in an oxidising atmosphere without the use of porcelain insulators in the usual manner.

After a trial of several base-metal elements, a couple of No. 18 nichrome and No. 12 constantan was found to answer the purpose very satisfactorily. These wires had a single asbestos wrapping, and were further protected by covering with a thick mixture of kaolin and sodium silicate, winding with asbestos cord, and again smearing with a thinner mixture of kaolin and sodium silicate.

A life test of this combination of thermo elements was made, together with others of nichrome-constantan and iron-constantan.

The couples of nichrome-constantan maintained a very nearly constant calibration—to within 10° C.—during their life, and could be relied upon to 10° C. as long as there was a metallic electrical circuit, whereas the iron-constantan couple had a practically uniformly diminishing E.M.F. In all cases it was the constantan wire that failed, by oxidation and becoming so brittle that it readily broke; the nichrome wire never became brittle, and showed no considerable oxidation.

The couple nichrome-constantan showed a remarkably high E.M.F.; the calibration curve was very nearly linear, and showed no departure from a smooth curve. The same calibration was found to hold good to within 1° up to 1,000° C. for other couples made of wire from the same lot, but it would probably be different for wires from other lots or other wires from this lot.

Couples were constructed of this combination for use in the investigation referred to, and to date had been found to give very good service.

For use in the air, therefore, to 1,000° C., even when only incompletely protected, these data and subsequent experience showed that the thermocouple nichrome-constantan would maintain its

CALIBRATION OF NICHROME-CONSTANTAN.

Temperature, Deg. C.	E.M.F., Millivolts.	Temperature, Deg. C.	E.M.F., Millivolts.
108	1'92	632	37'4
204	9'90	842	52'2
292	14'9	1,033	66'3
434	23'8		

constancy to within 10° C. (18° F.) until nearly completely oxidised. The E.M.F. of this couple was high, 63'8 mv. at 1,000° C., as compared with iron-constantan, 57'5 mv. at 1,000° C.; nickel-constantan, 27'2 mv. at 1,000° C.; nickel-nichrome, 28 mv. at 1,000° C.; and cobalt-constantan, 39'5 mv. at 1,000° C.

* Metallurgical and Chemical Engineering.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Employment of Disabled Soldiers.

It was with regret that I read your paragraph on the employment of disabled soldiers in the REVIEW of July 27th. You "note with surprise" that "a municipal undertaking is advertising for invalided young officers to act as switchboard attendants at 37s. a week." Further, you "cannot help feeling that this offer borders on an insult to men . . . who have received a liberal education, and who have occupied positions of trust and responsibility."

May I say quite frankly that this paragraph is an insult to every switchboard and sub-station attendant in the country? Does not the switchboard attendant hold "a position of trust and responsibility"? And how many of these attendants have not received an education equal to, if not better than, the average young officer? The majority of sub-station and switchboard attendants are as conversant with their work, and quite as intelligent and well educated, both socially and technically, as 75 per cent. of the officers in the Army to-day. From my own experience of over eight years I consider the average station attendant to be far better educated and to hold a far more responsible position than 90 per cent. of the men in other trades drawing the same salary. It must be remembered, too, that education and efficiency are not by any means the only roads to promotion in the Army; recent disclosures prove this.

As a constant reader of your valuable paper, I consider you would be rendering a greater service to the country by urging the importance and responsibility of every grade of power and sub-station worker, from the shift engineer downwards, than by belittling the responsibility of men who are silently serving their country controlling, day and night, the intricate copper networks forming the arteries through which the life blood of the munitions industry flows; or than by applauding the introduction to responsible positions of women, many of whom, previous to the war, never had more responsibility on their shoulders than the keeping of a toy dog.

E. M. F.

I have read with hot indignation your paragraph on page 87, protesting against officers being insulted by the offer of work as sub-station attendants at 37s. per week.

The theme of the article is sound, but what have sub-station attendants done to earn what the Editor of the REVIEW would, in other circumstances, call "a gratuitous slur" which runs through the paragraph? Had the lines been written by an officer one would have been tempted to put it down to snobbishness, but these gallant fellows are at least not guilty here.

In my experience of sub-station work, I have gone on shift with more than one B.Sc. The chief engineer of one of our largest electrical railways was once, I believe, a sub-station attendant. Yet here is the Editor of the REVIEW insinuating that we are all illiterate nonentities! True, many a hundred subscribe to the E.R., but perhaps it is because they like its pretty blue cover.

The fact that women can do the work does not render it less skilful in the operating; was the discovery of radium less important because a woman gave it to the world?

A good shift engineer, Sir, is worth his weight in gold, and companies who employ the inferior operator are asking for trouble. The best automatons will fail at times, and it is at this moment that a good man (even though he be not an officer) will save his firm as many hundreds of pounds as he earns shillings per week. The cheaper and inexperienced man (or woman) rushes about in confusion, with sudden death dogging his footsteps the while. The insult in question lies in the wage, not the work, that this municipality is offering to these gentlemen.

Teddington, August 4th, 1917.

Alfred Bridges.

[We fully appreciate the point of view of our correspondents, and admire the ability with which they plead their cause. We do not admit, however, that, when read without personal bias, our note can be made to bear the construction that they place upon it. For one thing, we said nothing at all about shift engineers why drag them in! The question at issue is simply whether the post of switchboard attendant, at a salary of 25s. a week + a war bonus of 12s., is a fit and proper one to offer to men who have borne His Majesty's commission, and have suffered in defence of their country. Is this the best that we can do for them?

The Council and the Local Sections of the I.E.E., as well as the L.C.C. and other public bodies, have decided that switchboard attendance is a suitable occupation for disabled soldiers and sailors who have had a few weeks' training; it stands to reason, therefore, if these authorities are right, that it does not call for the possession of those qualifications which are looked for, and should be found, in their quondam officers. We may cite also the Memorandum of the Reserved Occupations Committee, which was endorsed by the I.M.E.A., and recommended the employment of women in this capacity (see ELEC. REV., February 23rd, 1917, page 212).

As for the skilled and educated men on whose behalf our correspondents so ably intervene we had not the least intention to reflect upon their merits; our past records show that we have always striven to raise their status and their salaries—the A.E.S.E. was initiated through our columns and with our aid—and we are convinced that many of them are far too good for the jobs (and the pay) that they get. EDS. ELEC. REV.]

Prospective Engineering Policy in France.

Belloc has described her villages as the pinpoints on which the lace work of France is stretched.

The metaphor is delightfully appropriate. France has always striven after a peculiarly effective centralised system. Noticeable originally in her national policy, it has evolved a natural corollary in the grouping of her village communities.

Miserably ruined as they are, these clusters of razed brick and mortar in the area evacuated by the enemy last spring, form a strikingly definite object lesson to us who are fighting amidst the débâcle.

Your mention of M. Laurent's view on the prospective electrical energy of the country after this war, in your issue of July 13th, may make these lines of interest to your readers.

The enemy has taken special pains to totally destroy the original power network that fed the villages from large central stations established in the proximity of provincial towns in the pre-war days.

The country side is littered with the shattered concrete masts that directed electrical energy from point to point.

One thing is evident. France cannot build on the old foundations. She must conceive and carry out a totally new scheme; and this, I fear, will in a large measure impede immediate construction of power plant and supply.

We electrical engineers have naturally come to accept our scientific production as a primary source of vitality in the national life. Such a conclusion is justified, but only when the national life exists—i.e., when community is a fact, and definite symbols, such as houses, stand for the verification of that fact.

The problem that confronts the France of to-morrow is primarily the regeneration of her existence.

Will she adopt her intensely centralised plan of hitherto, or will she follow, say, on English lines, and have, not only the village, but also a formidable scattering of outlying farms and factories?

It is a question that will require very careful consideration and the boldest handling. The allotment of land fairly—on the basis of individual pre-war prosperity or on the numerical strength of remaining citizen families in proportion to the devastated area—is a trial that the strongest of nations may fairly quail from.

The engineer's rôle in the near future will be, not a fevered building for building's sake, but rather one of mature thought, out of which he will be enabled to form some idea, not only definite, but also one capable of a limitless and, above all, a quick expansion.

This is a task that, under the present abnormal conditions, has no precedent to guide its ultimate conclusion.

We have before us a wonderful scope, and it is our duty not only to fight with France, as we are doing to-day, but also, when the time comes, to strain every nerve to help her in her future policy. Taking account of the intimate local knowledge (often bitter) of her countryside that this war has given us, we must endeavour, as her ally, to help in adjusting—to the best of our ability—this policy, within the bounds of latest scientific law and probability.

The opening-up of your columns to matters French is, if I may say so, a big advance in an essential direction.

R. C. Andersen.

B.E.F., July 30th, 1917.

[Our correspondent's letter is very welcome, and we cordially agree with his views; we hope that our alliance with France in war time will persist as partnership when peace returns. May we point out, with reference to the last paragraph of Mr. Andersen's letter, that "the opening-up" of our columns to French affairs is no new departure? For many years past we have from time to time reviewed the progress of electrical developments in France, and we have published many illustrated articles on French electrical undertakings.—EDS. ELEC. REV.]

The Perils of Jest.

Mr. Perren Maycock's letters on your reviewer's remarks have brought tears to the eyes of many. They remind me of a conversation with my friend Mr. Macpherson, when I repeated the old tag that a Scotchman jokes with difficulty. Seeing his anger, I added that the statement was silly enough, for many of my most witty friends were Scotch. Mr. Macpherson glared at me, inflated his chest, and, with emphasis, replied: "Sir, no Scotchman ever lowers himself by such a contemptible act as a joke." As the poet has said:—

"Beware of a jest, for he is not blest,
Who jokes with a friend that is dour;
The man who is wise everlastingly tries
To hold up a face that is sour."

That rule is inviolate in the electrical industry, at any rate, on its official side. One no more should jest in a book review than at an I.E.E. meeting. Shortly before his death, Mr. Robert Hammond gave an address at a Local Section of the I.E.E., in which he related his early experiences. It was all very good, and had it been reported in the I.E.E. Journal, the number would have remained in a handy place long after the other volumes had received their merited promotion to the attic. But, alas! Mr. Hammond had the fatal defect of humour and humanness, and the speech is lost, for ever.

Mr. Maycock deserves reparation for his moral and intellectual damages. Why should not the Editor permit him to review the next edition of his book? At any rate, we would feel sure that the reviewer had read it.

Jack Point.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A Novel Soldering Iron.

A copper-pointed soldering iron which is heated by the contact resistance with two carbon electrodes, or more specifically by the white heat produced at the electrode tips, is being manufactured by the CLEMENS ELECTRICAL CORPORATION, of Buffalo, N.Y. The copper point is brought in contact with the electrodes by releasing a catch on the spring. The iron may be heated ready for use in

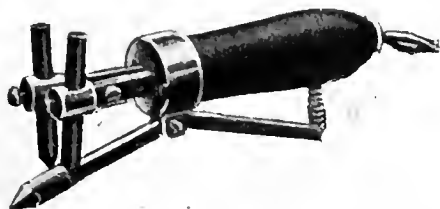


FIG. 1.—ELECTRODE-HEATED SOLDERING IRON.

less than two minutes, it is claimed. The outfit is designed for tinning, running seams, and soldering low-fusing metals such as zinc and lead. Two sizes are made, one requiring 60 watts and the other 150 watts. Any special pointed copper can be attached to this soldering iron. To heat these irons only 5 to 7 volts is used, transformers being provided to give this low voltage.

Gravity Cell with Small Local Action.

In a communication to the Société Internationale des Electriciens, M. Ch. Féry discussed the causes of the irregular wasting of the zinc rods in salammioniac cells, and stated that the more rapid consumption of the upper part of the rod was due not only to the oxygen of the air, but still more to a secondary electrolytic action between the parts of the rod which were immersed in two dissimilar liquids. As the result of experiments, the author concluded

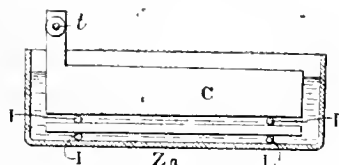


FIG. 2.—SECTION OF GRAVITY CELL.

that the best plan was to use a flat zinc plate lying horizontally at the bottom of the cell, as in fig. 2, supported on insulating rods *l, l*. The carbon electrodes resting on similar rods are L-shaped plates, on edge, joined together with a screwed metallic rod *t*. A cell of this type, having a zinc plate of 100 cm.² (15.5 sq. in.) and 10 carbon plates gave on short circuit a current of 2.5 amperes.

"Roller" Lock-Nut.

Of the designing of new forms of lock-nuts there would seem to be no end; the latest to come under our notice is one that has recently been introduced by the ROLLER LOCK NUT CO. of 61,

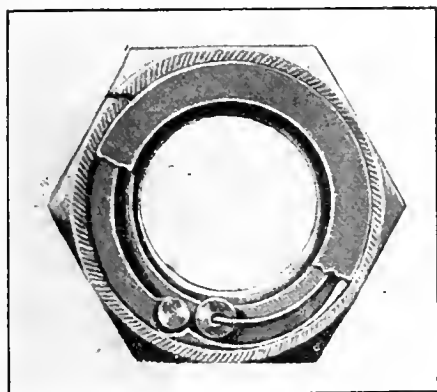


FIG. 3.—ROLLER LOCK-NUT, PART SECTION.

Broadway, New York, and which has certainly the feature of novel design. In the top of the nut is a recessed section, in which is attached a piece of thin spring brass bearing on one end a hard

roller. When tightening the nut, this roller is forced by the reverse motion of the bolt back into the recess. On the other hand, any motion of the nut backward off the bolt draws the roller forward against a projection in the wall, tending to hold it tighter. While the nut is thus claimed to be self-tightening under the usual conditions of vibration, it can, when desired, be loosened by a spanner. Just beyond the projection in the track of the roller is a deep pocket; when a spanner is applied sufficient force is exerted to carry the roller over the projection into this pocket, where it is out of the way and does not interfere with the free movement of the nut. Another advantage claimed for the new lock-nut is that as it contains its own locking device, only one nut has to be employed, thus allowing the use of a shorter bolt than when two nuts are necessary. At present the nut, which is stated to have been adopted by a number of leading American engineering concerns, is only being supplied in sizes for U.S. standard screw threads.

THE MUNICIPAL ELECTRICAL ASSOCIATION AND ELECTRICITY SUPPLY REORGANISATION.

A CIRCULAR letter has recently been issued to members of the I.M.E.A., in which the Council state that they feel they should give to the members as much information as possible regarding their actions in connection with the future of the electrical industry as now being dealt with by Committees appointed by the Board of Trade and otherwise.

It is a matter for great regret that full information cannot be imparted at the present time, owing to the withholding by the Government of the report of the Board of Trade Electrical Trades Committee (Sir Charles Parsons's Committee) and the interim report of the Coal Conservation Sub-Committee of the Reconstruction Committee.

The Council are strongly of opinion that pressure should be brought to bear with the object of obtaining the immediate publication of these reports. This would release evidence which has now to be preserved in confidence, and enable more open discussion by those most concerned and best informed.

The I.M.E.A. Council, on November 1st, 1916, agreed several resolutions regarding the appointment of a Central Board of Control or Commission to take over the whole of the duties at present exercised by the Board of Trade, Local Government Board, Home Office, and other Departments, so far as they relate to the administration of the Electric Lighting Acts; such Central Board to have full powers, but not to be authorised to own or operate electricity works.

The new Central Board will be a progressive body with the interests of the industry at heart, and should, therefore, have complete control—subject to Parliament alone—over all such matters as the granting of powers, approval of rates of charge, formulation of rules now drawn up by the Board of Trade, &c.

It was specified that members of the Board should be whole-time officers, who should sell out all securities owned by them in any electrical undertakings, so that the confidence of the country may be furthered by the assurance that those in control are entirely disinterested.

The Council have come to the conclusion that to secure the most economical production of electricity, generation in the future must be by large power stations, though not necessarily in every instance by new super-stations; that the large power stations can best be controlled and operated by District Boards consisting of representatives appointed by the present statutory undertakings (both local authority and company), and that the distribution shall remain with present undertakers, subject to suitable safeguards to protect consumers.

The Council are fully aware that the idea of transferring to a District Board some of the powers now exercised in regard to the generating side of the business may not commend itself to some existing undertakings, but they are convinced that in order to secure a large and economical supply of electrical energy, it will be necessary to adopt centralised generation with large units of plant, and the interests of all parties concerned are best met (so far as generation and transmission are concerned) by advocating joint control and operation by District Boards.

In the event of the status or remuneration of an official of any undertaking being adversely affected through the formation of a District Board, such an official shall be entitled to compensation.

A report of the Lancashire and Cheshire Linking-up Committee will be published within a few days, the details of which will prove of considerable interest in the fuller consideration of schemes for supply throughout the country.

A resolution was transmitted to the President of the Board of Trade in accordance with the instructions of the annual general meeting; it is a matter of great regret that, although three additional members have been added to the Committee, these additions have been made without reference either to the I.M.E.A., which represents the municipal electrical interests, or to the individual municipalities concerned. The Council feel that further attempts to get the representation on the Committee adjusted at the present time would be futile, and do not, therefore, propose to take further action at present.

As regards the giving of further evidence, Mr. Faraday Proctor having been deputed to give evidence for the Association, it is desired that any members having points of importance to be

brought forward which have not been otherwise dealt with, should send particulars of the same to him immediately, with a copy or draft of information prepared for witnesses.

It will be realised that many points have already been dealt with by the Association's witnesses before Sir Charles Parsons's Committee, and by the witnesses of the Association of Municipal Corporations.

At the annual general meeting of the I.M.E.A., on June 22nd, several members stated that plant extensions by municipalities were being refused by the authorities while power companies appeared to be favoured in that matter. The Council will be glad if members will advise them of specific examples, which have come within their personal knowledge, of undue obstruction experienced by local authorities, and of undue assistance given to power companies in connection with extensions of plant or mains, so that the information may be tabulated with a view to taking further action on the matter.

WAR ITEMS.

Trading with the Enemy.—The "London Gazette" for August 3rd contains further lists of persons or bodies in a number of countries with which or whom trading is prohibited:—Netherlands East Indies, Norway, Spain, Sweden, Venezuela, &c.

Copper Shortage in Germany.—Reuter's agent at Amsterdam quotes the *Koelnische Volkszeitung* to the effect that the German Government are requisitioning lightning conductors on account of the copper and platinum from which these are made.

The First Problem.—Reconstruction after the war was the subject of the inaugural address given by Mr. Herbert Samuel at the Oxford University Extension summer meeting. He said that an increased national production of wealth would be a prime necessity. It was clear that restrictions on the output of either workpeople or of machines would be more than ever injurious, but if they were to be removed it must be with the assistance of Labour, and some alternative means must be provided to give that protection to the worker which the restrictions were designed to secure. How to achieve this was the first of our problems.—*Times*.

Education After the War.—Lord Haldane, speaking at a conference at Oxford on educational reconstruction, said that the end of the struggle would not find society as it was when the struggle began. He looked upon education as the most important element in reconstruction. Let them begin with education, take it as their foundation, and social problems would solve themselves. Education was a thing of tremendous significance. One of the great problems of Labour was how to make Labour interesting; they had too little imagination about the grievances of the labourer. One of his great grievances was that his toil was mechanical and dull. With the march of science marched also the machine, which took away very much of the dull and monotonous work. The higher the application of knowledge to industry, and the more thoroughly science penetrated their industrial organisation, the more closely they would get to the time when every man, even the great bulk of those engaged in manual labour, would realise that brain power was as necessary as muscle power.

As reported in the *Times*, Lord Haldane said he was deeply convinced that in education, as in most other things, unless there were devolution—devolution to those who were able and willing to work in the various localities—they would not make very much progress. Local self-government was their principle there as elsewhere. This war had shown what the nation could accomplish when we were put to it, and we could accomplish far more for education if we had a little more orderliness in our composition. This was the time to think. Peace would come some time. It might come soon and it might not, and it might be sudden. The risk we ran was that before peace came we might not have thought out how to deal with the great problems which would be upon us.

The Work of Reconstruction.—Sir G. Cave, addressing the House of Commons respecting the setting up of the Ministry of Reconstruction, said (according to the *Times* report) that there was important and vital work for the Minister to do. The more he saw of the machinery of the war, and the more he realised the tremendous upheaval which must take place on the conclusion of peace, the more ardently he desired to take all the steps that he could to render efficient and effective the policy of reconstruction. The demobilisation, not only of the Army, but of the industrial army, would be of vital interest to the working classes. No one could think of the great bodies of men and women now employed in munition factories without being anxious as to what their fate would be if the war suddenly came to an end. They wanted a department which would charge itself with the consideration of those grave problems and would recommend to the other departments that were directly concerned the steps which should be taken.

Lord Parmoor, in a speech at Liverpool, said it was very right that even under the great stress of war we should look forward in good time to what was necessary for reconstruction

in our commercial life in the future. He did not believe so much in one large general scheme of reconstruction, but that every commercial society should do what it could within its own powers and its own area to add to what might be the stream of progress which they hoped might come after the war. He was a great believer in research and study and in collective action, but if they allowed that to supersede what he called the vitalising effect of individual energy and individual enterprise, they might purchase the advantage at too high a rate. However much they might depend upon research and knowledge, there was something in the energy, the life, and perseverance of the individual on which they had relied in the past in their English commercial enterprise, and which he hoped would not be less potent and less powerful in future. Lord Parmoor thought they ought to a great extent to revert to the old apprenticeship system.—*Daily Telegraph*.

Belgian Trade: A Government Committee.—The Government has appointed a committee to investigate the means of promotion and advancement of trade and commerce between the British Empire and Belgium. In view of the importance of the operations of this committee, we give its constitution and terms of reference in full:—The members of the Committee are:—

Representing the Foreign Office:—Sir Cecil Hertslet (Chairman of the Committee), His Majesty's Consul-General for Belgium; Mr. R. Macleay, Counsellor of Embassy in the Diplomatic Service, Deputy Controller of the Foreign Trade Department, Foreign Office; Mr. M. Neville Kearney (Secretary of the Committee), of the Consular Service, attached to the Foreign Office.

Representing the Board of Trade:—Sir W. H. Clark, Comptroller-General of the Department of Commercial Intelligence, Board of Trade; Sir E. Wyldbore-Smith, Director of the Commission Internationale de Ravitaillement; Mr. Percy Ashley, Board of Trade.

Representing British Commercial and Financial Interests:—Sir Algernon F. Firth, representing the Association of Chambers of Commerce of the United Kingdom; Mr. E. F. Oldham, representing the Federation of British Industries; Mr. M. Cleminson, representing the Chamber of Shipping of the United Kingdom and the Liverpool Steamship Owners' Association; Sir R. Vassar-Smith (chairman of the Committee of London Clearing Bankers), representing the Bankers' Clearing House; Lord Faringdon, representing the British Trade Corporation; Mr. Frank Potter (general manager, Great Western Railway), representing the Railway Executive Committee.

The terms of reference show that the Committee is established for the purpose of inquiring into all matters relative to trade between the British Empire and Belgium, with a view to increase and develop that trade by every desirable means. It will be the duty of the Committee to investigate as far as possible all means to be adopted in order to attain the foregoing object. The Committee will examine into the supplies and requirements of the representative countries (in so far as they have relation to its scope), and give advice as to how trade between them can best be established, developed, and increased. It will obtain information and evidence from all available sources, and endeavour to render all possible assistance in regard to shipping, manufactures, imports, and exports, and trade generally between the Empire and kingdom.

The Committee constituted as above, will have power to add to its numbers by the appointment of such persons of experience in the matters with which it has to deal as it may think expedient, and it will also consult from time to time other representatives of commerce having special knowledge of Belgian trade, shipping, and finance.

It is particularly laid down that the purpose of the Committee shall be a general one, and that it shall not be part of its duties to foster the advancement of the trade of any particular individual or firm, nor to devote its assistance to any special branch of trade or industry except in relation to the general principles for which it is established.

The Committee will be known as "The Belgian Trade Committee." An office has been established provisionally at 39, Parliament Street, S.W.1, to which all communications should be addressed.

Exemption Applications.—At Batley Local Tribunal, exemption to October 1st was granted in the case of H. A. Wilson (28, married, in Class B 2), a motorman for the Tramways Co. The representative of the company said there were already 14 cars standing idle owing to lack of drivers.

At Rochdale, the Tramways Department appealed for E. Kershaw (35, single, Class A), motorman. Mr. Webster, general manager, said he was hard pressed for drivers, and they were working seven days a week. The claim was refused, to report on September 30th.

At Ormskirk Tribunal, Levi T. Allen (35, B 1), electrical engineer, said he was the only electrical engineer and contractor for lighting and power purposes in the town. He had had to give up his shop in Burscough Street because he could not get men. Exemption to August 31st was given, no further appeal to be made without leave.

At Rochdale, on the application of the Corporation tramways department, conditional exemption has been granted to J. Brandrick (26, C 2), electrical fitter.

Douglas (Isle of Man) Tribunal has given conditional exemption, with the assent of the Military, to A. E. Barlow (25), tram conductor, and E. W. Dolson (37), tram driver.

In an appeal at Rugby, an electrician (33), stated that, on re-examination, his classification had been altered from general service to C 1; he asked for a Munitions Order. The Military Representative said that electricians were required for the Army, and final exemption until August 15th was granted.

On the appeal of Mr. Lambert, tramways manager, Maldstone Tribunal has granted six months' exemption to E. J. Freed (40, C2), inspector, and F. Rose (35, passed for general service), driver.

At Brighton, Mr. W. Marsh appealed for 27 men engaged on the Corporation tramways, and said that it was simply a question whether the trams were to run or not. All the men asked for were highly skilled, and it would be impossible to replace them. Each was given three months.

Before the Surbiton Tribunal, the resident engineer at the electricity works applied for exemption for a meter mechanic (27, C2). It was claimed that he was in a protected occupation, and it was mentioned that he had been rejected, although he underwent an operation to enable himself to pass. The Tribunal ruled against the man being in a certified occupation, but the appeal was respite for further consideration.

At Grays, the electrical engineer to the U.D.C. (Mr. E. D. Long) appealed for the retention of a mechanic (31, Class A). Three months, subject to substitution, were granted.

At Coalville, on Aug. 1st, a final month only was granted to an electrician (40, B1) appealed for by Mrs. Haydock, of Charnwood Towers.

Strood (Kent) Rural Tribunal has given exemption until October 31st to S. J. Nettingham, electrician, appealed for by the Thames Portland Cement Co.

At Southend-on-Sea, the Military asked for the withdrawal of exemption held by an overhead wireman in the employ of the Corporation. It transpired that this was not now the man's chief employment, and the certificate was cancelled.

Conditional exemption has been granted at Swinton to an electrician (41; B2), in business in the area.

At Canterbury, on July 31st, in the case of a coal trimmer at the Corporation electricity works, who had been exempted until substituted, it was stated that the man presented himself for the Royal Navy on July 2nd, and after being passed as a gunner-instructor, he failed to pass the doctor, and he had been discharged from the service. Mr. Blaschek (electrical engineer) had consulted with the recruiting officer, who had agreed that as a result of the recent War Office Order, the man, having been overseas, and only classified C1, was not to be called. The man did not want to go away for substitution, and it was agreed that the existing certificate should be cancelled, so that Mr. Blaschek shall have the right to appeal again.

Leyton Tribunal has allowed exemption until December 31st to B. L. Hutchins (37, C2), a L.C.C. tram conductor.

At Rotherham, the Corporation defended Military appeals against 12 tramway motormen and three car repairers. On it being suggested that there should be substitution, the assistant engineer said that 14 wounded soldiers had been sent, and only seven were able to stand the work. The Chairman (Ald. T. W. Grundy) expressed the hope that if substitutes were found the men most fit would be released. In reply to the Military Representative, the assistant manager said that it was impossible for females to drive cars in Rotherham. The Military appeals were disallowed and the exemptions confirmed.

Dartford Tribunal has granted conditional exemption to H. H. Lygo (27, B1), electrical engineer at the Joyce Green power station.

BUSINESS NOTES.

Patent for Disposal.—The proprietor of Patent No. 20,111, of 1913, "Speech-reproducing apparatus," wishes to dispose of the patent or to license British manufacturers to work under it. Full particulars are given in our advertisement pages to-day.

For Sale.—Owing to the death of the proprietor, the business, plant, machinery, &c., of MESSRS. ADAMS BROS., electrical engineers, Longton, is for disposal as a going concern. For particulars see our advertisement pages to-day.

Russian Exhibition in London.—There is being held at the Central Hall, Westminster, a Russian Exhibition illustrating the chief features of Russian economic life. The exhibition opened on Tuesday last, and will close on 18th inst. Lectures are being delivered daily. That on Wednesday dealt with mineral resources, that of yesterday considered the Russian industries, and to-day foreign trade will be the subject.

Tudor Accumulator Co., Ltd.—The annual meeting of this company was held on July 25th at 3, Central Buildings, Westminster. The board as now constituted is as follows:—Mr. B. M. Drake (chairman); Messrs. E. J. Clark, W. C. Johnson, Capt. T. Prestige, C. R. D. Pritchett, and G. E. B. Pritchett, directors; Messrs. A. B. Pescatore and E. Jacob, managing directors.

The chairman said it would doubtless be satisfactory to municipalities and others who used Tudor accumulators to know that the company was now in British hands. The directors were pleased to have been able to conclude agreements by which the services of the managers, both at the head office and the works, were retained. He referred to the very liberal war allowances, which amounted

last year to no less than £5,025, and he anticipated that the company would obtain a fair share of available work now that all enemy interests, which had acted as a deterrent in the past, had been effectually removed.

Catalogues and Lists.—MESSRS. GENT & CO., LTD., Faraday Works, Leicester.—List giving illustrations, brief particulars and prices of their "Tangent" mining bells, special keys, new pattern flameproof relay with machined flange joints (lock and key), ironclad telephones and switchboards. The bells and relays are wound to Home Office and Dr. Wheeler's recommendations.

FULLER'S CARBON AND ELECTRICAL CO., LTD., Woodland Works, Chadwell Heath, E.—Twenty-page catalogue of carbons for cinemas, search lights, arc lamps, primary batteries, welding, and general electrochemical purposes. More than half of the list is devoted to tabulated prices of flame, open and enclosed type arc lamp carbons. The company's new carbon works are now in full working order.

MR. F. J. DOWN, 90-93, Fenchurch Street, London, E.C. 8-page pamphlet containing an illustrated description of the reciprocating track grinder supplied by the Railway Track-work Co. of Philadelphia.

Dissolutions and Liquidations.—GLOBE ASSOCIATED CABLE AND TELEGRAPHIC SERVICES, LTD., 20 to 23, Holborn, London.—Liquidator released, July 31st, 1917.

HALL-EDWARDS & EMRYS-JONES, medical electro-therapists and X-ray specialists, 141A, Great Charles Street, Birmingham.—Messrs. J. F. Hall-Edwards and M. F. Emrys-Jones have dissolved partnership. The former will attend to debts.

ECONOMIC ELECTRIC CO., electrical and mechanical engineers, 127A, Oxtou Road, and Hamilton Lane, Birkenhead.—Messrs. T. W. Jefferson and T. E. Jones have dissolved partnership. Mr. Jones attends to debts, &c., and will carry on business at the Oxtou Road address as the Economical Electric Co. Mr. Jefferson will carry on business at 79A, Grange Road, Birkenhead, under his own name.

CANADIAN BRITISH ENGINEERING CO., LTD.—Creditors must send particulars of their debts, &c., to the liquidator, Mr. R. G. Sidford, 20, John Street, Adelphi, London, W.C. 2, by September 1st.

Trade Announcement.—THE CONSOLIDATED PNEUMATIC TOOL CO., LTD., have secured temporary accommodation at Egyptian House, 170, Piccadilly, W. 1, their offices at Palace Chambers having been commandeered by the Government authorities.

Bankruptcy Proceedings.—JOHN TAYLOR PEDDIE, mechanical engineer, Exhibition Buildings, Aldwych Site, Strand, London.—Trustee released, July 6th, 1917.

Fire.—A fire occurred, on July 31st, in a large vault used as stores at the premises of the Western Electric Co., Ltd., North Woolwich, E.

Book Notices.—"Scientific Papers of the Bureau of Standards." No. 299. "An Average Eye for Heterochromatic Photometry, and a Comparison of a Flicker and an Equality of Brightness Photometer." Washington: Department of Commerce, Bureau of Standards. The comparison of lights of different colours is supposed to be based on an "average normal eye." This paper records an attempt to approximate the results of such an eye with typical colour differences by using a large number of observers. In particular, results obtained by a flicker photometer and by an equality-of-brightness photometer, with different degrees of colour differences, are compared. In terms of the Ives-Kingsbury test solutions, for which the proposed normal ratio of transmissions (with a 4-w./c.p. carbon lamp) is 1.00, the average of 114 observers gives a ratio of 0.99. By using these test solutions, results obtained on the flicker photometer by a small number of observers can be corrected so as to give normal values with a high degree of accuracy. On the average, equality-of-brightness measurements also vary in proportion to the test ratio, but erratic variations often overshadow these systematic differences. For sources having relatively high intensity in the blue, flicker values tend to fall below those obtained on the usual standard photometers, but the difference is comparable in magnitude with the uncertainty of the latter values. This publication is now available for distribution, and those interested may obtain a copy by addressing a request to the Bureau.

The July issue of the Tramways and Light Railways Association Journal is a special Congress number, containing reports of the papers and discussions at the annual gathering held in June.

The Journal of the Junior Institution of Engineers for August contains some useful hints on the rectification of faults in the working of paraffin engines, and notes on "Quantities and Estimates" by Mr. C. O. Mourant.

LIGHTING AND POWER NOTES.

Burnley.—VEHICLE CHARGING.—The Electricity Committee has decided to provide charging facilities for electric vehicles, the price being 14d. per unit.

Batley.—PRICE INCREASE.—The Corporation has decided to increase the price of current by $7\frac{1}{2}$ per cent. on the pre-war charges for lighting, and 2½ per cent. for motive power. The new prices will operate from October 1st.

Bath.—YEAR'S WORKING.—The annual report of the working of the Corporation electricity department for the year ended March 31st last, shows a deficit of £1,782, due to the increased cost of coal, wages, &c. The total income of the undertaking was £26,507, as compared with £26,490, and expenditure amounted to £14,987, as compared with £13,529, leaving a gross profit of £11,520, as compared with £12,961; interest and sinking fund charges absorbed £12,649, and, with £120 for special expenditure, made a total of £12,769, which leaves a deficit of £1,782. The total amount borrowed is £192,574, of which £105,486 has been repaid, leaving a balance outstanding of £87,088. Next year two of the earliest loans will be liquidated, totalling £50,378, which will mean a relief in the repayments item of over £3,000. The total number of units generated during the year was 2,603,945, and the total maximum demand 1,318.5 kw.

Bradford.—PROPOSED PRICE REVISION.—Last week the City Council considered the proposed increased scale of electricity charges, to operate from October 1st, and referred to in our last issue. Ald. G. H. Robinson (chairman of the Electricity Committee), in moving the minutes, said he disagreed with the proposal, because the price to the flat-rate consumers had not been increased. Making deductions in respect of extra output, the increased cost in wages and salaries during the year ended March 31st, 1917, as compared with that ending the same date, 1914, amounted to £6,582, whilst £2,288 had been paid in allowances to dependents, and the increased cost of coal, after deductions in respect of increased output, had been £15,298. On top of these extra charges, which totalled something like £25,000, were other extra charges under the head of interest on loans, £3,272, and income-tax, £9,832, which meant together about £37,000. Electricity to the amount of £24,178 was supplied on the flat rate, and an increase of 10 per cent., in accordance with the proposal of the engineer—who was in the best position to judge, and was supported by the chairman and deputy-chairman—would mean an extra income on the flat-rate supply of £2,417. The "poor shopkeeper" had been spoken of. The shopkeepers consumed 362,000 units, and paid only £6,033. If they were charged according to the engineer's proposal, the extra income from them would be only £603 a year. The banks, also on the flat rate, consumed only 32,500 units, paying £541, and nobody would deny that they were well able to pay an extra 10 per cent. The 471 mill and warehouse consumers used 401,000 units, at a cost of £6,685, and surely those businesses could pay the extra £668 per year. The 464 offices, using 133,000 units, paid £2,223, and could afford to pay £222 per year extra. The 553 private houses on the 4d. flat rate consumed 101,000 units, and paid £1,693. They would pay an extra £169 on the 10 per cent. increase. He maintained that all flat-rate consumers could well afford to pay the increase. Ald. Robinson then said he was prepared to move an amendment to his own Committee's minutes, that they be referred back. Ald. J. Hayhurst asked the Council to accept the recommendation, with a variation to include the decision in regard to flat-rate consumers. The Council agreed to send the minutes back for reconsideration, passing the minutes with this amendment.

Canada.—ELECTRIC FARMING IN FRASER VALLEY.—Quite recently a number of ranchers to the south of Chilliwack clubbed together and raised \$5,000 for the construction of a power line from the town's electric plant to their premises, the idea being to use electric power generated by the British Columbia Electric Railway for a variety of purposes hitherto dependent on man-power. The total investment represented in line construction, power installation, and motors was in excess of \$5,000. The step taken may be attributed to the good work of Chief Electrician Porter, of the B.C.E.R. Co., Vancouver, who for the past couple of years has been demonstrating how the farmers of the Fraser Valley might lessen the hard work of husbandry by taking advantage of the company's far-flung electric system. Many farms closer to Vancouver have already done so, and now the farmers of Chilliwack district, 80 miles away, are coming into line.—*Electrical News*.

Clones (Co. Monaghan).—STREET LIGHTING.—The Urban Council has accepted the tender of the Clones Electric Light and Power Co., Ltd., for the public lighting of the town for three years, at 5d. per unit, with a rebate of 10 per cent. should the account in any year exceed £50.

Continental.—SPAIN.—A concession has been secured by Joaquin Moreno Ramirez to extract water from the River Segura, and erect a hydro-electric station for the generation of electric current for industrial purposes.

Gillingham (Kent).—PRICE INCREASE, &c.—The Corporation Electric Light Committee is considering the advisability of adapting the existing Diesel plant to use tar oil. The charges for current are to be increased from 25 per cent. to 10 per cent.

Hove.—PRICE REVISION.—The Lighting Committee has considered the advisability of revising the present charges for power purposes. The present flat rate is 1½d. per unit, which is less than the present war-time cost of generating the unit. The Committee recommends an increase to 2d. per unit on the flat rate and by 10 per cent. on the indicator rate.

Leeds.—WAGES ARBITRATION.—On Tuesday, last week, Mr. Forbes Lankester, K.C., sat as arbitrator between the Corporation and the General Workers' Union, the latter of whom claimed, on behalf of the workers in the electricity and gas departments, an advance of pay of 10s. per week above pre-war rates, instead of the

7s. granted. For the men it was pointed out that they worked alongside members of the Amalgamated Society of Engineers, who, as from August 1st, were to receive an advance of 15s. above pre-war rates by a recent award. For the Corporation it was held that the ratepayers were already hard pressed by war conditions, and that the claim was uncalled for so soon after the award to the tramwaymen. The men who were not tramwaymen, and who had received an advance of 2s. only three months ago, should be satisfied. The arbitrator heard the deputation from the men, and reserved his decision.

Maidstone.—PRICE INCREASE.—The T.C. has increased the charges for current for lighting by ½d. per unit for traction by ½d. per unit, and the fixed charge per annum of 12s. per 30-watt lamp and all other forms of supply by 10 per cent.

Newport.—LINKING-UP.—Mr. A. Nichols Moore has reported to the Electricity Committee in regard to the linking-up proposals for South Wales, his report being generally in line with that already submitted to the Cardiff Electricity Committee by Mr. Arthur Ellis, and the Committee has authorised him to take any steps that are necessary to further the proposals, on the distinct understanding that such steps as are taken shall in no way commit it to any scheme. Mr. John Moxon, chairman of the Electricity Committee, emphasised the importance of the Corporation taking an active part in any deliberations that might be on foot.

Queensbury and Clayton (Yorkshire).—PROV. ORDER.—The Electrical Distribution of Yorkshire, Ltd., has informed the Queensbury Council that it has abandoned its application for a prov. order to supply Queensbury and Clayton, owing to the opposition of the Bradford and Halifax Corporations. The company considered it had an obligation to Queensbury, even if Clayton became merged in Bradford, and stated it would proceed with the application in the next session of Parliament.

Rockdale.—The Corporation Electricity Committee notifies that new applications for electric power supply cannot be entertained at present.

Royton.—An arrangement has been made between the District Council and the Oldham Corporation Electricity Committee for the supply of electricity. The contribution to the cost of the prov. order was fixed at £200 up to a cost of £300, and one half if over that sum. The prices are to be the same as those charged in the borough. To the withholding of consent to the Lancashire Electric Power Co. to come into the area, Royton agrees so far as it can lawfully do so. The period of agreement with Oldham is to be 30 years, terminable then on a prior six months' notice, with subsequent periods of 10 years.

Spenborough.—PROPOSED BULK SUPPLY.—The U.D.C. is in negotiation with the Yorkshire Electric Power Co. with respect to a bulk supply of electricity.

St. Austell.—STREET LIGHTING.—The Electric Light Co. has asked the U.D.C. for an allowance of 30 per cent. on the contract price (£1 16s. 9d. per lamp per annum) in respect of 95 lamps unused last year. The Council has decided to offer 25 per cent.

Stoke-on-Trent.—The Ministry of Munitions is to, be requested, before any men are taken from the existing staff of the electricity works, with the Dilution Officer's consent, to cause an inquiry to be held, as the obligations of the Corporation to give and maintain supply cannot be met with a smaller or less efficient staff than that which at present exists. Steps are to be taken to retain the commercial assistant, charge and shift engineers, switchboard attendants, stokers, and the pipefitter at the Burslem works, in view of the absolute necessity of maintaining the supply next winter. The B. of T. is to be asked to authorise the Council to disconnect part of the supply in the event of the staff being reduced below the minimum necessary to maintain the whole supply, lack of steam due to the want of sufficient and suitable coal, or any other cause rendering it necessary to reduce the load upon the steam generating plant at the central power house or any other of the stations.

Stratford-on-Avon.—PRICE INCREASE.—The E.L. Co. has, from the date of the August meter readings, increased the price of current by ½d. per unit.

Swindon.—THREE-PHASE SUPPLY.—Last week the chairman of the Electricity Committee officially started up the new three-phase A.C. plant, which is now supplying a local works.

Tasmania.—The Board of Trade Journal mentions that the company which has been formed for the production of electrolytic zinc from the Broken Hill zinc ores is erecting large works at Risdon, which will shortly commence working. If successful, an extension of works, costing from £400,000 to £500,000, will be made as soon as possible.

Tonbridge.—LOAN SANCTION.—Without holding a public inquiry, the L.G.B. has given the U.D.C. sanction to a loan of £18,000 for extensions to the electricity works. Mr. M. P. Plunkett, electrical engineer, estimates that the extension will yield an annual income of £1,600.

Tunbridge Wells.—PRICE INCREASE.—The T.C. has increased the charges for current as from September 29th as follows:—Lighting, 10 per cent.; power and heating, 25 per cent.; power for lifts, 10 per cent.

Wimbledon.—PRICE INCREASE.—There was a deficit of £4,220 on the past year's working of the Corporation electricity undertaking, and it has been decided to raise a temporary loan not exceeding £5,000 to meet the working expenses. The charge for lighting in Wimbledon, Merton, the Maldens, and Coombe is to be increased to 6d. per unit, and for power, heating, and cooking to 2d. per unit.

TRAMWAY AND RAILWAY NOTES.

Accrington.—YEAR'S WORKING.—During the past year over 5 million passengers were carried on the Corporation tramways, being 169,318 more than in the previous 12 months. The accounts show a deficit on the year's working of £976, notwithstanding the fact that the income was increased by £1,169. The sum of £872 has been granted to former employes now serving with the Colours. This is £155 less than in the previous year. A striking feature in the expenditure is the amount paid for power, £7,861, which is £1,915 in excess of the sum paid the year previous.

Australia.—A great strike of railway and tramway workers has taken place in New South Wales, it being estimated that 20,000 men are affected. The strike appears to have a political origin.

Belfast.—The recent revision of the stages and the fares of the Corporation tramway system, which it was hoped would have placed it on a better financial basis, had not that effect, for the reason that not a little of the increased revenue was immediately neutralised by raising the wages of the employes, plus quite a number of recent extensions which are not paying, and the making good of which is falling on the paying sections. Last year there was a deficit of £7,000, and there is now a certainty of a still greater deficit at the end of the present one. At the monthly meeting, the chairman of the Tramways Committee said that the time had come for the Corporation to call a halt in its expenditure, or it will have to ask Parliament to relieve it of the obligation imposed by Clause 63 of the Tramways Act of 1904. The undertaking has been saddled with an increased expenditure of £25,000 per annum, and as the revenue comes from the public, the latter must be prepared to pay up, or reconcile itself to the transfer of the undertaking to a private company. A partial remedy would be the lopping off of the terminal extensions, which are being run at a dead loss to the ratepayers.

Bradford.—In recording tramway receipts of £8,256 for last week, an increase of £577 on the receipts of the corresponding period last year, it is reported that the receipts for the 119 days of the current tramways year were £129,978, an increase of £11,322 on the same period of the previous year.

Burnley.—Following a mass meeting of Corporation tramway workers and the passing of various resolutions, it was reported on Monday that the men were about to come out on strike again. There was, however, an official assurance forthcoming from the men's secretary. It is alleged that learner drivers are being imported from Ireland.

Dartford.—FIRE.—The car sheds and 13 cars employed in the local tramway service were destroyed by fire on Tuesday morning. Great inconvenience has been caused in the town, and L.C.C. cars are being sent as substitutes.

Glasgow.—WAR RELIEF SCHEMES.—The T.C. has given its consent to a new scheme for raising money through the agency of car collections in aid of the various war relief agencies. As has been reported in the REVIEW, a large sum was secured by means of a prize drawing, the prizes consisting of works of art and war savings certificates. The Secretary for Scotland, however, prohibited the scheme, holding that it did not come under the scope of the Art Unions Act, a position from which he refused to recede, notwithstanding the representations made by several deputations who travelled to Westminster. The new scheme is, briefly, that tickets will be sold week by week as before at one penny each, but that no prizes be given—the holders of the numbers drawn in the lottery having the privilege of nominating the war charities to which the revenue accruing will be handed. Several members of the T.C. have maintained the opinion that the element of chance has not yet been eliminated from the scheme, while others argue that the sporting chance is not sufficient to attract the public, and that the scheme will, therefore, not be a success.

Halifax.—TRACK RENEWALS.—Replying to questions in regard to the Tramway Committee's proposal to relay portions of the track in Gibbet Street and on North Bridge, Mr. A. Broadley told the T.C., last week, that the Committee had sufficient rails to relay the most dangerous portion of the track—a stretch at High-roadwell, a little below the old tram depot, and another length on North Bridge. No rails being now rolled, the Committee proposed to take up rails in Fountain Street, Church Street, Thrum Hall Lane, and in the upper car-shed, which were not being used, and use them for this relaying.

Keighley. Owing to a misunderstanding, the recent arbitration award advancing the bonus from 5s. to 6s. a week, made no mention of the additional allowance of 6d. per week for each dependent child under 13 years of age, which had previously been in force, and as a result some married drivers found themselves worse off than before. This has now been rectified by the arbitrator.

Leeds.—WOMEN INSPECTORS.—The Leeds Tramways Committee has appointed six women inspectors, who commenced duty on Friday, last week, despite the opposition of the department's employes. Mass meetings of male and female employes were held, and it was decided to inform the Tramways Committee that the women inspectors would not be recognised.

Nelson.—ELECTRIC VEHICLE.—The Ministry of Munitions has refused to sanction the importation of an electric wagon purchased by the Health Committee from the Edison Accumulators, Ltd. The Committee has decided to ask the L.G.B. to assist it in obtaining permission for the delivery of the wagon.

Oldham.—Since the outbreak of war, 317 employes of the Corporation tramways have joined the Forces. The amount paid in allowances during the past 12 months was £5,463.

South Lancashire.—The Lancashire C.C. has decided to oppose the granting of the Lostock and the Barton and Stretford Light Railway Orders, in view of proposed level crossings on main roads.

TELEGRAPH AND TELEPHONE NOTES.

New Wireless Record.—According to R. Thonberg and C. Bowers, operators on the American steamer *Sonoma*, wireless messages were picked up over the record distance of 11,500 miles by the *Sonoma* from the German station at Eilvese. The *Sonoma* was two days off Australia at the time.—*Wireless World*.

Trans-Atlantic Wireless Communication.—The Marconi Co. announces that, in conformity with instructions received from the Government, as from the 4th inst., its trans-Atlantic service, both East bound and West bound, has been discontinued until further notice. The closing of this service is in no sense brought about by any fault of the Marconi Co. either here or in Canada, but is purely a necessary war measure.

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—MELBOURNE.—October 10th. Department of the Navy. Pumping plant and equipment for the Commonwealth Naval Dockyard, Cockatoo Island, Sydney. Specifications from the Director of Navy Contracts, Melbourne.

London.—BERMONDSEY.—Sept. 7th. B.C. 500-KW. rotary converter. See "Official Notices" August 3rd.

H.M. OFFICE OF WORKS.—August 20th. 400 miles of bell wire. See "Official Notices" to-day.

Manchester.—August 18th. Supply, &c., of two electrically-driven turbo-pumps with automatic control and switch-gears, &c., for the Waterworks Committee. The Secretary, Water Department, Town Hall.

Portsmouth.—August 28th. Tramways Committee. Six months' supply of engine-room stores, insulating material, &c. See "Official Notices" to-day.

CLOSED.

Basingstoke.—T.C. Tar-oil for the electricity works: Burt, Boulton & Hayward, £5 5s. per ton.

Bridlington.—T.C. Coal (1,200 tons) for the electricity works: W. B. Wilson, York, 19s. 11d. per ton.

Rotherham.—T.C. Accepted tenders:—

Babcock & Wilcox, Ltd.—Six boilers and extensions to power station, £150,600.

British Thomson-Houston Co., Ltd.—Switchgear extension, £10,945.

Spenborough.—District Council. Supply of 1,000 tons each of coal for the electricity works for one year: W. Bennett and Sons, and W. H. Sharp & Sons.

Stoke-on-Trent.—T.C. Accepted tenders:—

British Westinghouse Co., Ltd.—3,000-kw. extension turbo-generator, &c. £18,805.

G. & J. Weir, Ltd.—10,000-gallon rotary feed pump, £381.

Aiton & Co., Ltd.—Pipes for cooling tower, £55 10s.

ANNEALING STEEL AND MELTING NON-FERROUS METALS IN THE ELECTRIC FURNACE.*

In a paper read before the CLEVELAND ENGINEERING SOCIETY, Mr. T. P. BAILEY said that the development of electric furnaces for the heating operations subsequent to the melting and refining of steel had been attended by the usual slow progress of any radically new development; the types now in operation were the result of the gradual elimination of weak and faulty features rather than of skill in original design.

The incidental advantages of the modern electric furnaces were so apparent that even at an equal operating cost for fuel, electricity now had the preference, while in some cases, where the net cost of operation with electricity was less than with gas or other fuel, complete installations of magnitude were being made.

All of the furnaces described were of the so-called resistance type, and had, in the case of rectangular furnaces, two troughs made of carborundum fire sand located one on each side of the furnace, with carbon or graphite electrodes located at each end of each trough. The troughs were filled with a broken carbonaceous material called "resister material" establishing a connection between the electrodes and completing the electric circuit. The general plan of these furnaces was similar to a closed box of fire brick in the walls of which were two glowers, which might be likened to huge incandescent lamp filaments. The control of the current, and hence the heat, was effected by varying the voltage impressed on the electrodes, this variation being obtained by means of numerous taps on the secondary of a special transformer supplied with each furnace.

A car-type 150-kw. annealing furnace, with the capacity of heating 1,000 lb. of steel to a temperature of 1,650 deg. F. in one hour, had a consumption of 300 kw.-hours per ton of material heated to that temperature. The door of the furnace was a heavy casting faced with fire brick, and backed by a filling of loose kieselguhr held in place by a steel plate.

A furnace of the same type, but of 300-kw. capacity, in the same plant as the previously described furnace, was used for annealing steel castings. Furnaces of this type were well adapted for handling steel castings and heating large or irregularly shaped forgings, or for the annealing of copper and aluminium, to which use they had already been put.

When materials were of uniform size, or of such shape and nature that they could be pushed along mechanically, or placed in containers of uniform size, the continuous furnace was sometimes preferable to the car-type annealing furnace. A 120-kw. furnace was used for carbonising rifle receivers in one of the large rifle-making plants in the East. The parts to be carbonised were placed in the usual pots and pushed through the furnace by means of pushers.

Other furnaces of the same general type, but with a different type of pusher, were used for annealing brass and German silver flatware blanks in one of the oldest and best known plants making plated tableware. Two of these 200-kw. units in operation at this plant had an hourly capacity of one ton of brass each.

The heat treatment of steel, as distinguished from the simple annealing operation, consisted of heating the metal to above a critical point, quenching at that temperature in some cooling medium, such as water or oil, and subsequently reheating to a temperature under the critical point mentioned.

For the highest quality of work in heat treating, two furnaces were recommended, each one running at the ruling temperature desired in the material at that particular stage of its treatment, and a quenching bath (or spray, as the case might be) located between the discharge end of the first or heating furnace and the charging end of the second or drawing furnace.

Two sets of two furnaces each were already installed in a progressive manufacturing plant, for the heat treatment of cast-steel drawbar knuckles. Each set had a capacity of 72 tons of steel per day, and consumed 900 kw.

These particular furnaces, and a similar set of 600 kw. furnaces for heat-treating large high-explosive shells, were automatically controlled by special pyrometers, so that the only hand work required was the placing of material on the charging platform of the first furnace of the set.

The reliability of the type of furnaces described above for annealing and heat-treating work seemed to justify the assumption that with the necessary modifications as to hearth and shape of furnaces they would work equally well on non-ferrous metals. The first furnace for this purpose was installed three years ago for melting silver in one of the plants mentioned previously, where continuous annealing furnaces were used for annealing brass flatware blanks. This furnace was rectangular in shape, and provided with a hole in the top and the necessary cover. The metal was melted in crucibles, the furnace being adapted to hold two crucibles of size No. 10. Not only was silver melted, but scrap copper as well. The ruling temperature of the furnace was 2,500 deg. F., very hot metal being required, as the castings were small and the moulds heavy iron chills.

There seemed to be no real necessity for the use of a crucible excepting in the melting of precious metals. Their high cost, rapid destruction, and the necessity of handling small quantities of metal when they were used, with attending high labour charge, had led to the adoption of a tilting-hearth furnace. This type of furnace was first used for aluminium and aluminium alloys, and later the same type, with slight modifications in the details, had been used to melt brass.

This furnace, with a normal rating of 105 kw., and a melting capacity of 600 lb. per hour, had melted, and superheated to a suitable pouring temperature, the following materials, with an average energy consumption as noted below:—

New red brass.—400-lb. heats in 1 hr. with 90 kw.-hours, or 450 kw.-hours per ton.

Scrap yellow brass.—(72 per cent. Cu, 28 per cent. zinc) 750-lb. heats in 1 hr. 10 min. with 120 kw.-hours or 320 kw.-hours per ton.

Scrap yellow brass.—(70 per cent. Cu, 30 per cent. zinc) 800-lb. heats in 1 hr. 18 min. with 110 kw.-hours or 275 kw.-hours per ton.

Brass chips and borings.—(70 per cent. Cu, 30 per cent. zinc) 700-lb. heats in 2 hr. 30 min. with 220 kw.-hours or 720 kw.-hours per ton.

Of all the electric furnaces of the type described now developed, the tilting-type furnace was the one offering the greatest saving in cost over fuel-fired furnaces of any type, whether oil, gas, or coke fired, since the metal loss was lower, the crucible cost was eliminated entirely, while the labour item was less on account of size and convenience of operation.

The following figures might be safely taken as operating conditions with yellow brass in a shop operating 24 hours per day:—

	Per ton.
Electricity, 400 kw.-hours per ton at 1 c. ...	\$4.00
Metal loss, 1 per cent. zinc at 10 c. per lb. ...	2.00
Labour, 1 man per hr. per 600 lb., at 40 c. per hr. ...	1.20
Renewals and repairs ...	1.00
Total per ton of melt ...	\$8.20

It was believed that the performance of these brass-melting furnaces was such, and the saving over other methods so great, that their introduction would be rapid, even more so than in the case of the annealing and heat-treating furnaces described, which were now accepted without question.

NOTES.

The British Engineers' Association.—The fifth annual ordinary general meeting of this Association was held at Caxton Hall, Westminster, London, on July 26th, and was attended by a large number of representative members from many parts of the country. In moving the Council's report, balance-sheet, and income and expenditure account for the year ending December 31st, 1916, which had been issued to all members, the chairman (Mr. Wilfrid Stokes) reviewed the work done by the Association during the past year, and dealt with the action which it was proposed to take in future. The new memorandum and articles of association, which had been revised in accordance with the resolution passed at the extraordinary general meeting of the Association on July 13th, 1916, had received the sanction of the Courts, and were now operative. He reminded members that the memorandum and articles had been revised in order to strengthen the relations between manufacturing engineers and those bodies and individuals with whom they were naturally brought into contact in the course of their business, as set out in the Manchester scheme for the organisation of the British engineering industry. He pointed out that much interest had been shown in the election of the new Council, and for the 30 seats on the Council, about 90 members, including retiring members, were nominated in the various districts, a total of 1,369 votes being recorded.

At the first meeting of the Council, held the same day, Mr. Wilfrid Stokes was re-elected president, and the Council for 1917-18 stands as follows:—

President: Mr. Wilfrid Stokes.	
Vice-Presidents: Mr. T. O. Callender, Sir John Cowan, Mr. Peter Denny, Mr. Herbert Marshall, Capt. L. E. Mather, Mr. J. E. Thornycroft, and Mr. Douglas Vickers.	
Mr. Daniel Adamson	Joseph Adamson & Co.
Mr. H. Alcock	W. T. Glover & Co., Ltd.
Mr. H. Austin	Austin Motor Co., Ltd.
Mr. Stanley Brotherhood ..	Peter Brotherhood, Ltd.
Sir Edwin Grant Burs, C.S.I. ..	Vulcan Foundry, Ltd.
Mr. George Cradock	George Cradock & Co., Ltd.
Mr. Robert Goudie	Loudon Bros., Ltd.
Mr. John Hemming	F. H. Lloyd & Co., Ltd.
Dr. G. B. Hunter	Swan, Hunter, and Wigham Richardson, Ltd.
Mr. John Hunter	Sir Wm. Arrol & Co., Ltd.
Mr. A. Jacob	British Aluminium Co., Ltd.
Mr. Christopher James	Joshua Buckton & Co., Ltd.
Mr. J. R. C. Kearns	H. W. Kearns & Co., Ltd.
Mr. B. Longbottom	Electromotors, Ltd.
Mr. Hugh Lupton	Hathorn, Davey & Co.
Mr. C. P. Martin	C. A. Parsons & Co., Ltd.
Mr. A. E. Owen	Rubery, Owen & Co.
Mr. Henry Steel	Steel, Perch & Tözer, Ltd.
Mr. T. Cuthbert Stewart ..	Stewart & Lloyds, Ltd.
Mr. H. J. Ward	J. & E. Hall, Ltd.
Mr. J. C. Ward	Edgar Allen & Co., Ltd.
Mr. A. P. Wood	Lancashire Dynamo & Motor Co., Ltd.

* Metallurgical and Chemical Engineering.

The Metric System.—According to *l'Industrie Electrique*, China will be the next convert to the metric system. Since February 15th the shops in Peking have adopted metric measures, authorised by the Chinese Chamber of Commerce under the instructions of the Ministry of Agriculture and Commerce.

A New U.S. Carbon Electrode Factory.—Work has been started on the first unit of a new factory that will form an immense addition to the present large plant of the Speer Carbon Co. at St. Mary's, Pennsylvania, and which, when entirely completed, will involve the expenditure of approximately £100,000 for additional land, buildings, machinery, equipment, and general improvements.

The first building, which will be devoted exclusively to the manufacture of the larger-sized carbon electrodes for electric furnaces will be 100 x 168 ft. (30.5 x 51.2 m.) in size, constructed entirely of brick, concrete, and steel. Glass sidewalls will also be employed, thus admitting daylight throughout the entire structure. It is expected that the entire plant will be in full operation by September next.

The Speer Carbon Co. has for several years past manufactured carbon electrodes in the smaller dimensions, the maximum sizes including 4 in. square and 6 in. diameter. The new factory will be equipped to turn out both round and square electrodes in all sizes from 6 to 24 in. in diameter.

The demand for carbon electrodes is daily increasing, the condition being caused by the enormous demand for tungsten steel and other products which, in turn, necessitated the installation of large numbers of electric furnaces throughout the entire country. The requirements of the Government have also influenced the Speer Carbon Co. very largely in the erection of a new plant.—*Metalurgical and Chemical Engineering*.

The Industrial Progress of Spain.*—For many years Spain has been depending upon England, France and Germany for goods of all kinds. These countries, and principally Germany, have dominated the Spanish market, due to their commercial organisations, to the establishment of branches of French, English and German banking institutions, to the facility with which the European manufacturers adapted themselves to trade conditions in Spain, to their sending out of Spanish-speaking salesmen, to the establishment of branch offices with goods on consignment and the granting of easy terms of payment. People in Spain have always been accustomed to having prices quoted, delivered in Spain, duty and freight paid. It has always been customary in dealing with substantial firms to grant from three to six months' credit against acceptance of drafts.

With the outbreak of the European War the country was suddenly cut off from its accustomed sources of supply, and a great paralysis of industrial life in Spain started on account of the disorganisation of the market. Slowly during the second year only of the war, Spanish industries began practically to realise to what extent they had been depending on foreign markets, and chiefly due to individual efforts, industrial life in Spain acquired in many branches a degree of activity never attained in previous peace times.

Spain is to-day a country in which electricity is developed to an astonishing extent. The cities of Madrid and Valencia are supplied with more than 40,000 H.P. produced by hydro-electric plants. In the district of Barcelona a company, largely managed by American interests, has just finished a concrete dam, 330 ft. high and 700 ft. long, the largest in the world, with an electric power plant producing to-day about 20,000 H.P. In the same district a French concern is building in the Pyrenees another hydro-electric plant, to bring 30,000 additional H.P. into the industrial district of Barcelona.

The principal industries in Spain, up to the present, have been the following:—Mining, textiles, lace, sugar, cement and gypsum, pottery, the steel industry of Toledo and Eibar, and shipbuilding. A prominent industry created in Spain in recent years is the railroad and tramway car-building industry. There are five factories in Spain, two of which are very important: Barcelona and Bilbao possess large blast furnaces and steel mills manufacturing rails, structural shapes, steel and tin plate.

An important automobile factory, turning out one of the best-known cars in Europe, exists in Barcelona, and a new truck factory is now under construction for the purpose of building 2,000 trucks and tractors per year.

In the Barcelona district alone the following new industries, with products for which the country always has been dependent on Germany, England and other countries, have been created: rolling mills for sheet-metal and structural shapes, tin plate, factories producing enamels and ironware, electrical supplies and motor factories, textile machinery, machine-tool woodworking and metal-working machinery. New plants have been erected, and several million francs have been invested in these new industries lately. In the last two years several new factories have been created with the exclusive object of specialising in the manufacture of machine-tools, chiefly lathes, drilling machines and presses. In electrical material, lighting fixtures, large motors and generators, Spain has always been entirely dependent upon Germany and France for her supply. The Government intends to promote the installation of all kinds of industries supplying the country's needs in electrical material.

The industrial awakening of the country will, for the next 10 years, necessitate the establishment of factories that will require raw materials and machinery, tools and equipment.

* *American Machinist*. Extracts from an address delivered by H. S. Moos before the Foreign Trade Bureau of the Cincinnati Chamber of Commerce.

Low-Priced Lighting Fittings of Steel.—The *Electrical World* says that a brisk demand for low-priced lighting fittings has led a number of fittings manufacturers to place on the market a new line of fittings of the same design and appearance as expensive fittings, but produced to sell at a very low price. The secret of the low price is steel. In place of brass, which is used in the more expensive fittings, pressed steel with a brass finish is employed. This increased demand is coming from the labouring people, who during the last year and-a-half or more have been earning high wages. The demand for more expensive fittings has fallen off perceptibly, since the buyers of this class of goods are the salaried men. The labourer, however, has now more money than he ever had before, and consequently one of the trades to feel this increased buying power is the fittings trade.

Electrical Enterprise in Spain.—Under the style of Sociedad Espanola de Construcciones Electromecanicas, a company has been formed, with a capital of 25,000,000 pesetas, for the erection of works at Cordoba for the construction of all kinds of electrical machinery; 15 hectares (37 acres) of land have been acquired, and the aim of the promoters will be to render Spain independent of foreign importations. The capital is mainly Spanish, but French and English support is included, and apparently German, as the firm of Bauer is mentioned. The French promoters include the Creusot establishment, the firm of Fougere, and the Union Parisien Bank.

Peat Fuel at Moscow Electricity Works.—The Assistant Minister of Trade and Industry, N. N. Savin, has proposed to the Provisional Government to grant a loan of 2,000,000 roubles to the Elektro-peredatch (Electrical Transmission) Co., Moscow, for a period of nine months, at 8 per cent. annual interest. The memorandum accompanying the proposition states that the company delivers 40,000,000 kw.-hours per annum, almost entirely for industrial purposes, the fuel for the production of which consists of the company's peat deposits. In the current campaign the company contemplates using 113,000 tons of air-dried peat, and the wages of the peat workers have risen about threefold. It is the increased wages list, that necessitates the advance of cash asked for. The difficulties of the company were further accentuated by the Revolution having broken out just when the station was in course of construction, and the plans made earlier for financing the concern could not be carried out, owing also to the proposed elimination of foreign capital interests. The Minister adds that last year 70 per cent. of the work done by the company was for the national defence, and a considerable percentage of the energy delivered by the Moscow 1886 Company could, if the peat were properly exploited, be delivered by the Elektro-peredatch, and a corresponding consumption of petroleum be avoided. For the reasons stated, the Ministry considers that the loan requested should be granted.

Large Gas Engines in U.S.—The opinion seems prevalent, based probably on conditions a few years back, that the large gas engine is rapidly on the decline, and will soon be a thing of the past. Therefore, many will be surprised to learn that there are now in course of construction a large number of these units for at least four of the biggest steel plants in the country. Some of these engines will be of more than 1,000 H.P., and will be employed both for blowing and for driving electric generators. It appears then that the large gas engine business was merely lying dormant, awaiting the impetus to the steel industry which has been supplied by the conditions arising out of the war.—*Power*.

Volunteer Notes.—COUNTY OF LONDON VOLUNTEER ENGINEERS (FIELD COMPANIES).—Headquarters, Bahlerton Street, Oxford Street, W.

Orders for the week, by Lieut.-Colonel C. B. Clay, V.D., commanding:—

Monday, August 13th.—Technical instruction (searchlight) for No. 3 Company, Right Half Company, at Regency Street. Drill, No. 3 Company, Left Half Company, Signalling Class. Recruits' Drill, 6.30.

Tuesday, August 14th.—Lecture, 6.30. Physical drill and bayonet fight ing, 7.30.

Wednesday, August 15th.—Drill and elementary bridge construction, No. 1 Company, Right Half Company.

Thursday, August 16th.—Drill and elementary bridge construction No. 2 Company, Right Half Company. Ambulance Class.

Friday, August 17th.—Technical instruction (searchlight) for No. 3 Company, Left Half Company, at Regency Street. Drill, No. 3 Company, Right Half Company. Signalling Class. Recruits' Drill, 6.30.

Musketry.—All N.C.O.'s and men who have signed the "A" and "B" agreements are required to attend during this month to re-classify in order to enable the Corps to obtain the Capitulation Grant. Preference will be given to these men in firing.

Armlets.—The new issue armlets can now be obtained at Headquarters, and every enrolled man must obtain one without delay, and all old (red) armlets must be returned to the Orderly Room.

Note.—Unless otherwise indicated, all drills will take place at Headquarters. (By order) MACLEOD YEARSLEY, Adjutant.

Parliamentary.—The Electric Lighting Orders Confirmation Act, 1917, and the Companies (Particulars as to Directors) Act, 1917, have received the Royal Assent.

The Engineers' Award.—The Leyton Council raised a point as to whether the Committee on Production award applied to electrical workers, and has received the following letter from the secretary of the Committee on Production:—

"In reply to your letter of July 17th, the findings of the Committee on Production to which you refer affect directly only the establishments of members of the Engineering Employers' Federation, the arbitration proceedings in each case having been between the Engineering Employers' Association and the Trade Unions.

"The question of the application of those awards to a certified municipal electricity undertaking is not one upon which this Committee is able to advise. The Committee is an Arbitration Tribunal, and it can deal only with cases that are referred to it by the Ministry of Labour."

Electro-Culture.—As previously mentioned in these columns, Mr. E. M. Ashley, of Southport, is experimenting with electro-culture on an allotment at Crowlands, and expresses himself as confident in its success. He records good results with early crops, and mentions that the cost of electricity is about 1d. per day.

A similar experiment of a more ambitious nature is being undertaken by the Liverpool authorities at Calderstones Park, where an acre of ground has been initially equipped. The crops comprise a variety of vegetables and oats, and some 300 sq. yards of the ground is being treated on allotment lines, a similar control plot being provided for purposes of comparison. Although the experiment has only run a few weeks, the electrified crops have a healthier appearance than those in the control area.

In North Wales, an electro-culture equipment has been set up by Sir Thomas Roberts in his vegetable gardens at Plasbryn, Carnarvon. The equipment is run from a 220-volt circuit supplying the house, and the discharge wires are fixed at a height of 7 ft. above the ground. It is stated that the energy supplied to the primary terminals is 450—460 watts per acre, and also hinted that the owner contemplates experimenting with field crops later on.

National Insurance (Unemployment) Acts, 1911 to 1916.

—**Unemployment Insurance.**—A. The Umpire has decided that contributions are payable in respect of:—

2,366 X. Students at technical institutes receiving training under arrangements made by the Ministry of Munitions.

B. The Umpire has decided that contributions are not payable in respect of:—

2,364 Workmen engaged wholly or mainly in wolfram streaming.

2,365. Workmen engaged wholly or mainly in printing, enamelling, varnishing, or similarly treating tin-plate prior to its being cut into sizes suitable for making boxes or canisters.

The Electrolytic Pickling of Steel.—Messrs. M. De K. Thompson and O. L. Muhlman, in a paper read before the American Electrochemical Society, state that all iron and steel objects which in the process of manufacture have been heated in the air are covered with "fire scale," which is an oxide of iron. This has to be removed before the surface can be plated or galvanised. The usual practice has been to immerse the objects in some acid until the scale is removed by the hydrogen formed by the action of the acid on the iron beneath the scale, which it reaches through the cracks in the scale. The action which would be expected if a sheet of iron covered with scale were used as a cathode in an acid solution is a reduction from a higher to a lower oxide. This oxide would be dissolved by the acid. There would also probably be a certain amount of chemical action between the iron under the scale and the acid, as in the purely chemical treatment. It is this action which the electrochemical process attempts to avoid as much as possible. The method of comparing the two operations consisted in treating two similar mild steel plates by the two methods until their appearance showed that the pickling was completed. In two experiments the saving effected, in acid and the amount of iron removed, for every 2,000 lb. of iron, including the cost of power, was about \$70, and in a third about \$50. These results point to important economies that may result from the adoption of the electrolytic method.—*Franklin Inst. Journal*.

A Log of Domestic Electricity Supply.—A recent article in the *Electrical World* contained some detailed figures as regards the daily use of domestic appliances by a family of two. A separate meter was installed for each of 10 different devices, another meter on two little used devices, and another for lighting. All cooking and heating of water was done electrically, but the water was heated, as required, by an immersion heater, which is said to act rapidly enough to make a fair substitute for a permanent hot water supply. It was impossible to segregate energy used for heating water, but the energy so used would be proportional to the number of times the disk stove and immersion heater were used for water heating, and this indicated a consumption for water heating of 375 kw.-hours, or 25 per cent. of total energy used for all purposes. The use of one outlet per device worked well, except for the immersion heater and the installation of a suitably worked double-throw switch, obviated the necessity of two outlets for this device.

The article contains tabulated data in regard to ratings and consumption for the year, month, &c., and number of times the device was used. Twelve lamps of 530 watts were in use, and 171 kw.-hours were consumed during the year. Percolator and samovar: used 81 times; 9 kw.-hours used. Toaster stove: used 351 times; 39 kw.-hours. Frying pan: used 586 times; 122 kw.-hours. Immersion heater: used 910 times; 272 kw.-hours. 9-in. disk stove: used 171 times; 371 kw.-hours. Oven: used 238 times; 129 kw.-hours. Fan: used 30 times; 1 kw.-hours. Sewing-machine motor: used 61 times; 2 kw.-hours. Iron: used 107 times; 51 kw.-hours. Bathroom radiator: used 18 times; 22 kw.-hours. The total connections made for using this apparatus (apart from lighting) were 2,856, which represents an average of 161 kw.-hour used for each connection. The total kw.-hours used for all purposes were 1,498.

The maker's rating in watts of the above apparatus was:—Percolator, 140; samovar, 110; toaster, 500; frying pan, 660, 330, or 165; immersion heater, 600; disk stove, 1,200, 600, or 300; oven, 2,000, 1,000, or 500; 12-in., three-speed fan (no loading given); sewing machine motor, $\frac{1}{2}$ h.p.; iron, 150; bathroom radiator, 1,500, 750, or 375 watts.

It will be noted as one would expect, that the oven and disk

stove used the bulk of the energy—i.e., 429 and 374 kw.-hours respectively; the immersion heater used only 272 kw.-hours. The bathroom radiator, though, it only accounted for 22 kw.-hours during the year, took 18 kw.-hour on the average each time it was used.

Attention is drawn to the value of the figure for average consumption of all appliances (3461 kw. hours) each time apparatus was used, and it is remarked that such devices as fans, sewing-machine motors, heating pads, &c., do little to increase the energy used, though they serve to popularise electric service.

Porcelain Pyrometer Tubes.—For the purpose of protecting thermo-couples at furnace temperatures the tubes made of Marquardt refractory porcelain by the Royal Berlin Porcelain Manufactory have proved very successful, as is shown by the experience of many years. These protection tubes, owing to war conditions, are now not obtainable.

The need of effective protection for the costly platinum and its alloys so extensively used in pyrometry prompted investigation and manufacture in the United States. The Ceramic Section of the National Bureau of Standards carried on experiments for the purpose of reproducing, and, if possible, of improving upon the Marquardt porcelain. The result was a highly refractory product which, though made entirely from American raw materials, was found to be of most excellent quality. The manufacture of this porcelain was taken up by the Stupakoff Laboratories of Pittsburgh, Pa., who successfully overcame the unavoidably attendant difficulties, and brought on the market a protection tube under the name "Usalite."

It is claimed by the manufacturers that tubes of this material will readily withstand exposure to temperatures exceeding 1,650° C. A highly refractory glaze covers the surface of the outer pyrometer tubes, in order to make them impervious to gases of combustion.

Usalite tubes, when withdrawn from white-hot furnaces, and brought into the open air, neither broke nor cracked. The smaller diameter unglazed tubes effectively withstood sudden exposure to highest temperature. A glazed outer tube heated to 1,100° C. readily withstood the introduction of cold steel rod of nearly the same diameter as that of the bore of the tube.—*Met. and Chem. Engineering*.

Electric Loom Brake.—Mr. J. F. Crowley, Blackwater Mills, Rathmore, Co. Kerry, has been granted a patent (106,663) for an invention relating to electric and magnetic brakes. A solenoid is energised to take off the brake when the motor switch is closed, and the switch is held closed by a trigger device which can be released manually, or by a safety device on the (electrically-driven) loom, or by failure of the current. The solenoid may be short-circuited after the brakes have been taken off thereby, and the brakes may be held off by a second trigger, which may be connected to the switch-trigger device.

A Cardiff Electrical Dispute.—Mr. McWhirter presided at a special conference, held on Friday at Cardiff, concerning the strike of about 300 members of the Cardiff Electrical Trade Union. Members of this body met the representatives of the National Federated Electrical Association and Mr. Palgrave Simpson, head of the labour and wage section of the Ministry of Munitions. The whole matter of the dispute was carefully considered. The statement of the members of the Trade Union is that an award was made on June 8th placing the electricians on the same level as the allied engineering trades. The men came out owing to a different reading of the awards granted by the Committee on Production on this date, which gave the men 12s. per week more than pre-war rates. Consequently, notice was tendered to the employers that labour would be withdrawn if the awards were not observed. As the notice terminated on Thursday, about 300 men came out on strike. It has been stated that notice was also tendered to the Ministry of Munitions, but this is denied by the members of the National Federated Electrical Association. In the afternoon session the employers and Union representatives met, and the men agreed to resume work, the matter being referred to the Chief Industrial Commissioner (Sir George Askwith), with a view to arbitration as early as possible.—*Western Mail*.

Appointments Vacant.—Dynamo attendants (38s.) for the Manchester Corporation Electricity Works; shift engineer, for the City of Peterborough Electricity Department. See our advertisement pages to-day.

London Association of Foremen Engineers.—A set of rules for conducting the business of meetings has been drafted and printed.

Electro-Chemically Produced Petrol.—In view of the scarcity and high price of petrol in this country at the present time, it is interesting to learn from New York that Mr. Louis Bond Cherry, who is described as a member of the American Institute of Electrical Engineers and of the American Electro-Chemical Society, is stated to have invented an electro-chemical process for producing synthetic petrol from kerosene or paraffin, at a cost of 3d. per gallon. Mr. Cherry describes his process as the successful application of the electromagnetic theory of matter by mixing hydrocarbons; it is also stated that an experimental plant capable of converting 60,000 gallons per day has been established, where 78 per cent. of the kerosene treated has been converted into petrol of a sufficiently high quality to run the engines of motor vehicles. It is added that further experimental work is in hand in connection with the proper length and diameter of the treating chambers.

Electric Steel.—In the issue of *La Nature* for July 14th, a description is given of the work being carried on at the Keller factory at Livet for the production of "synthetic pig-iron." As long ago as 1908, M. Keller took out a patent for a process of manufacturing synthetic pig-iron, consisting of the introduction of measured quantities of carbon and silicon into a molten bath of steel turnings. In order to improve the method, the Keller Co. was formed in 1915. The first work was the manufacture of steel-quality iron for shells. The works were extended, and this work was carried on more extensively. In the latest development M. Keller melts the turnings by the continuous process, in special electric furnaces, to obtain a steel with a carbon and silicon percentage higher than that finally required. The steel which is worked up is transferred to a refining furnace. With the new method the advantages are two. In the first place, the desulphurised and supercarburised steel, containing any required proportion of silicon, is obtained by continuous fusion, with maximum thermal efficiency, in the electric furnace. The work does not require the employment of specialists, and the energy consumption per ton does not exceed 600 kw.-hours. Secondly, the refining furnace gives a good yield per hour. The dephosphorisation process is carried out in a second operation. M. Keller has generously placed his invention at the disposal of the French Government, and a national factory has recently been erected somewhere in France to produce 300 tons per day.

Northampton Polytechnic Institute.—Particulars of the Engineering Day Classes and Courses in Technical Optics for the next session appear in our "Official Notices" to-day.

Australian Brown Coal Deposits.—The recent report of the Brown Coal Sectional Committee of the Institute of Victorian Industries, which has been investigating the utilisation of the Victorian brown coal deposits, much in the same way as the Canadian Advisory Council on Industrial Research, is doing in connection with the immense lignite deposits of the Dominion, contains some interesting features. The following is a synopsis of data contained in the report:—

Brown Coal Uses.—(1) To supply electrical power to Melbourne and other parts of the State; (2) briquette making for household and other requirements; (3) producer gas, town gas, tar and its derivatives, ammonia, and coke.

Power Production.—The Melbourne City Council and Melbourne Electric Supply Co. can at present supply a maximum of 28,000 h.p. Requirement in 1925, estimated from normal increase, 120,000 h.p. This estimate is for Melbourne alone, and does not allow for new industries made possible by cheap power. Electrolytic treatment of zinc concentrates may absorb 200,000 h.p.

Costs.—Newcastle slack coal costs 20s. per ton. Estimated cost of Morwell coal, 2s. 3d. per ton at mine. Morwell coal, with 40 per cent. moisture, has 0.116 the heat value of Newcastle coal. Electrical energy produced at Morwell by 5s. 5d. worth of brown coal equals amount produced in Melbourne from 20s. worth of Newcastle coal, and can be transmitted to town at about half the fuel cost of the latter. Victoria pays 10s. more per ton for black coal than New South Wales. The electrical power scheme will remove this handicap.

Briquetting.—Morwell briquettes need no binder, and can be produced at from 11s. to 13s. per ton. They can be sold to householders in Melbourne and suburbs at about 24s. per ton, as against 24s. 6d. for wood, 32s. 6d. for coke, and 35s. for black coal. Estimated cost of single-press plant, £15,000 to £20,000.

The report goes on to recommend that immediate State action be taken:—(1) to confirm estimates in regard to public power requirements, and the best means of satisfying these by electrical energy generated from brown coal; (2) to decide what authority shall do the work, and when; (3) to obtain estimates of the cost of:

(a) 50,000-kw. plant at Morwell, and of similar plant at Altona, with transmission line, &c., in each case.

(b) Opening up workings at Morwell, and equipping them to produce coal for a 50,000-kw. power station, and to supply 120 tons of briquettes a day.

(c) A briquetting plant, starting with a one-press unit of 60 tons a day capacity, with arrangements for ultimate expansion to six or seven presses.

(4) That two experts should be sent abroad immediately to investigate latest power plant practice, and equipment necessary to secure full utilisation of Victorian brown coal resources.

The State Cabinet has now decided to obtain the advice of a committee of experts, including Mr. H. R. Harper, city electrical engineer, Melbourne; Mr. W. J. Clements, manager Melbourne Electric Supply Co.; Mr. W. Stone, electrical engineer to the railways; and Mr. H. Herman, of the Geological Survey: on the best means of developing the deposits.

Fatalities.—An inquest was opened last Saturday regarding the death of Private Samuel Cowsill (23), 6th Manchester Regiment, who had been sent as an electrical engineer to work in connection with the installation at a new munition factory. On August 2nd, while engaged in wiring 20 ft. above the floor, he was using a blowpipe, which burst and burnt him severely about the face and chest. He fell in a heap on the floor, and was taken to the infirmary, where he died next day. The inquest was adjourned till August 10th, so that the Factory Inspector and witnesses could attend.

An inquest was held at Liverpool concerning the death of George Ferdinand Corfe (28), who was killed at Bibby's Copper Works, Garston, where he was working a pneumatic hammer. According

to the *Liverpool Courier*, the air compressor was driven by electricity. The fuse-box was about 10 ft. from where he was working, and he was found dead in a crouching position on the floor with a fuse holder in his left hand. It was presumed he had gone to the box to replace a fuse, and had received a shock. This, it was stated, was no part of his duty, and the men were warned against interfering with the electrical installation. The jury returned a verdict that death was accidental and was due to electric shock, caused by deceased interfering with the fuse-box.

American Electric Brougham Test.—Our contemporary, the *Electrical Review and Western Electrician*, contains particulars of a speed and endurance test carried out with a Baker R and L stock vehicle, between Atlantic City and New York, under the auspices of the New York Electric Vehicle Association. The time taken was 5 hours and 58 minutes, showing an average running speed of 20.5 miles (33 km.) an hour, over the journey of 123.5 miles (199 km.). The entire distance was covered with the car running at fifth and sixth speeds. One of the startling disclosures brought out by this trip was that the energy used cost less than half the price of gasoline for the same work. Some 283 ampere-hours were used, or an average of 2.29 per mile (1.41 per km.), which at 5 cents (2½d.) per kw.-hour—the maximum charging rate in New York—would make the cost \$1.55 (6s. 6d.).

Time Signals by Electric Lights.—A new kind of time signal has recently been installed at the Hector Observatory, Wellington, New Zealand. Three electric lamps are mounted in a vertical row on the Observatory flagstaff, 6 ft. apart; the lowest green, the middle red, and the highest white. The lights are switched on 50 minutes, 10 minutes and 5 minutes, respectively, before the hour of the signal, at which hour they are all extinguished simultaneously. The signals are given at 20 hours, 21 hours and 22 hours, Greenwich mean time.—*Scientific American*.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station and Tramway Officials.—Blackpool Electricity Committee has considered an application from the Coal Mines Department of the Board of Trade for the services of Mr. CHARLES FURNESS, the borough electrical engineer, in rendering part-time assistance in visiting certain local authorities in Cumberland and North Lancashire with the object of discussing fuel economies and submitting reports thereon to the Board. The matter has been left to Mr. Furness to act as he may think best.

Burnley T.C. is increasing the salary of Mr. H. MOZLEY (general manager of the tramways department) from £450 to £500 per annum.

On Tuesday, the Exeter City Council unanimously adopted a resolution expressing entire confidence in Mr. MUNRO, electrical engineer, and warm appreciation of the ability he had displayed in the management of the undertaking. This decision was taken in justice to the engineer after the vote at a previous meeting, when, by 23 to 19, it was decided to reject the unanimous recommendation of the Electricity Committee to advance Mr. Munro's salary of £175 per annum. Ald. Reed (Chairman of the Committee) said that body had not met since the Council dealt with the matter, but the members were very angry at the way they had been flouted, and it was quite possible they might resign in a body by way of protest.

Sunderland T.C. on Wednesday agreed to the application of the Board of Trade (Coal Mines Department) for the partial use of the services of the general manager of the electricity department, temporarily, in connection with economy in coal consumption.

Mr. REGINALD XENAKY, lately of the Yorkshire Electric Power Co., has been appointed technical assistant to the station superintendent at the Salford Corporation electricity works. Mr. FRED VALENTINE, of Salford, has been appointed secretary to the borough electrical engineer.

General.—The Controller of Coal Mines has appointed Mr. FRANK PICK, commercial manager of the London Electric Railways, as his assistant to deal with matters in connection with the London coal distribution scheme.

At the head office of Messrs. Ellis & Ward, Ltd., Portugal Street, Kingsway, on July 31st, Mr. C. W. V. CLARKE, London manager, and Mr. H. FOWKES, of the engineering staff, the former having completed 21 years and the latter 22 years of continuous service with the company, were presented with gold half-hunter watches with engraved inscriptions. Mr. H. Willoughby Ellis, managing director, made the presentation.

Mr. A. W. ASHTON, D.Sc., M.I.E.E., has been appointed Principal of the Mechanical and Electrical Engineering De-

partment of the Stoke-on-Trent Central School of Science and Technology.

Lieutenant J. S. B. PLUMMER, who has just returned to France, joined the Surrey Yeomanry (Queen Mary's Regiment) at the outbreak of war, and later transferred to the Leicestershire Regiment, from which he was recommended for a commission. Lieutenant Plummer was formerly a representative of W. T. Henley's Telegraph Works Co., Ltd., in the Midlands.

SAPPER HARRY JONES, of the 3rd Electrical Section, R.E., who before the war was partner in the firm of Frederick Thomas & Co., asks us to state that he is not the Sapper Harry Jones whose death has occurred at Longmoor. He is well, and usefully employed in France.

Roll of Honour.—Private A. COYLE, of the Manchester Regiment, killed in action, was with Messrs. Brankingham Bros., electrical engineers, Sunderland.

Lieutenant J. N. PAYNE, who joined the South African Infantry as a private, and who has died of wounds received in action in East Africa, was formerly on the staff of Messrs. Bruce Peebles, Ltd., of Edinburgh, and just prior to the war he accepted a position at a power station at Johannesburg, South Africa.

Armourer's Mate A. J. WALLACE, who was lost by the explosion on H.M.S. *Vanguard*, joined the Navy whilst with Mr. W. D. Willson, electrician, of Croydon.

Gunner A. HOLT, aged 22, of the R.F.A., who has been killed in action, was employed at the United Electric Car Works, Preston.

Private B. METCALFE, K.O.Y.L.I., who has died in a French hospital, was formerly an electrical engineer in the employ of the Belfast City Tramways Co.

Private E. FRAME, of the King's Liverpool Regiment, killed in action, was employed by Messrs. Ward & Goldstone, Salford.

Second-Lieutenant O. V. MOSELEY, Lancashire Fusiliers, attached King's Liverpool Regiment, wounded and gassed, is the well-known North of England and Lancashire County lacrosse player. Before the war he was a representative of Messrs. C. Macintosh & Co., Ltd., electric wire and cable manufacturers.

Private R. C. STOCKWELL, Manchester Regiment, who has died from wounds received in action, was employed by Messrs. Dorman & Smith, Ltd., of Salford.

Gunner W. J. WOLSTENHOLME, R.F.A., reported wounded in action, was employed by Messrs. Jones Bros., electricians, Blackpool.

Sergeant S. WARD, South Staffs. Regiment, who enlisted from the Rugby works of the B.T.H. Co., has been awarded the Military Medal for gallantry.

Private W. H. DYCE, City of London Rifles, killed in action, was on the staff of the Ilford U.D.C. electricity works.

Private J. FLETCHER, North Staffs. Regiment, who has fallen in action, enlisted whilst with Messrs. Siemens Bros., Ltd., of Stafford.

Private R. HOLMES, Northumberland Fusiliers, who has fallen in action, was on the staff at the York Corporation electricity works.

Private J. ENTICOTT, Oxford and Bucks Light Infantry, employed at the Rugby works of the B.T.H. Co., has gained the Military Medal for gallantry whilst acting as a stretcher bearer.

Private T. CUNNINGHAM, Lancashire Fusiliers, killed in action, was on the staff of the Manx Electric Railway Co., Douglas.

Company-Sergeant-Major FENTON, of the Lancashire Fusiliers, a tramcar driver in the service of the South Lancashire Tramways Co., has been appointed to a commission as second lieutenant in the 3rd King's Liverpool Regiment. He joined up on the outbreak of the war, having been discharged on pension after a period of 21 years 150 days with the Colours. He saw service in the Dardanelles campaign, was subsequently transferred to Kantara, Egypt, and then to France.

Private L. SMITH, Scots Guards, who was employed at the Electrical & General Stores, Leeds, has been killed in action, aged 20.

Captain L. A. F. FOERS, who was articled as an electrical engineer to Mr. Priestley, the manager of the Mexborough and Swinton Tramways, has been wounded in action. Some time ago he was awarded the Military Cross.

We regret to learn that Captain JAMES GRIMSHAW CUNLIFFE, M.Sc. (Tech.), A.M.I.C.E., A.M.I.E.E., of the Manchester Regiment, died of wounds on August 1st. Three weeks ago he was awarded the Military Cross for bravery. Captain Cunliffe was educated at Acerrington Technical School and the Manchester School of Technology. After taking his degrees he entered the service of the Manchester Corporation tramways, attaining the position of assistant electrical engineer. He went from Manchester to a similar position at Birmingham, remaining there until the war broke out. Joining the Victoria (Manchester) University Officers' Training Corps in August, 1911, he received his commission in one of the Manchester Regiments ("Pals") on their formation. Besides being an active member of the Manchester Section of the Institution of Electrical Engineers, Captain Cunliffe was joint author with his brother, Mr. R. G. Cunliffe, M.Sc. (Tech.), in the publication of papers read before electrical associations.

NEW COMPANIES REGISTERED.

Etablissements de Dion Bouton Société Anonyme (1,596f.).

Particulars filed July 28th, 1917. Registered in France, January 28th, 1908, to exploit and develop the factories and undertakings founded by De Dion Bouton & Co., and carry on the business of manufacturers of and dealers in motors, mechanical implements, motor chassis, &c., and also to carry out transactions in metallurgy and various branches of the electrical industry. British address: 10, Great Marlborough Street, W. Messrs. Kenneth Brown, Baker & Baker, of Lennox House, Norfolk Street, W.C.2, are authorised to accept service.

Piggott Electrical Co., Ltd. (148,132).—Private company.

Registered August 1st. Capital, £5,000 in £1 shares. To take over the business of the Piggott Electrical Co., the Piggott Conduits & Cable Co., and the Piggott Electrical Lift Co., carried on by George and Sarah Piggott at 24, New Bridge Street, E.C. The subscribers (each with one share) are: Geo. E. Piggott, 24, New Bridge Street, E.C.4, electrical engineer; Sarah Piggott, Loxwood, Woodcote Avenue, Wallington, Surrey. Permanent governing director, Geo. E. Piggott. Registered office: 24, New Bridge Street, E.C.

Brodmins, Ltd. (148,137).—Private company. Regis-

tered August 2nd. Capital, £2,000 in £1 shares. Electro platers, electro depositors of metal or other substances, enamellers and finishers of china, porcelain, earthenware, pottery, and glass, gold and silver refiners, gold and silversmiths, jewellers, manufacturers and dealers in novelties and fancy goods, metal toy manufacturers, &c. The subscribers (each with one share) are: F. H. Pepper, 34, Waterloo Street, Birmingham, solicitor; J. E. Smith, 78, Springfield Road, King's Heath, Birmingham, cashier. First directors are to be appointed by the subscribers. Registered office: 34, Waterloo Street, Birmingham.

S. T. Taylor & Sons, Ltd. (148,146).—Private company.

Registered August 2nd. Capital, £15,000 in £1 shares. To acquire the business carried on at Scotswood-on-Tyne as S. T. Taylor & Sons, and to carry on the business of manufacturers of and dealers in non-conducting cements and other coverings suitable for boilers, pipes, heated and other surfaces, and the insulation of ships, refrigerators, and buildings of all descriptions, builders' contractors, mechanical, electrical, aircraft, heating, and sanitary engineers, manufacturers of and dealers in chemicals, oils, colours, cements, and varnish, motor-car manufacturers, &c. The subscribers (each with one share) are: E. Taylor, Roseworth, Whickham, Co. Durham, cement manufacturer; S. T. Taylor, Holmroft, Grange Road, Newcastle-on-Tyne, cement manufacturer. The first directors are E. Taylor and S. T. Taylor, each of whom may retain office while holding 1,000 shares. Registered office: Tynes Works, Scotswood-on-Tyne.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Lamplough & Son, Ltd.—Satisfaction in full on July 10th, 1917, of mortgage dated May 16th, 1916, securing £1,200, has been filed.

Mander & Co., Ltd.—First mortgage debenture dated July 20th, 1917, to secure £400 and interest charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Minnie Gertrude Mander, 38, Davey Road, Perry Barr, Birmingham.

CITY NOTES.

Crompton and Co., Ltd.

At the annual meeting, last week, the chairman said that he was sorry that they were not able to present at that meeting the accounts for the year ending March 31st, 1917, but, in deciding to postpone their publication, they were following the example of many other companies which, like themselves, were controlled establishments. He was able to say, however, that the turnover showed a very satisfactory increase on that of the previous year. Unexecuted orders at the works at the close of the year represented a very large amount—greater, in fact, than the total annual output a couple of years ago. The company's profit-earning capacity likewise continued to expand. With their increasing turnover, and with the continued rise in price of material, they still found it necessary to be conservative in the matter of distribution of profits, quite apart from the fact that they had the important question of war taxes to bear in mind. They felt, nevertheless, quite justified in recommending a distribution of 5 per cent. on the ordinary shares, in addition to the preference dividend. There was much talk of Labour unrest, but the relations between their company and its employees during the year had been entirely satisfactory. They had added considerably to the number of women employed—they were doing excellent work. Many of the staff at the works had had to put in long hours, but they had done it with a willingness which was much appreciated. If ever the employees had merited their thanks it was in respect of the work done in the past year. To Mr. Reeves, the managing director and secretary, and to Mr. Britten, the works manager, and now a director, were due their hearty thanks. To these two gentlemen, loyally supported by their efficient staff, was to be attributed the general improvement in the company's position. They had sustained a loss in the death of Mr. E. J. Erskine, their Aus-

tralian manager, who had been the head of the Sydney office for over 20 years. With regard to the future, they had plenty of work in hand, and this should mean satisfactory profits for the current year. They would publish the accounts for last year as soon as possible. No pains were being spared to arrive at final figures which they could place before them. In regard to the question of war taxation, this country was, in effect, a gigantic trading concern, and one result of the war was to dissipate a very large amount of the working capital of that trading concern. When the working capital of a business was reduced, that business was no longer able, with its smaller working capital, to do the volume of business that it previously carried on without embarrassment. It followed, in his opinion, that when the war was over very great efforts would be required of the commercial community to restore and augment the trade of the country. The Government, in their policy of war taxation, were paying too little attention to this all-important matter of the future rehabilitation of the country's trade, and he sincerely hoped that the many efforts which had been made by commercial men to impress upon the Government the importance of this point would not be without some effect.

French Companies.

The accounts of the *Société Westinghouse* for 1916 show net profits of £76,000, as compared with £12,000 in the previous year, and with the amount brought forward the balance available is £101,000, as against £58,000 in 1915.

La Société des Câbles Berthoud-Borel reports net profits amounting to £18,200 for 1916, as contrasted with £7,900 in the preceding year, the balance forward raising the sum available for distribution to £26,000. It is proposed to pay a dividend of £1 12s. per share, and to carry £13,000 forward.

The *Société des Tramways de l'Est Parisien* reports that the continuation of the war placed a heavy burden on the results in 1916. Although the traffic showed an improvement over the preceding year, the company was confronted with a considerable increase in the working expenses, owing to the advancing cost of labour and materials, and the profits consequently underwent a marked decline as compared with 1915. The directors had applied to the Prefect of the Seine for compensation in the form of a request to increase fares, but had not obtained any satisfaction. The profits amounted to £32,000, as compared with £48,000 in 1915, and after meeting compulsory charges, taxes, &c., the balance of £17,000 has been transferred to the renewal fund.

The report of the *Ateliers de Constructions Electriques du Nord et de l'Est, of Jeumont-Nord*, reminds the shareholders that as the company's works were situated in enemy occupied districts it was impossible to submit accounts for 1916, as in the previous year. Every effort had been made by the directors to keep themselves informed of the state of their works and installations during the occupation, but communication had become more difficult and uncertain in recent months, and the information obtained from various sources was frequently mostly of limited accuracy. However, there was reason for believing that most of the plant and supplies at the works had been carried off by the enemy, although the company would only know definitely the exact situation when the district had been evacuated. The equipment of the workshops at Saint-Ouen had been increased, and the results hitherto had been satisfactory. The directors were chiefly preoccupied with maintaining their plant which could subsequently be transferred to Jeumont, in order that the latter works might be put in a condition to resume working as soon as possible.

The *Société Parisienne pour l'Industrie des Chemins de Fer et des Tramways Electriques*, which is a promoting and investment company with an ordinary share capital of £2,000,000, reports that the financial results in 1916 were again affected by the consequences of the war, and the situation was substantially the same as in the previous year. A large number of the industrial establishments and tramways established or developed by the company were still occupied by the enemy, and information could only be given concerning the others, which experienced more and more the influence of the excessive rises in the prices of coal and other raw materials. Among these undertakings are mentioned the *Société d'Electricité de Paris*, the *Tramways de Paris*, the *Chemin de Fer Métropolitain*, the *Société d'Electricité pour la Russie*, the *Chemins de Fer Economiques du Nord*, and the *Cairo Electric Railway and Heliopolis Oases Co.* The accounts for 1916 close with a credit balance of £106,000, of which the balance forward represents £87,000. After meeting general expenses the balance of £98,000 has been carried forward to the next account.

The directors of *l'Eclairage Electrique* state that new manufactures were undertaken in 1915-16 at the instance of the Munitions Department, and the company's works, especially at Lyons, had been largely extended. The number of workers exceeded 18,000, of whom 41 per cent., or over 8,000, were women. Extensions were also made at the works in the Rue Lecourbe, where the construction of electrical machinery had been resumed with great activity, whilst at the same time continuing the production of equipment for the various munition works. The Lorraine workshops at Jarville, although partly occupied by the military authorities for the repair of motor lorries, had nevertheless resumed the con-

struction of electric motors. A foundry added to these shops had rendered useful services to the company's other works for the manufacture of machine parts, engine parts, and lathes; a steel plant had also been started, and orders were being executed for dynamo steel and steel for machine guns; and an electric furnace was in process of erection for the production of tool and special steels. Land had been purchased for the extension of the works in the Rue Bolivar in order to increase the output of cables and wire; the production of war material at the Colombes works had been augmented, whilst more active demands were experienced every day for tubes and small appliances, and it had been also necessary to embark on the manufacture of electrical apparatus which were hitherto only made abroad, in order to meet the requirements of customers. The works in the Avenue de Choisy had also been enlarged. The net profits are returned at £150,000, and after transferring £90,000 to the general reserve fund the balance has permitted of the payment of a dividend of 10 per cent. for 1915-16.

The Swiss Brown Boveri Co.—The report of Brown, Boveri & Co., of Baden, states that the pressure of orders continued throughout the financial year 1916-17, notwithstanding the advance in sale prices. On the other hand, the greatest difficulties were experienced in obtaining supplies of raw materials, especially in the second half of the year, when deliveries from Germany considerably decreased. As a consequence, it was impossible to reach the former level of production in peace times from the standpoint of quality, but the turnover financially and the results corresponded to normal years. The activity of the company, it is said, was again restricted solely to the branches worked in peace times. All the foreign manufacturing undertakings associated with the company had yielded satisfactory results. In the case of the electricity supply works a great demand for energy prevailed, and the sales showed a considerable increase. The cost of production in the case of the hydro-electric works remained within the customary limits, but the steam generating stations suffered from the extraordinary rise in the cost of fuel, which could scarcely be equalised by an advance in the charges for current, as these were mostly fixed by contracts of long duration. The conditions created by the war had brought forward in Switzerland the importance of the greater utilisation of water power and of electric railway working. It was recognised specially in regard to the latter that military considerations were not against electrification if it was compared with the danger of the complete dearth of coal in the case of steam railways. Unfortunately, a great obstacle to rapid progress was found in the difficulties in carrying out new installations and the provision of the machinery. In the matter of the conversion of the St. Gothard railway to electric traction, the report mentions that the Ritom power station was in course of construction and trial locomotives were on order; but it could not be foreseen when the latter would be completed. The accounts for 1916-17 indicate gross profits of £332,000, as contrasted with £454,000 in the preceding year. After defraying general expenses, and setting aside £106,000 for depreciation, as against £53,000 in 1915-16, the accounts show net profits and balance forward of £122,000, as compared with £106,000. It is proposed to pay a dividend of 7 per cent. on the ordinary share capital of £1,280,000, this contrasting with 6 per cent., 5 per cent., and 5 per cent. in the three previous years respectively. The share capital is now to be increased to £1,440,000 by the issue of new shares for £160,000.

Spain.—The *Compagnie Generale Madrileña d'Electricité*.—The French committee of holders of bonds in this Madrid company, whose financial troubles were referred to in this journal on February 16th in the present year, announce that the French Government have offered to purchase these bonds at the price of 440 pes. net per bond. Those holders who accept the offer, which the committee consider to be advantageous to the owners, are requested to deliver the bonds to the *Société Générale* or to the *Banque Périer* as soon as possible. The intervention of the Government is due to the circumstance that the purchase and re-sale of the bonds will have a favourable influence on the rate of exchange by procuring capital for French national needs in the Spanish market, and the committee recommend the holders to co-operate with the Government in the matter, they, at the same time, mentioning that it has only been possible to offer the price of 440 pes. per bond by reason of the rise in the peseta in relation to the franc, which increase appears momentary, and will disappear.

Consolidated Electrical Co., Ltd.—The accounts for the year ended March 31st show an available sum after providing for general charges and including £3,159 brought forward, of £6,716. A dividend of 2½ per cent. has been declared, the same as for 1915-16, leaving £3,066 to be carried forward.—*Financial Times*.

Waste Heat & Gas Electrical Generating Stations, Ltd.—Interim dividend of 2½ per cent. for the half-year ended July 31st, less tax.

Willans & Robinson, Ltd.—The "Financial Times" reports that holders of "B" preference stock of Willans and Robinson have received an offer from Dick, Kerr & Co. of 50 6 per cent. cumulative preference shares and 20 ordinary shares in that company, or, alternatively, £65 in cash in exchange for each £100 of "B" preference stock held. The offer will remain open until 30th proximo.

Kensington & Knightsbridge Electric Lighting Co., Ltd.—Interim dividend, 3 per cent. on the ordinary shares for the June half-year.

Calcutta Electric Supply Corporation, Ltd.—The number of units sold to consumers during the five weeks ended June 1st, 1917, amounted to 2,700,256, compared with 2,482,756 units in 1916.

Montreal Tramways Co., Ltd.—Further dividend of 2½ per cent., making 10 per cent. for the year.

Vickers, Ltd.—Interim dividends for the June half-year: 2½ per cent. (less income-tax) on the preferred 5 per cent. stock and 5 per cent. preference shares; 1s. per share (free of income-tax) on the ordinary shares.

STOCKS AND SHARES.

TUESDAY EVENING.

HOLIDAY influences are the main factor in Stock Exchange markets. Evidently a good many people extended the Bank Holiday for a day or more longer; at all events, the attendance in the Stock Exchange is certainly less than it has been of late. The possibility of another new loan, so far from having any adverse effect upon investments stocks, seems to be somewhat inspiring, because the gilt-edged markets are so firm as to reflect strength into other investment departments, and once again the scarcity of floating stock is prominently noticeable.

Marconi shares underwent a sharp reaction when it became known that the Government had commandeered the overseas service of the company. This announcement, with its abrupt 24 hours' notice, coming on the top of a report which was considered disappointing, caused a good deal of selling of the shares, the price of which has fallen 3/16 to 2 15/16. The preference are also ½ down at 2½, and all the recent buoyancy has been wiped out. On the fall, however, cautious bargain-hunters appeared, and moderate purchases were made by those who contend that the Government payment for services since August, 1914, is bound to be a substantial one. The yield on the shares comes to over 5 per cent., and the dividend is still included in the price.

The cable group is as strong as ever. Globe ordinary shares at 12½ are ½ up. Eastern ordinary, Eastern Extensions and Westerns held their recent rises, and it is pointed out that on the quartet just mentioned an average return of 5½ per cent. is obtainable, which is equal to 7½ per cent. on taxed dividends.

Naturally, it does not stand to reason that because companies have paid their dividends tax free in the past, they will continue this practice indefinitely; and the example of several big industrial concerns is quoted as a warning to undue optimism in respect of these cable and manufacturing companies' shares. As we have pointed out in the past, however, there can be little doubt but that they will do their utmost to maintain a long tradition; and as the trend of investment at the moment is set strongly towards the shares of companies which do distribute their dividends tax free, there is not likely to be any diminution in the strength of the stocks of the companies concerned.

India-rubber shares are another 5s. up, but still the yield of 7½ per cent. is certainly tempting, being equivalent to 10 per cent., less tax. The Telegraph Construction return of 6½ per cent. is equal to over 8 per cent., less tax. The same trend has assisted a further recovery in the income bonds of the Underground Electric Railways of London. Whereas the price fell 5 to 79 on the declaration of the dividend, it has now rallied to 81½, this including the 2 per cent. net due in three weeks' time, and so affording a clean return of 5 per cent. on the money.

Metropolitan Railway ordinary hardened to 22½, in sympathy with improvement in Home Railway stocks as a whole—due mainly to the pronounced firmness of gilt-edged issues. Districts remain at 15½.

Interim dividends by the Home Electricity companies are sufficiently satisfactory to have brought fresh buyers into the market. Charing Cross ordinary at 3½ show a rise of 5s. St. James' are ½ up at 6½. It is a little curious to notice that both the ordinary and preference of the Charing Cross Co. yield the same amount. Business is quiet in this department, where buyers, however, are more conspicuous than sellers.

The foreign groups are colourless, and news from Mexico is anxiously awaited. Brazilian Tractions stick at 50. The Argentine Tramways market is a shade firmer, without, however, affecting nominal quotations. No recovery has yet started in British Columbia Electric Railway issues.

General Electric ordinary have improved to 16, and the

preference maintain their rise to 10½. Miscellaneous shares are firm throughout. In the Rubber market, the price of the raw material improved to half-a-crown per lb. without inducing any appreciable increase in business. There is nothing of fresh interest in the markets for base metal descriptions, and the armament group is good, without showing much change.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.			Price Aug. 7, 1917.	Rise or fall this week.	Yield p.c.
Dividend					
1915. 1916.					
Brompton Ordinary	10	9	6½	—	£8 18 6
Charing Cross Ordinary ..	5	5	8½	+ ½	6 13 4
do. do. 4½ Pref. ..	4½	4½	8½	—	6 13 4
Chelsea	4	3	2½	—	5 4 4
City of London	8	8	12½	—	6 5 6
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
County of London	7	7	11½	—	6 4 5
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
Kensington Ordinary	7	10	5½	—	5 11 7
London Electric	8	8	1	—	Nil
do. do. 6 per cent. Pref.	6	4	8½	—	5 6 8
Metropolitan	8	8	2½	—	6 0 0
do. do. 4½ per cent. Pref.	4½	4½	8½	—	7 4 0
St. James' and Pall Mall ..	8	8	6½	+ ½	5 18 5
South London	5	5	2½	—	7 5 6
South Metropolitan Pref.	7	7	21½	—	6 10 8
Westminster Ordinary ..	7	7	6½	—	6 1 9
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	97½	—	6 2 9
do. do. 89/8 ..	89/8	1½	22½	—	6 16 4
Chile Telephone	8	8	7	—	5 14 4
Cuba Sph. Ord.	5	5	8½	—	6 17 8
Eastern Extension	8	8	14½	—	5 11 4
Eastern Tel. Ord.	8	8	143½	—	5 11 6
Globe Tel. and T. Ord. ..	7	7	12½	+ ½	5 9 10
do. do. Pref.	6	6	10½	—	5 15 8
Great Northern Tel.	22	24	86	—	6 13 4
Indo-European	13	13	52½	—	6 3 10
Marconi	10	15	2½	—	5 2 0
Oriental Telephone Ord. ..	10	10	2½	—	3 16 5
United R. Plate Tel.	8	8	6½	—	5 0 9
West India and Pan.	6d.	6d.	1½	—	1 12 0
Western Telegraph	8	8	14½	—	5 10 4
HOME RAILS.					
Central London, Ord. Assented	4	4	61½	—	6 10 1
Metropolitan	1	1	22½	+ ½	4 8 6
do. do. District	Nil	Nil	15½	—	Nil
Underground Electric Ordinary	Nil	Nil	1½	—	Nil
do. do. "A"	Nil	Nil	5½	—	Nil
do. do. Income	6	4	81½	+ ½	4 18 2
FOREIGN TRAMS, &c.					
Dividend		1915. 1916.			
Adelaide Sup. 6 per cent. Pref.	5	5	5	—	6 0 0
Anglo-Arg. Trams, First Pref.	5½	5½	2½	—	9 11 4
do. do. 2nd Pref. ..	5½	—	2½	—	—
do. do. 5 Deb. ..	6	5	68	—	7 6 6
Brazil Tractions	4	4	50	—	—
Bombay Electric Pref. ..	6	6	10	—	6 0 0
British Columbia Elec. Rly. Pice.	5	5	50½	—	9 19 0
do. do. Preferred ..	Nil	Nil	80½	—	Nil
do. do. Deferred ..	Nil	Nil	27½	—	Nil
do. do. Deb. ..	4½	4½	55	—	7 14 7
Mexico Trams 5 per cent. Bonds	Nil	Nil	36	—	Nil
do. do. 6 per cent. Bonds	Nil	Nil	30	—	Nil
Mexican Light Common ..	Nil	Nil	14½	—	Nil
do. do. Pref. ..	Nil	Nil	22½	—	Nil
do. do. 1st Bonds ..	Nil	Nil	89½	—	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	5½	—	4 17 10
British Aluminium Ord. ..	7	10	30½	—	6 13 4
British Insulated Ord. ..	17½	20	12½	—	7 16 0
British Westinghouse Pref.	7½	7½	2½	—	5 17 2
Callenders	20	20	14½	—	7 0 6
do. do. 5 Pref. ..	5	5	4½	—	6 1 8
Castner-Kellner	22	22	8½	+ ½	6 10 2
Edison Swan, fully paid ..	—	—	1½	—	Nil
do. do. 4 per cent. Deb.	4	4	70½	—	6 18 6
Electric Construction ..	7½	7½	1½	—	8 0 0
Gen. Elec. Pref.	6	6	10½	—	6 17 1
do. do. Ord. ..	10	10	16	+ ½	6 5 0
Henley	25	25	16	—	7 16 8
do. do. 4½ Pref. ..	4½	4½	4	—	5 12 6
India-Rubber	10	10	19½	+ ½	7 11 0
Telegraph Con.	20	20	38½	—	6 5 2

* Dividends paid free of income-tax.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of wheels.	Total to date.		Route miles open.
		£	£		£	£	
Bristol (Trams) ..	July 27	23,939	+2,926	30	165,146	+19,479	80½
Cork	" 27	2,634	+ 303	30	15,743	+ 997	9·89
Dublin	" 27	30,603	+2,850	30	194,584	+22,119	64·25
Hastings	" 29	6,952	+1,067	80	32,833	+ 5,641	19·8
Lancashire United	" 25	11,778	+8,907	80	64,897	+12,879	42
Llandudno-Col. Bay	" 20	1,833	— 88	83½	8,678	— 680	6·6
Anglo-Argentine ..	" 29	198,402	+3,930	30	1,635,461	+ 7,070	—
Ankanda	June 30	23,693	+1,888	62	282,694	+ 7,981	26·69
Calcutta	July 81	18,438	+ 20	—	—	+ 1,846	—
Kalgoorlie, W.A. ..	April	2,705	—	17	10,101	—	20·5
Madras	June 30	4,809	+ 840	26	27,227	+ 2,638	—
Montevideo	July	28,697	+8,877	39	271,998	+ 5,106	—
Dublin-Lancan Rly.	June 16	806	+ 145	24	8,404	+ 896	7

TRADE IN SOUTH AFRICA.

A summary is given below of certain sections of the recently-issued report* of H.M. Trade Commissioner in South Africa, which will be of interest to the electrical and allied trades:—

It is hardly an exaggeration to say there is no engineering industry in South Africa. The operations of the iron foundries, such as exist, are almost entirely confined to repairs and replacements, mainly in connection with the gold mines; and engineering establishments similarly deal with repairs and erection of imported machinery. There are now two rolling mills, one of which is successfully coping with a seriously felt want in light rails, but even these are at present dependent for raw material on scrap iron and steel, chiefly obtained from the railways. The necessity for having local supplies of pig-iron has become more than ever obvious as the result of the war. It seems, however, unlikely that any steps can be taken at present to utilise the iron ores of the Transvaal. The war has made it even more difficult to obtain machine tools than industrial machinery, so that it has not been possible to make a start, for which such an excellent opportunity presented itself, in engineering work, such as locomotive building.

Apart from mining there is an exceedingly limited demand for machinery. The most noticeable fact is the absence of engineering works. Power is at present very little used by the farmer or pastoralist in South Africa as compared with Australia or New Zealand, and the importation of small gas and oil engines for use on farms is exceedingly small. Another surprising feature is the very limited use of coal gas, either for lighting or heating. This is no doubt due in the Cape Province to the high price of coal, which has to be brought by sea from Natal, or by rail from the Transvaal. Competition has no doubt greatly reduced the cost, but electricity had too long a start to be displaced. Electricity may be said to have matters all its own way in practically every centre. In the direction of meat packing there is promise of great development.

There is little to be said regarding public engineering works. Several water and sewage schemes are pending. In relation to the Cape Town water supply, the expert committee has reported the proposal to add a hydro-electric installation to be impracticable. Any electrical development which may come later, such as electrification of suburban railways, will be in the direction of a new power station.

Supplies of electrical apparatus, &c., previously obtained from Germany, have been furnished by the United States and Japan, into whose laps an unusually large share of the trade of South Africa has fallen during the past two to three years. In respect of machinery, however, South Africa, as is pointed out elsewhere, is a peculiarly small buyer apart from mining requirements. There is no scope of importance for the cheap American gasoline engine, stationary or marine, because so few engines of this kind are required. There is a restricted market for wood-working machinery, and for heavy machinery generally there is no partiality for American makes, so that little business has been given across the Atlantic. Unfortunately, urgent necessity seems likely to cause the purchase of locomotives required by the South African railways from America owing to British makers being engaged on war work. The requirements of the gold mines have been specially arranged for by the Ministry of Munitions, and the transference of orders to the United States has consequently not been large.

As regards industrial machinery, refrigerating plant, woollen or paper mills, cement-making plant and the like, it is essential that manufacturers should realise the elementary facts in relation to countries such as South Africa, which are—apart from mining—only on the threshold of industrialism. Apart from the engineers actually engaged in direct connection with established factories, there are practically none who are specialists in connection with any particular industry. There are, for instance, only two firms manufacturing cement, one woollen mill, two match factories, and no paper mills at all in the country. A glass factory and a coal-tar distilling plant were set up, and subsequently shut down. Even industries such as wood-working, laundries, and others which are carried on in most populous centres are few and on a small scale; and it may fairly be said that no one of these could provide enough business to justify anyone who wished to make a living in specialising. Consequently, manufacturers of plant, if they desire business, must be prepared to provide the expert knowledge themselves. If necessary, they must be ready to send men out to assemble, install, and start up such machinery as they sell. They must, at least, always provide complete working drawings, and full explanations, such as any mechanical engineer without specialist knowledge can understand and work on. Further, it must be borne in mind that inquiries usually come from people who have no engineering knowledge at all, and whose first question is: "How much capital would it require to set up such-and-such an industry?" Some British firms fully understand this, and go to enormous trouble to work out specifications on a basis of a minimum output which could be produced with reasonable economy; but many more obviously do not.

A subsidiary point is the need for British manufacturers

to keep themselves fully posted as to local conditions, such, for instance, as the effect of the high altitudes and low atmospheric pressures on prime movers, both steam and internal-combustion engines, and the areas of South Africa where such altitudes are to be found. The frequency and violence of thunderstorms, the destructive effect of the climate on many kinds of timber, as well as the depredations due to insect life are other points in this category. Many of these important factors are taken for granted by those who live in a country as matters of common knowledge, and they do not always remember to point them out in their inquiries for plant.

Yet another matter to bear in mind is the backward condition of engineering, and consequent difficulty and expense of getting repair work or replacement carried out in many centres. It is, therefore, of vital importance that those lapses which manufacturers are too often inclined to deny should not take place, and that the reliability which they claim for their foremen, their testing and packing staff, and for their system generally, should stand good in all circumstances.

Satisfactory agency arrangements in the case of industrial machinery constitute a very difficult problem. The mining industry is on such a large scale, and is, on the whole, so much centralised, that it has been found possible to organise supply with extreme efficiency and economy. In the case of general industrial machinery, on the other hand, the opposite is the case. Those firms which are qualified to handle such inquiries are to some extent overloaded already, and it is a little doubtful to what extent any of them are in a position to look for business, or still less to create openings. For instance, in connection with the frozen meat industry, much can be done in actually providing the initiative and the suggestion leading to the formation of companies. To study local conditions and economies, and then come forward with a practical working scheme and knowledge as to the capital required, may at least accelerate the formation of such undertakings, and will certainly go a long way to secure goodwill. Manufacturers may further interest themselves financially in such ventures without necessarily taking up the whole financial burden.

There is very ample room for a group or groups of manufacturers of industrial machinery of all kinds, woodworking, machine tools, textile, &c., to have their own representatives on the spot, not only to look for business and deal with inquiries, but to look for possibilities and actually prompt inquiries. To leave this work to busy indent agents, already pre-occupied with local interests of all kinds, seems to the Commissioner unsound. With more initiative, more business can be created, and industrial development can be accelerated. A commission basis in this work also is wrong. Representatives should be good trained men, tactful, and energetic; but it is essential that they should not be deterred from seemingly thankless pioneer work by being dependent for a living on quick results. Nor must they be in the position of having to spend money themselves on travelling long distances to follow up inquiries, with a feeling all the time that it is a gamble whether there will be business to pay for the journey. The representative must be well paid with salary and expenses, and he must be able to have permanent headquarters. In connection with mining, many firms send out their own expert representative, and attach him to the staff of their local agents. This is an excellent arrangement, and a similar plan might be adopted in the case of industrial machinery, except that the representative would probably have to look after the interests of a home group instead of a single firm. For instance, a group might be formed to cover all the industries connected with, and derivative from, frozen meat, makers of abattoir plant, refrigerating machinery and ammonia compressors, disintegrators and fertiliser machinery, and by-product recovery. Fell-mongers' machinery has in the past come chiefly from Germany and America. The making of glue and gelatine, tanning and currying, are similarly allied to the slaughter of cattle, and wool scouring and drying lead easily on to carding and spinning. In this way a very considerable range of machinery could economically and efficiently be not merely represented, but actively pushed. The initiative for forming such groups must come from manufacturers themselves.

REVIEWS.

The Year Book of Wireless Telegraphy and Telephony, 1917. 928 pp. London: Wireless Press, Ltd. Price 3s. 6d. net.

The fifth issue of this well-known year-book has been considerably extended in point of size, and still more so in point of matter contained—both remarkable achievements in these days of printing difficulties, paper restrictions, and price. Nor is there any lack of improvement in quality, but the price of the volume remains the same, and might be called ridiculously low were one not so thankful to obtain anything at once cheap and good in these days! The task of reviewing so compendious a work is best attacked by giving some indication of the scope of its three main sections, viz., the reference section, the technical section, and the special contributions.

The reference section is naturally much the same as in

* Cd. 8,614. Price 3d.

previous years, but has, of course, been brought up-to-date. The "record of development," which is necessarily far from complete since August, 1914, nevertheless contains a number of items for 1916 which bear eloquent witness to the extended use and incalculable possibilities of wireless telegraphy. Amongst the items which have hardly been noticed in the stress of war by others than those directly affected are the part played by wireless during the Irish rebellion (when the English cable was cut); the compulsory licensing for wireless of every British-registered vessel of 3,000 tons or over; and the establishment of commercial radio-service across the Pacific. Partly in order that the latter achievement may be appreciated more fully, the "wireless map" in the year-book is in the form of a duplicated Mercator, showing the Far East as reached by both eastern and western routes.

The reprints (translated where necessary) of the world's wireless laws and regulations have been revised in accordance with the amendments made by certain British dependencies and foreign countries during 1916, and the function which the year-book discharges in thus providing a reliable collection of all national and international regulations and agreements, is of great utility, for it facilitates enormously the establishment of world-wide consistency and the observance of all special requirements.

The list of land and ship stations is unique and invaluable, and is as complete as it can be under present conditions. We would again suggest that the notes on nature of service would be more convenient if arranged at the foot of each page instead of being at the end of the list. We trust that it will soon be possible to record in this list a large number of stations open for public wireless telephone service. Whilst mentioning wireless telephony, we would again urge that a reasonable proportion of the year-book be devoted to this important subject. Possibly the fault is ours, but so far we fail to find any other mention of wireless telephony than in the title of the year-book and in a few items in the record of developments. In view of the achievements of 1915 it is hardly conceivable that there is nothing which might usefully be said concerning wireless telephony in 1916. Probably the truth of the matter is that it would be too *useful*—to the enemy!

The standard features of the technical section have again been revised and brought up-to-date. In addition to the chapter on international time and weather signals, there are many pages devoted to useful data, and to a very valuable collection of useful formulae and equations which has been revised by Dr. Erskine Murray. The same authority has also compiled a glossary of terms used in wireless work, combining the glossary issued in previous editions with definitions derived from other European sources, and with the definitions evolved by the American Institute of Radio Engineers. The result is a table which it is hoped "will find acceptance on both sides of the Atlantic." Our old friend, the five-language dictionary of wireless terms, again appears, and very welcome it is; but why have not the Russian equivalents of the words been added? Surely, the time is ripe for that addition. The catalogue of wireless telegraph patents has been brought up to date, and other similar lists which are so invaluable for reference purposes are the bibliography of books and periodicals in all languages dealing with wireless matters, and the directories of wireless societies and of companies engaged in the commercial development of wireless. The ever-extending collection of portraits and biographical notices forms in itself a sufficient testimony to the status and world-wide development of wireless telegraphy.

Turning now to the special contributions, these include some articles of technical interest and some of general interest, and are alone worth the price asked for the whole volume. A summary is presented of Judge Mayer's decision in the Fleming Valve-De Forest Audion action, which decision constitutes an education in itself on the subject of detectors, and is regarded as one of the finest technical decisions ever promulgated. Dr. Fleming writes with characteristic thoroughness on the electric arc as a generator of persistent oscillations; Dr. Eccles contributes a fine monograph on the peculiar action and immense possibilities of ionic valves; Prof. Howe writes on the inductance, capacity, and natural frequency of aerials; and Dr. Marchant deals with what is commonly known as the "Heaviside layer"—that hypothetical, but probably existing, ionised layer of the upper atmosphere which offers so much in the way of explaining why signals can be sent across the Atlantic from and to aerials only a few hundred feet high, round or over a wall of water and earth nearly 100 miles high. Mr. C. H. Taylor's experience in the construction and working of American long-distance stations enables him to write with authority on this subject, and, whilst his article will be found instructive by the specialist, even those readers with little technical knowledge will also be able to profit from his lucid exposition.

Of Imperial interest are the tales of "wireless heroism," recounting the deeds of operators who were singled out for official recognition last year. "The Wireless Drama," by A. Noyes, describes one "incident" in which a U-boat was thwarted by wireless; the achievements of wireless telegraphy are surveyed by P. W. Harris; and a list is given of vessels which have figured in disasters where loss of life has been prevented or mitigated by "wireless to the rescue." In concluding these remarks, which do less than justice to a most

fascinating and valuable volume, we may mention that the map showing the wireless stations of the world has been improved, not only by enlargements, but also by printing in red those stations which are open for ship and shore communication.

Primary Batteries: Their Theory, Construction, and Use. New and enlarged edition. By W. R. COOPER, M.A., B.Sc. London: The Electrician Printing & Publishing Co., Ltd. Price 12s. 6d. net.

Since 1901, when the first edition was published, Mr. Cooper's "Primary Batteries" has deservedly been regarded as the standard book on this subject. While in the intervening 16 years no radical developments have taken place either in the theory or in the main types of primary batteries, considerable improvements in details of construction have come about, and for the book to maintain its position, at least on the descriptive side, it was essential to bring it up to date. This Mr. Cooper has done with the same care and discrimination as were displayed in the original compilation.

In the first five chapters, which cover the theory of the subject, few changes or additions are to be noted. True, the electron theory has become of outstanding importance since the date of the first edition, but, as the author remarks, while it gives us a simple way of looking at some of the phenomena, it does not add directly to our knowledge of primary cells—except in the rather special case of selenium cells.

Among the newer types of one-fluid cells described (Chapter VIII) is the interesting Benkö bichromate cell, in which polarisation is eliminated by forcing the electrolyte or allowing it to diffuse through the carbon negative plate. Descriptions of improved forms of the Edison-Lalande cell, the Columbia Track, largely used in America, and the Neotherm cell, and an account of Bellini's interesting cell in which the positive plate is amalgamated lead and the electrolyte a mixture of sulphuric and nitric acids, have also been added to this chapter. A further important addition is a section on the effect of the physical quality of manganese peroxide on its depolarising power, and the Post Office specification for Leclanché cells is also a new and useful feature of this chapter. New matter in the following chapter, dealing with two-fluid cells, includes an account of the Bleek-Love, an Australian cell with zinc/lead-peroxide elements, the E.M.F. of which, 2.5 volts, is higher than that of any other primary cell.

Dry cells (Chapter X) are of particular importance at the present day, when enormous numbers are being manufactured daily for use in pocket flashlamps. It is a curious omission that the small cells used for this purpose are not specifically dealt with. Although they are, to be sure, merely miniature forms of the standard types of dry cells, they certainly present problems of their own which might have been discussed. Otherwise, this chapter is most informing, particularly on the question of tests, which is discussed somewhat fully. Included here are an account of the methods of testing standardised by the American Electrochemical Society, and the specifications on the same subject issued by the British Post Office. The chapter on standard cells (Chapter XI) has also been much enlarged and revised, the chief novel features being a full account of the latest practice in the preparation of the materials, and the assembling of Clark and Weston cells based on the methods employed at the National Physical Laboratory and the Bureau of Standards at Washington. The information in this chapter, as throughout the book, is brought home to the reader and rendered exact by constant reference to quantitative tests, and the book abounds in illustrative curves.

An entirely new chapter discusses the properties, theory, and uses of selenium cells, and very useful it is to have collected together the considerable amount of scattered information on this subject that is now available.

The last chapter, dealing with carbon-consuming cells, differs little from that in the first edition—a sad tribute to the disappointed hopes of many an ingenious inventor. The direct production of electricity from coal remains a dream of the future.

CANADIAN ELECTRIC COOKING NOTES.

THE recent business convention of the Canadian Electrical Association, at Montreal, dealt briefly, in one of its reports, with the question of electric cooking and heating, and its future development. This branch of supply business has been, to a large extent, "side tracked" in Canada, as in this country, by more pressing matters, but it is considered that it is now on a sound basis, and that electric cooking will be universally adopted within a very few years.

It is agreed that the range load will come in part on the peak of the average station, but that this will be more than offset by its demands at other times, particularly in the morning.

The maximum demand of a group of 20 ranges or more rarely exceeds 15 per cent. of the installed capacity, and this diversity reduces the additional investment of the station on account of the load, and ought to provide an incentive to supply authorities to

refrain from half-hearted methods of tackling the cooking problem.

The report to which we refer goes on to consider water heating, remarking that "one can scarcely be considered without the other, for very often the installation of an electric range means the removal of the old method of heating water for domestic purposes. While the load characteristics appear to oppose each other, they have a complementary effect in balancing the load curve. The peak of hot water heating often comes on as late as 10 p.m., where heaters are used to a large extent for dish washing and bathing.

"One of the principal member companies in Canada is engaged at the present time in working out a plan to sell, on a term basis, electric ranges connected up ready to operate. The same company already has in effect a water-heating proposition, under which they furnish, install, and connect water heaters for a definite sum. These heaters are arranged to be connected for 500 watts under a flat rate, and 2,000 watts through the meter. Current for the high heat is sold at the residence rate, the heater consumption usually being billed entirely on the third step of the rate, which is low.

"It is recommended that, so far as possible, water heaters installed in connection with ranges be placed on a double-throw switch, so that the water heater is not in circuit while the range is in use."

The water-heating problem has not yet met with a satisfactory solution in this country, one reason, no doubt, being that the coal range and boiler are fixtures, and are not removed from the premises when the electric range is installed, while another and more material reason is the lack of serious effort by supply engineers and electrical manufacturers to meet the competition of rival methods.

The following brief statements on the development of business represent the views of Canadian central station men in touch with the demands of the situation:—

"Central stations must plan to take care of as much business as gas companies have in ranges."

"Efficient salesmen specialising in the business of ranges must be employed."

"Educate the customer in efficient operation."

"A national publicity campaign on the ease, safety, cheapness, and other advantages which the electric range alone possesses."

"Central stations must sell service rather than KW.-hours and cooking rather than ranges."

"The fullest co-operation must obtain between the manufacturers, contractors, and central stations."

Attention is drawn to the cost of connecting ranges, which should be reduced.

Many companies are not prepared, so far as their circuits are concerned, to take on a cooking load without some additional expense, and it has been found that the costs for individual service range from \$75 to \$100, a figure which will decrease with numbers.

The Association is recommended to carefully investigate the question of keeping down distribution cost and providing satisfactory regulation.

In reference to range construction, it is pointed out that manufacturers are guaranteeing a life of 4,500-5,000 hours for heating units, which can readily be renewed.

The following features are regarded as essential:—

Indicating device to show whether current is "on" or "off."

Standard elements, quickly and cheaply interchangeable.

Oven construction such that it can be thoroughly and easily cleaned; a reliable thermometer.

Terminal contacts placed so as to give the minimum of trouble; separate fuses for each heater; and rigid frame construction.

In an address at the same Convention, Mr. Julian C. Smith referred to the time, five or ten years hence, when the average demand of the domestic consumer will reach 300 KW.-hours per capita, instead of 100 KW.-hours, which is considered the present average.

It is the fact that we have not sufficiently probed the electrical possibilities of the domestic consumer, and until we do so, it is impossible to estimate the probable effect of the domestic load on the station or even to frame a tariff which will result in the desired development.

A GRANULAR CARBON ELECTRIC FURNACE.*

By SAMUEL A. TUCKER,

A VERY useful furnace for maintaining temperatures considerably above those possible with the usual wire-wound furnace has been constructed in our laboratories (Columbia University).

The design here shown in figs. 1 and 2 is simple to construct, the parts are inexpensive, it will reach a high temperature in a short time, energy consumption is not great, and the heated space is perhaps larger than is usually found in such furnaces. One difficulty in using a circular granular carbon resistor is in the tendency to uneven heating, particularly at the start. This furnace is, therefore, provided with four electrodes, as shown in the sketch.

The furnace body, 12 in. × 12 in. × 9 in., is of fireclay, with an opening as shown. This particular shape was used because it happened to be in the laboratory; however, such a body could have been taken from one of the usual gas crucible furnace parts which are to be obtained on the market. Four holes are bored to admit the electrodes about 1 in. diameter to the open space B; this space is partitioned by the carborundum ring C, which is 1 in. outside diameter $3\frac{1}{8}$ in. inside and $3\frac{1}{4}$ in. high. This gives an annular space for the granular carbon connecting all four electrodes.

Granular carbon was obtained from the National Carbon Co., the size of grain being about 20 mesh, and was filled in to the top of the refractory ring.

The ring itself was constructed as follows (fig. 3):—Carborundum ground fine in a ball mill was mixed with 25 per cent. fireclay and

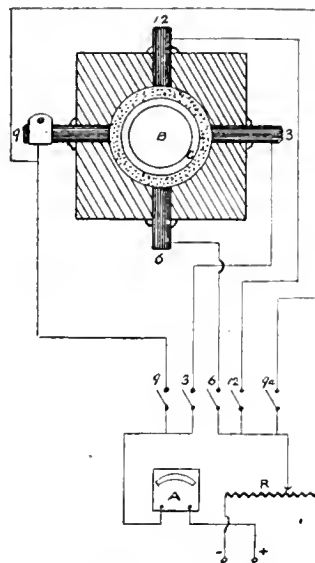


FIG. 1.—HORIZONTAL SECTION OF FURNACE.

enough water added to make a thick mass. This mix was then tamped into the cardboard mould shown in the drawing. The inner form at 1 and 2 is made by wrapping the cardboard on wood form 2, and holding it on the wood with small tacks or glue.

The outer form at 3 is also of cardboard held on the wood base projecting up inside the cardboard cylinder, as shown by the dotted line, and strengthened by the wood block at the top. In this way the form can be made quite strong enough, and, at the same time, is sufficiently porous to permit of the drying-out of the mixture. After thoroughly drying in a gas oven at 110° C., it is transferred to a gas muffle and thoroughly baked at a temperature of 900° to 1,000° C. The mould is, of course, lost, but it is so easily made that it is of little consequence. The ring so constructed is quite strong enough for the purpose intended, and the furnace cover, &c., may be made in the same way. Electrical connections are made as shown in the diagram from the five switches with wire of about 50-ampere carrying capacity. On closing switches 9, 3, 6, and 12 we have adjacent electrodes of opposite polarity, and a short time

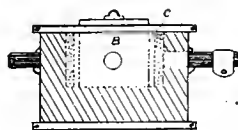


FIG. 2.—VERTICAL SECTION OF ELECTRIC FURNACE.

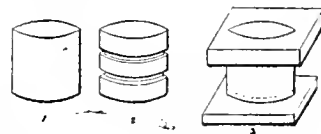


FIG. 3.—CONSTRUCTION OF RING.

will suffice to show whether the ring is heating evenly. Should this not be the case, and one quadrant appears to be too hot, this can be cut out by opening the switches for that position. When all have become evenly heated, 9, 6, and 12 are opened and 3 and 9A closed, by which arrangement it acts as a two-pole furnace, which is the normal manner of running.

The following figures give a run with such a furnace using direct-current at 120 volts through variable rheostats R:—

Time.	Amperes.	Volts.	Temp. deg. C.	Remarks.
9.30	25	—	—	4-pole
9.40	40	—	500	Changed poles to regulate
9.50	38	—	700	
10.00	12	—	720	2-pole
10.10	36	—	900	2-pole
10.20	18	98	1,000	2-pole
10.40	23	98	1,200	2-pole
11.00	24	98	1,300	2-pole
12.00	22	97	1,300	2-pole

The furnace was covered with a carborundum disk and further with asbestos board, with a small opening to allow the introduction of the thermocouple. In another case the furnace reached 1,400° C. in 45 minutes, using 50–60 amperes at from 51 to 53 volts.

* Metallurgical and Chemical Engineering.

It is necessary to have the electrodes fitted well to the openings provided in the body, and this can be done by wrapping with thin asbestos paper and luting with asbestos fireclay cement from the outside. Iron bands are necessary to clamp the body to prevent cracking.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

EXPORT PROHIBITIONS IN CERTAIN ALLIED AND NEUTRAL COUNTRIES.—The *Board of Trade Journal* has issued as a Supplement (in two parts) complete lists of the articles which are prohibited to be exported from the United Kingdom, Denmark, France, and Algeria, Italy, Japan, Netherlands, Norway, Portugal, Russia, Spain, and Sweden. Copies of the Supplement may be obtained, price 3d. each part (post free 3½d.), from H.M. Stationery Office, Imperial House, Kingsway, W.C. 2.

FRANCE.—The French Customs Department have recently issued a number of decisions regarding the classification of certain articles under the French Customs Tariff, among which the following are noted:—

Apparatus and machines for dissolving or softening rubber and gutta-percha—to be classed as apparatus not specially mentioned (number 525 *ser*).

India-rubber, not worked, mixed with indirect derivatives of coal tar—to be subject to duty, *on the whole weight*, as chemical products derived from products of the distillation of coal (number 280).

Asbestos substitute (admixture of mineral materials, cellulose fibres, and asbestos fibres)—to be classed as cellulose pulp, mechanical, dry (number 168).

PORTUGAL.—Some further restrictions on the exportation of certain goods from Portugal have been decreed since the issue of the Board of Trade Supplement above referred to. The new restrictions include asbestos in any form, and manufactures thereof; rubber wares, balata, gutta-percha, and other similar products in any form; chromium, manganese, molybdenum, mercury, nickel, titanium, vanadium, precious metals, and alloys thereof, in any condition; emery, corundum, natural and artificial (alundum), carborundum, and any other substance for similar use; ferro-silicon; graphite; electrical material suitable for use in war, and accessories and separate parts thereof. Exportation of any of these goods may only be effected under authority issued by the Ministry of Finance, and subject to the payment of any existing surtax on the goods.

UNITED STATES OF AMERICA.—According to a Treasury Department Circular recently issued, mail packages found upon examination to contain samples having a dutiable value of less than one dollar will be admitted free of duty, and no mail entry will be required. [This modifies the announcement in the *Review* of June 29th.]

ST. VINCENT.—A new schedule of import duties has been brought into operation by Order-in-Council, and took effect on April 1st last. An all-round increase in the rates of duty has been made, with the expressed purpose of increasing the revenue of the Colony. Hitherto the majority of goods imported have paid a general *ad valorem* rate of 10 per cent, for British goods and 12½ per cent, for foreign. The new rates are 13½ per cent, and 17½ per cent, respectively. The specific rates of duty, which are comparatively few in number, have been increased in the same proportion. Electrical machinery not on the free list accordingly will pay 13½ per cent, *ad val.* under the British Preferential Tariff, and 17½ per cent, *ad val.* under the General Tariff. [NOTE.—The free list includes telegraphic, telephonic, and electrical apparatus and appliances of all kinds for communication or illumination; also certain other classes of electrical machinery and appliances when not imported for sale.]

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

- 10,535. "Apparatus for electroplating articles having holes." G. L. A. R. B. COHEN AND PAUL BROS. & CO., July 24th.
- 10,575. "Circuit interrupting devices." BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO. (Westinghouse Electric & Manufacturing Co., U.S.A.), July 23rd.
- 10,584. "Dynamoelectric machines." S. F. BARKLEY & VICKERS, LTD., July 23rd.
- 10,587. "Electro-therapeutic apparatus." M. VERNON-WARD, July 23rd.
- 10,588. "Contact makers and interrupters for ignition systems." W. J. McLEESIE-JACKSON (Philips-Brinton Co.), July 23rd.
- 10,606. "Combined electric motor and generator." H. PEARCE, July 24th.
- 10,612. "Electric connecting clip." S. GEORGE & T. J. HICHINSON, July 24th.
- 10,615. "Magneto-electric machines for ignition in internal-combustion engines." M. S. CONRAD & C. C. PLECKETTE, July 24th.
- 10,616. "Electric starters for combustion engines." D. C. S. SANDMAN, July 24th.

- 10,630. "Condensers for ignition magnetos." M.-L. MAGNETO SYNDICATE and E. A. WATSON, July 24th.
- 10,642. "Contact Apparatus for magneto-electric machines." T. H. CLOUTIERO & F. SPURK, July 24th.
- 10,652. "X-ray tube stand and table." E. E. GRAVILLE, July 24th.
- 10,664. "Electrical appliances for igniting combustible gases." S. J. BENNETT, July 25th.
- 10,694. "Electrical drilling apparatus." H. SCHOLEY & F. N. WOODROOFE, July 25th.
- 10,704. "Electrical heating apparatus for aircraft." F. N. SHUMAKER, July 25th.
- 10,708. "Multiple-type fuses." E. S. CONRAD, July 25th.
- 10,709 and 10,713. "Prismatic glassware for illuminating." HOLOPHANE, LTD. (Holophane Glass Co., U.S.A.), July 25th.
- 10,737. "Insulating composition for magneto distributors." T. S. CHIVERS & C. MARTER, July 26th.
- 10,748. "Wireless signalling systems." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.), July 26th.
- 10,765. "Glassware for illuminating." HOLOPHANE, LTD. (Holophane Glass Co., U.S.A.), July 26th.
- 10,766 and 10,767. "Prismatic glassware for illuminating." HOLOPHANE, LTD. (Holophane Glass Co., U.S.A.), July 26th.
- 10,769. "Means for destroying submarines." GENERAL ELECTRIC CO., July 26th.
- 10,772. "Ignition current generators." L. J. LE PORTAIS, July 26th.
- 10,773. "Method of removing and replacing storage battery connectors." H. S. BOWLER & F. FREMMER, July 26th.
- 10,778. "Electrically-heated radiators." A. F. BERRY, July 26th.
- 10,779. "Electric heat radiators." A. F. BERRY, July 26th.
- 10,785. "Methods of forming and treating electric coils." J. W. HOBLEY, July 27th.
- 10,794. "Magnetising coils." AUTOMATIC TELEPHONE MANUFACTURING CO. and P. N. ROSEBY, July 27th.
- 10,813. "Magnetic drive for petrol pumps for aeroplanes." P. DELVES-BROUGHTON, July 27th.
- 10,817. "Operating electric switches from a distance." A. H. FRANKS and TELEPHOS DOMESTIC & STREET LIGHTING CO., July 27th.
- 10,822. "Electrical induction apparatus." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.), July 27th.
- 10,830. "Utilisation of high-frequency oscillations in wireless installations." D. W. BROWN, July 27th.
- 10,832. "Telephone transmitters." J. BIRRELL, W. BIRRELL & R. A. CAVENAGH, July 27th.
- 10,843. "Electric batteries." SYNDICAT GRAMMANS PATENTS, July 27th.
- 10,859. "Tramway systems and transporting goods thereon." P. KENYON, July 28th.
- 10,884. "Sparkign plugs." T. J. SIDDY, July 28th.
- 10,885. "Electric starters for internal-combustion engines." A. H. MIDGLEY & C. A. VANDERVELL & CO., July 28th.
- 10,889. "Insulating or covering materials." J. C. CRETS, July 28th.
- 10,896. "Electric switches." C. P. DRESCHE, July 28th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

- 2,636. LAMP GLOBES OR SHIELDS. T. Masuda, August 23rd, 1916. (107,602.)
- 4,407. ELECTRIC ENGINE STARTER AND ELECTRICITY GENERATING SYSTEMS. C. F. Kettering & W. A. Chrysler, October 11th, 1915. (101,784.)
- 9,246. MEASURING INSTRUMENTS, RELAYS, AND THE LIKE. Marconi's Wireless Telegraph Co. & H. A. Ewen, June 30th, 1916. (107,622.)
- 9,298. PROPELLING DEVICES. B. Schmelzer, July 3rd, 1916. (107,627.)
- 9,370. ELECTRIC LAMP AND THE LIKE GUARDS. St. Helens Cable & Rubber Co. & J. C. White, July 4th, 1916. (107,633.)
- 9,539. MEASURING THE FREQUENCY OF ELECTRIC CURRENTS. Marconi's Wireless Telegraph Co. & I. Shoenberg, July 6th, 1916. (107,647.)
- 9,541. ELECTRIC ROTARY CONVERTERS. British Westinghouse Electric and Manufacturing Co. (July 6th, 1915. (100,847.)
- 9,749. SPARK PLUGS. O. Baysdorfer & G. Baysdorfer, July 11th, 1916. (107,653.)
- 9,776. ELECTRICAL HEATING APPARATUS. A. M. Jane, July 11th, 1916. (107,655.)
- 9,825. ELECTRIC ACCUMULATOR CONTAINERS. B. M. Drake & D.P. Battery Co., July 12th, 1916. (107,656.)
- 9,926. ELECTRIC POCKET LAMPS. M. Steinman (E. Picard), July 14th, 1916. (107,658.)
- 10,038. PORTABLE DUST SUCTION APPARATUS. R. Haddan (Elektromekaniska Arkitektbolaget), July 17th, 1916. (100,954.)
- 10,072. ELECTRIC FUSES OR CUT-OUTS. L. Newitt, July 18th, 1916. (107,664.)
- 10,535. ELECTRIC RESISTANCES FOR COMPENSATING AND THE LIKE PURPOSES. J. E. Pollak (Soc. Anon. des Etablissements L. Bleriot), July 26th, 1916. (107,675.)
- 10,720. COMBINED STARTER AND LIGHTING DYNAMOS. A. H. Midgley and Vandervell & Co., June 28th, 1916. (107,680.)
- 11,055. ELECTRIC OSCILLATING OR WIRELESS SYSTEMS AND APPARATUS. Indo-European Telegraph Co. & A. H. Morse, August 4th, 1916. (107,682.)
- 13,659. CONTROLLERS FOR ELECTRIC MOTORS AND LIKE APPARATUS. G. Edison, September 26th, 1916. (Addition to 12,882/13.) (107,699.)
- 14,703. HOLDERS AND SUPPORTS FOR INCANDESCENT ELECTRIC LAMPS. H. C. Gabel, October 16th, 1916. (107,705.)
- 17,003. DETECTION OF EARTH CONNECTIONS IN ELECTRIC CABLES. G. Giles, December 9th, 1915. (102,621.)
- 17,436. ENERGY METERS FOR ALTERNATING ELECTRIC CURRENTS. Fabrique des Longines Franchillon & Co., April 22nd, 1916. (106,465.)

1917.

- 579. DOOR OPERATING APPARATUS. W. M. Hummel, January 11th, 1917. (107,731.)
- 3,958. MAGNETO-ELECTRIC GENERATORS. G. F. Cooke, March 19th, 1917. (107,741.)
- 5,753. IGNITION ARRANGEMENTS FOR INTERNAL-COMBUSTION ENGINES. C. F. Kettering & W. A. Chrysler, October 11th, 1915. (Divided application on 6,407/16.) (105,922.)

United States Training Camp Equipment.—The electrical requirements of the 16 great camps that are being established for the training of the new U.S. Army are outlined in the *Electrical World*. The principal items include 20,800,000 ft. (6,339,853 m.) of insulated wire, 260,000 ft. (79,248 m.) of lamp cord, 125,000 key sockets and shades, 150,000 cleat receptacles, 3,175,000 pairs of porcelain cleats, 1½ million porcelain tubes, seven million screws, 4,800 lb. (2,177 kg.) of solder, and other materials in proportion.

After the war, perhaps, we shall be able to give some particulars of the electrical work done in our own camps, which must have been on a colossal scale.

THE

ELECTRICAL REVIEW.

VOL. LXXXI.

AUGUST 17, 1917.

No. 2,073

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ELECTRICAL INTERCONNECTION IN LANCASHIRE AND CHESHIRE.

THE second report of the Committee for the Interconnection of the Lancashire and Cheshire Electricity Supply Systems, which we reproduce elsewhere in this issue, will be studied with great interest by electricity suppliers throughout the country. The Committee presented an interim report in September, 1916, which formed the basis of the Manchester Conference in March last: one result of this was a semi-official invitation to the Committee to work out the essential details of a scheme, which are embodied in the report just issued. The important feature of this report, to our mind, is that it presents concrete proposals to the electricity suppliers of the country—instead of the intangible nebosity which has so far enshrouded official deliberations on the matter.

It would be premature to suggest that the recommendations set forth—though they are made by authorities whose intimate knowledge of the inner working of both municipal and private electricity supply undertakings is beyond question—will result in unalloyed harmony amongst the many authorities with conflicting interests in the area concerned. To achieve such a result at all is an impossibility in an average community: but despite the difficulties which one may discern lurking in the background, there is sufficient in the second report of the Committee to form a working basis for a practical scheme of electricity supply on a scale which accords with modern ideas—one which provides for the evolution of electricity supply along well-recognised lines, with the least possible disturbance to financial and local interests.

The report, which should be studied in detail, is in two sections, the first portion dealing with the constitution and powers of a proposed Joint Board, representative of both local authority and company interests, and its powers—which practically amount to the general control of the operation of the generating stations in the area, the formulation of tariffs for bulk, stand-by, and reciprocal supplies, the allocation of financial charges incurred in giving such supplies, and the making of the necessary agreements between the various authorities. The Board would also act in an advisory capacity, and to facilitate its work it would be divided into four District Boards representing groups of undertakings, and these would elect a central executive, both the boards and the executive having various powers delegated to them. It is not proposed to invest the Board with any powers to raise capital, the present arrangement being regarded as sufficient "under existing conditions" and in view of the proposed allocation of expenditure between participating authorities.

Amongst other matters which we can only briefly mention are compulsory powers for wayleaves, and public road crossings: also powers to reimburse authorities who may

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.
The Oldest Weekly Electrical Paper. Established 1872.
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OFFICE 1-4, LUDGATE HILL, LONDON, E.C. 4.
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Telephone Nos.: City 997; Central 4425 (Editorial only).
The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 6d.; Canada, £1 3s. 10d. (\$5.80). To all other countries, £1 10s.

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4, Ludgate Hill, London, E.C. 4.

be adversely affected financially through co-ordination. The Committee records its opinion that *no direct profits* should be made on the class of supply dealt with in the report, except under special (and quite obvious) conditions; it further advocates the exemption from local taxation of interconnecting mains and plant, except where used for distribution purposes.

This section of the report deals with matters arising from the interconnection of supply undertakings, but the Committee recognises that this is but a first step, and that at the present rate of increase in the maximum load of the area dealt with, *i.e.*, 32,000 kW. per annum, the question of generating capacity must be considered, although not strictly within the terms of its reference. It therefore recommends in a supplementary section of the report that the Joint Board should have powers to erect new power stations and to acquire existing ones, considering it advantageous that the financial and controlling powers in the area should be centred under one owning and operating authority. In the case of companies it is suggested that this would probably involve purchase of their entire undertakings, though it should be noted that the Committee feels that the rights of statutory undertakings should be maintained as regards the distribution and sale of energy.

The Committee voices its agreement with the recommendation tendered to the Board of Trade Electrical Trades Committee advocating the appointment of a new tribunal consisting of a limited number of Electricity Commissioners, but suggests that the latter should be the central authority on technical matters, besides possessing all other powers now exercised by Government departments, or which may be conferred on them. The portion of the report dealing with the acquisition, &c., of generating stations has not been subscribed to by the three company representatives on the Committee, for obvious reasons; one municipal representative also disagrees with the further powers proposed for the Joint Board.

We have necessarily dealt somewhat cursorily with the report, which demands more leisure than we possess at the moment. To us it represents, on the whole, a carefully studied working scheme, drawn up with a view to furthering the national interests in cheap electricity supply, in the best of all possible ways, *i.e.*, by the mutual co-operation of existing supply authorities under expert guidance.

The L.C.C. Tramways.

THE question why the London electric tramway system, providing transportation for a population numbering some $4\frac{1}{2}$ millions, is barely able financially to keep its head above water, whilst the tramways of other great cities with less than a quarter of that population, such as Glasgow, Manchester, and Liverpool, not only cover all their expenses, including large allocations to the redemption of debt and the building-up of large reserves, but also contribute very substantial sums to the reduction of the rates, presents a serious problem for the consideration of the residents in the County Council's area of administration. It is a matter of considerable complexity, and no single cause can be assigned for the disappointing results that are annually made public. It must be admitted that the conditions obtaining in the Metropolis present wide divergences from those existing in any other British city, and consequently it is hardly possible to institute comparisons on an equitable basis; but even if the case of London be considered without regard to what can be done elsewhere, it is difficult to believe that the results so far achieved are the best attainable.

Perhaps the greatest misfortune that the system has suffered has been the fact that from the beginning it was the victim of political manœuvring and the sport of rival parties, not only in the Council, but also in the State. By the adoption of the underground conduit system, the consequences of which policy were foretold in our pages, the undertaking was saddled with a tremendous financial burden from the start; as Mr. A. J. Lawson reminds us elsewhere in this issue, the Glasgow tramway system cost less than half as much per mile as the London tramways, although in later years the trolley system has been adopted for a large proportion of the latter. This

initial error can never be wholly retrieved. The tramways also were debited with heavy charges for road widening and other improvements, the benefits of which, however, have enured very largely to other interests. Again, though this circumstance is not restricted to London, the cost of maintaining the paving between and alongside of the tracks is a heavy item, which in fairness ought not to fall upon the tramways alone—particularly in view of the competition set up by motor-buses, which wear out the roadway more rapidly than any other agency, and yet contribute practically nothing to the cost of their maintenance. Another excessively costly burden is the provision of transportation at rates far below cost price, known as "workman's fares," but in actual fact at the service of all persons travelling between certain hours of the morning. These fares were granted in pre-war days, and were undoubtedly reduced to their present absurdly low level for political purposes; whether the desired end was achieved or not we do not know, but it is certain that the loss on this class of fares is in reality simply a subsidy paid to the London employers, who would otherwise have had to pay higher wages to their workpeople.

Even at that, it is grossly unfair, as Mr. Lawson points out, for only those employes who go to work early in the morning can travel at the cheap rates. The absurdity of the position is well brought out if one contrasts it with the well-known "restricted-hour" tariff in electricity supply. In the former case, the charges are reduced to a nominal value during the morning peak load, and are maintained at a far higher value during the slack hours; in the latter case, those who use the supply during the peak-load hours quite properly have to pay correspondingly higher rates, and it is the users in the slack hours who are encouraged with cheap rates. Surely the present management of the L.C.C. tramways—on the commercial side—is the very antithesis of scientific method; it is also unjust, and, worst of all, unsuccessful. The system is also burdened with excessive capital outlay, and oppressed by unfair competition; the former cannot be remedied, but at least the L.C.C. should secure some control over the competing omnibuses, such as is already vested in provincial municipalities.

It may be argued that the tramways are not intended to make profits, or even to pay their way—that their purpose is to carry the people at the lowest possible rates, the resulting benefits to the county more than outweighing the cost of meeting the deficit. This is quite a comprehensible, if somewhat Socialistic, point of view, and there is much to be said in its favour—but if this be the intention of the Council, it ought to be openly avowed, and avowed beforehand. It is easy, when one has made a loss, to say one never meant to make a profit, but it is not convincing; and we do not recollect any occasion on which such a policy was advocated by the Council.

Now, if ever, is the time to reform the faulty system of assessing fares, when employment is universal and well paid; we do not suggest that extra charges should be made during peak-load hours, but at least the absurd anomalies of the existing system should be removed, and the undertaking placed upon a sound financial basis. We believe that it can be done by relieving the tramways of unfair charges, subjecting competitive users of the roads to a fair measure of taxation, and taking steps to ensure that no passenger shall ever be carried below cost price.

At the same time improvements should be made in the service by equalising the intervals between cars, and instructing the drivers and conductors to look out for intending passengers. It is the rule, rather than the exception, on some routes to see three or four cars pass in a bunch, an interval of five minutes or more elapsing before the next bunch comes along, during which period the omnibuses have things all their own way. Cars cannot be prevented from bunching when approaching busy junctions and crossings, or in dense traffic, but when the road is clear a driver should not be permitted to approach within, say, 300 yards of the preceding car. As for keeping a look-out and trying to pick up all the traffic that can be handled—apparently this is not regarded as good form. At any rate, it is not done. In this respect the L.C.C. staff have much to learn from the motor-bus conductors.

HALIFAX CORPORATION ELECTRICITY WORKS.

To cope with the rapidly increasing demand for electrical energy in the Halifax area, the Corporation recently installed a new turbo-generator set of 6,000 kW., a description of which is given below.

Originally the system was three-wire D.C., but six years ago it was decided to adopt for power supply a three-phase system at 50 cycles, 6,600 volts, and to install a 1,500-kw.

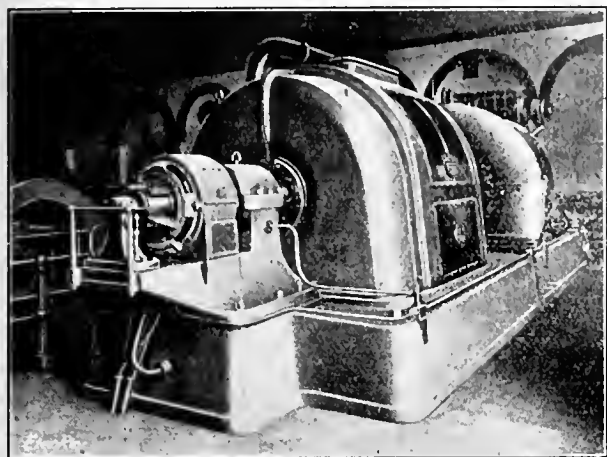


FIG. 1.—B.T.H. 6,000-KW. TURBO-ALTERNATOR AT HALIFAX.

turbo-generator, the British-Thomson Houston Co. being given the contract for this, together with the necessary switchgear, while the Worthington Pump Co. received the contract for the surface condensing plant. At the same time, it was decided to install two 750-kw. rotary converters in order to convert the alternating current to direct current for supplying the ordinary D.C. network for lighting and power purposes, and the overhead lines for traction. The contracts for these rotary converters were also given to the British Thomson-Houston Co. The demand increased very rapidly, and a further turbo-generator with a capacity of 3,500 kW., together with surface condensing plant, was installed at the end of the year 1913, this plant being also divided between the British Thomson-Houston Co. and the Worthington Pump Co., while another 1,000-kw. rotary converter, made by the British Thomson-Houston Co., was installed just as the war commenced in 1914. Owing to the rapid increase in demand for power purposes due to the war, this plant soon became loaded up, and it was therefore decided to install the 6,000-kw. turbo-generator referred to above. This plant was officially started up by Lady Rhondda on July 19th, 1917.

In the meantime the demand has been such that the existing 1,500-kw. and 3,500-kw. turbo-generators have been running practically on full load for over 18 months without any spare, and it speaks well for the reliability of turbo-plant that only one small breakdown occurred during the whole of that time, this being due to a very slight mishap on the governor gear of the small auxiliary turbine driving the condensing plant of the 3,500-kw. set; a repair was effected within three hours of the mishap occurring.

During the time when the above extensions were being made to the generating plant, substantial additions were made to the steam-raising plant in the shape of four Babcock & Wilcox water-tube boilers, two of which were capable of generating 21,000 lb. of steam per hour, one

30,000 lb. per hour, and the remaining boiler 27,000 lb. per hour. The first two are fitted with chain-grate stokers of Messrs. Babcock & Wilcox's make, while the others are fitted with the underfeed type of stoker, as made by the Underfeed Stoker Co., the forced draught for these being provided by fans made by Messrs. Musgrave & Co., of Belfast. At the present time the boiler-house plant is barely sufficient to cope with the demand, but another water-tube boiler, to evaporate 30,000 lb. of steam per hour, is being supplied by Messrs. Babcock & Wilcox, together with Green economisers and an induced-draught fan by Messrs. Musgrave & Co. This plant should have been ready for delivery before the winter load comes on, but it is doubtful whether the delivery date promised will be kept, owing to the difficulty in obtaining steel plates.

The recent progress of the undertaking may be gauged by the fact that whereas the annual output (sold) up to the end of March, 1911, had not exceeded 6 million units, in 1913 it was 7½ millions, in 1915 11 millions, and in 1916-17 16,703,101 units; the maximum demand rose during the period referred to from 2,960 kW. to 6,784 kW. in 1916-17. Since 1899 the revenue account has shown a surplus every year, and the history of the undertaking has been a record of continual upward progress.

By the courtesy of the borough electrical engineer, Mr. W. M. Rogerson, M.I.E.E., who has been responsible for the design and supervision of the whole of the extensions, we are enabled to reproduce photographs of the new plant. The turbine is of the well-known Curtis horizontal impulse type as manufactured by the British Thomson-Houston Co., Ltd., of Rugby, being similar to the 3,500-kw. set which was installed some three and a-half years ago, except that it is of the 11-stage type, running at a speed of 1,500 R.P.M., with a steam pressure of 150 lb. per sq. in. and superheat of 500° F.

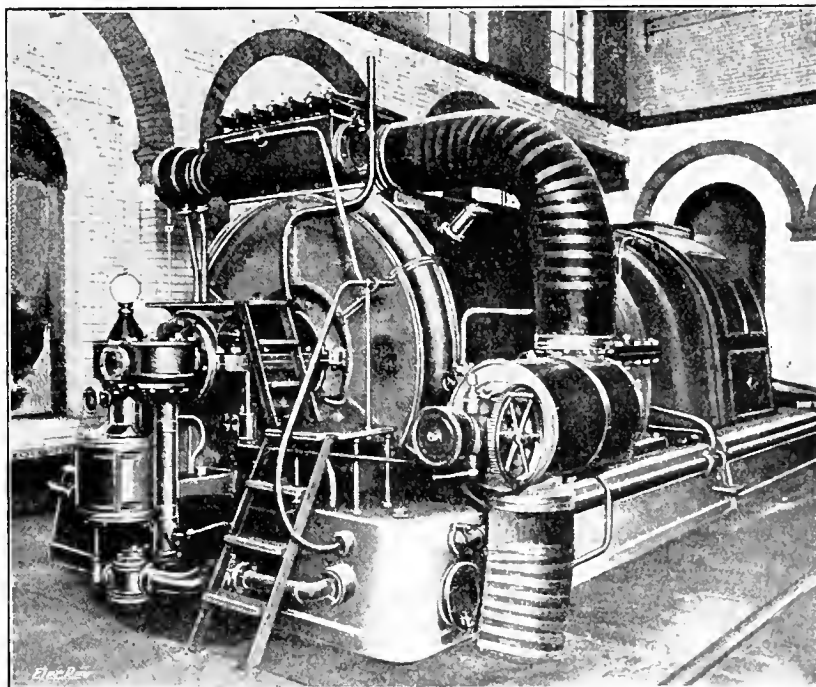


FIG. 2.—B.T.H. TURBO-ALTERNATOR, STEAM END.

The alternator is of the revolving-field type, connected direct by a flexible coupling to the shaft of the turbine. The machine is designed so as to require no external ventilating fans; air is drawn through a special air duct at the bottom of the machine, passing through filters before entering the air duct, and is expelled into the engine room through an opening in the top of the machine.

The exciter is driven direct by means of a flexible coupling from the alternator shaft.

The normal full load of the set is 6,000 kW. at 100 per cent. power factor and 7,500 K.V.A. at 80 per cent. power

factor, and the alternator is capable of 25 per cent. overload output for a period of two hours at 80 per cent. power factor. The voltage is controlled by a Tirrill regulator fixed on the switchboard. The guaranteed steam consump-

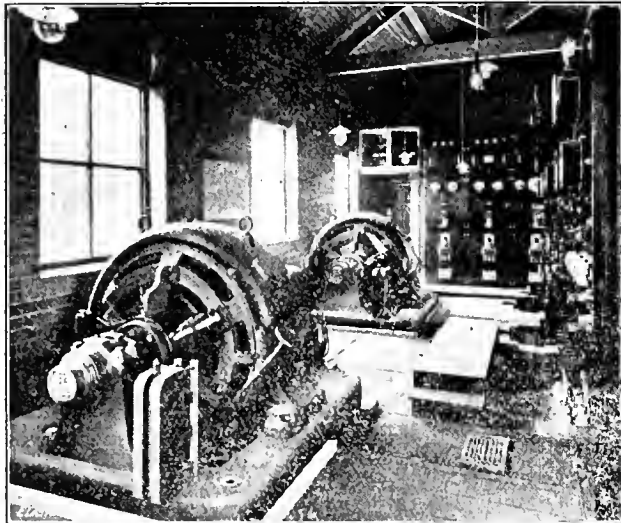


FIG. 3.—WITTON ROTARY CONVERTERS AND SWITCHBOARDS AT HIPPERHOLME SUB-STATION.

tion per kW.-hour at 100 per cent. power factor and with a 28-in. vacuum is as follows:— $1\frac{1}{2}$ full load, 14.0 lb. per kW.-hour; full load, 14.1 lb. per kW.-hour; $\frac{3}{4}$ full load, 14.4 lb. per kW.-hour; $\frac{1}{2}$ full load, 15.3 lb. per kW.-hour. The above figures are guaranteed with a $2\frac{1}{2}$ per cent. margin.

The condensing plant was supplied by the Worthington Pump Co., Ltd., and consists of a circular surface condenser with a cooling surface of 16,500 sq. ft. The circulating pump is of the 16-in. twin high-speed type dealing with 12,500 gallons of water per minute against a total head of 42 ft., lifting the water to the top of the existing cooling towers.

The air pump is of a somewhat novel type, consisting of a 10-in. rotary air pump and an 8-in. low-lift operating pump. These pumps take water from a tank and discharge it through a regulating valve into the nozzle of an

of approximately rectangular cross section, leaving sufficient space between each other for the entry of air and vapours removed from the condenser; at the same time, the wheel imparts to the jets a rapidly revolving motion, as a result of which the water jets rush through the ejector cone and diffuser in the form of a helix with a pitch and velocity diminishing as the compression of air and vapours proceeds.

The air and vapours from the condenser entering round the rotary transforming wheel are caught and enclosed by the issuing water jets, and compressed on the way down to the diffuser discharge. The water discharged by the ejector into the tank gives up the air entrained, and is circulated over again by the centrifugal pump, and in order to prevent an undesirable rise in temperature in the operating water by the process, cold water is constantly supplied to the tank. The results of this apparatus have been highly satisfactory: it is extremely simple, and can run practically without attention. The vacuum obtained is excellent, and the power required moderate. It has the advantage that if air leaks open up in the system, causing the vacuum to drop, it will accommodate itself to such condition, and maintain the best possible vacuum, and if the cause of the leak is removed, will pull the vacuum to the original height.

If the transforming wheel stopped or was taken out altogether the efficiency and vacuum would be reduced, but the machine would continue its work just the same.

For extracting the condensed steam from the condenser



FIG. 5.—HEBDEN BRIDGE SUB-STATION.

and delivering it into the hot well on the engine-room floor level, a 5-in. two-stage centrifugal hot-well pump is provided.

All the above pumps are arranged on one convenient bed-plate, and are driven by a horizontal single-stage Curtis turbine, rated at 275 B.H.P., the exhaust steam from which is taken direct to the condenser.

The cost of the whole plant, including foundations, piping, &c., has been approximately £23,000.

It is interesting to note that the above set has displaced a 300-kw. Pollit engine and alternator and two 200-kw. Parsons D.C. turbo-generators, which plant was installed some 18 years ago.

In order to afford a supply of continuous current to the outlying areas of Hebden Bridge and Hipperholme, the Halifax Corporation has recently constructed two converting stations in these districts. For the electrical equipments of these sub-stations the contract was entrusted to the General Electric Co., Ltd., of London. The converting unit chosen was the 250-kw. Witton rotary converter, together with an oil-insulated air-cooled transformer, taking in three-phase power at 6,600 volts, and generating at 550 volts for traction and 220.0-220 volts for lighting, the rotary converters serving the double purpose.

The incoming feeders are controlled in each sub-station by Witton mistake-proof switchboards. The Hipper-

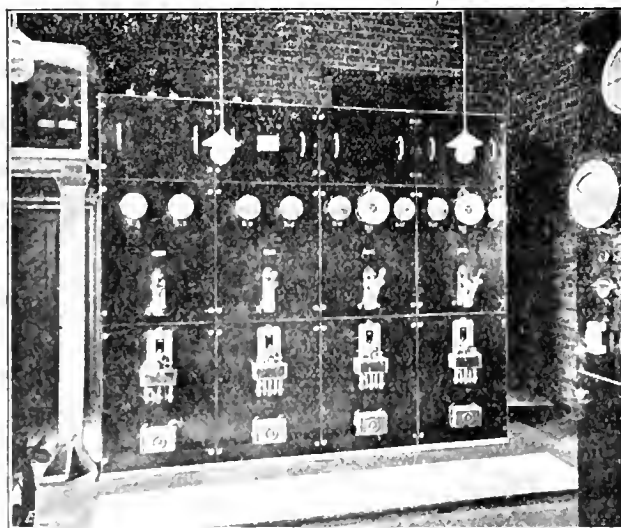


FIG. 4.—WITTON MISTAKE-PROOF IRONCLAD SWITCHBOARD AT HIPPERHOLME.

ejector. When leaving the nozzle the water passes through a wheel, by which the jet is divided up into a number of jets

holme sub-station, having two converting units, has two incoming feeder panels on the high-tension board, and two machine panels; that at Hebden Bridge has but one machine panel. These installations are carried out on the Witton boiler-plate cubicle system for sub-stations. The cubicles eliminate the possibility of accident to the operator through inadvertence, a thorough interlocking arrangement preventing such occurrences.

The rotary converters run at a speed of 1,000 R.P.M., and are designed for reactance control. For the purpose of keeping constant the voltage across the three-wire network, the neutral wire is taken from the star-point of the transformers. The converters are of the self-synchronising pattern, being run up to speed by a starting motor and switched in through choking coils. They fall into step easily without any synchronising and without any reversal of polarity.

The Witton low-tension boards include both traction and lighting panels, and a simple arrangement of interlocks between the liquid starter for the motor, the circuit breaker, and the short-circuiting switch for the liquid starter, precludes any possibility of error in the sequence of the operations. Change-over switches are also included on the board for applying the machines either to lighting or traction, and these switches make provision for the opening of the neutral connection when the machines are required for the latter purpose.

We are indebted to Mr. W. M. Rogerson, borough electrical engineer of Halifax, for assistance in preparing this description.

LONDON COUNTY COUNCIL TRAMWAY RESULTS IN 1916-17.

By A. J. LAWSON, M.Inst.C.E.

THE accounts for the past year's working of the tramways of the London County Council were presented in final adjusted form at the Council meeting held on July 17th, and the following tabulated synopsis and analysis gives the chief items of information:—

Total receipts for year	£2,552,204
Receipts from passenger fares	£2,476,309
Operating expenses	£1,817,694
Interest on borrowed money	£314,165
Redemption of debt	£429,851
Total expenses	£2,561,710
or £9,506 more than the total receipts.	
Route miles operated	141'67
Revenue per route-mile	£17,479
Car-miles run	49,478,973
Passengers carried	586,127,976
Passengers per car-mile	11'846
Average fare per passenger	1'014d.
Operating expenses per passenger	7'44d.
Total expenses per passenger	1'049d.
(including interest on and repayment of debt)	
Operating expenses per car-mile	8'817d.
Total expenses per car-mile	12'424d.
Total receipts per car-mile	12'420d.
Receipts per car-mile from passengers' fares	12'011d.

Actually, therefore, the total revenue properly appertaining to the working of the tramways was £9,506 short of the total revenue required to meet all expenses, but owing chiefly to interest received on cash balances, and interest or rent from surplus properties, there is shown a credit balance or surplus of £11,342 10s. 3d., which is carried to the renewals fund account, being the first addition thereto since 1912-13—and more in name than in reality, since no account is taken of the depreciation in investments which that fund represents, nor of the depreciation of investments in which the general reserve fund is supposed to be placed.

The nominal value of these at March 31st last was:—

Renewals fund	£282,978
General reserve fund	72,391

The total debt incurred up to March 31st, 1917, was

£13,930,660, of which £4,788,831 had been repaid, leaving the amount outstanding £9,141,826.

Owing to the electrification of the horse tramways, capital expenditure of £2,021,689 has become obsolete, of which, after taking all credits into account, £943,711 has still to be provided for, besides a further amount of not less than £117,826, representing expenditure incurred in connection with electric traction which has also been rendered obsolete, while much more is obsolescent.

The outlook is far from hopeful. Increased payments to drivers and conductors, and heavy salaries for newly-created officers, make large holes in any increase in revenue from passengers; yet the Council continues to make bird pecks—they can't even be called bites—at the passenger-fare cherry.

True, it has "suspended" halfpenny fares and return tickets, with the prospect of reaping a benefit of about £315,000 a year, or about £1,000 per work-day, from these sources; but it studiously refrains from touching the workmen's fares, though the people who benefit by them are by no means the poorest or worst paid of the wage earners who travel by the Council's tramcars. It has been often remarked by workmen themselves that those who can afford to live some distance from the centre of London, and who, therefore, can get houses at cheap rents and low rates, get also the cheapest tramway fares, and this is borne out by the reports of the Highways Committee, which show that a workman living in the neighbourhood of the Tower Bridge (where neither rents nor rates are low), who travels daily to Waterloo Station, a distance of 2 miles only, has to pay 1d. for a single or 2d. for a return ticket—just the same as the probably better-off artisan who dwells in a suburban "villa" in the Beckenham or Bromley district, but is employed in the neighbourhood of Victoria Station, who can ride 9½ miles each way for the same money. The average length of the workmen's routes is over 5 miles for a penny fare. The poor clerk, or underpaid shop girl or waitress, whose hours are from 8.30 or 9 a.m. to any time at night, does not benefit at all from cheap tramway fares. He or she has to pay three times as much as the better-paid workman for the same distance, or get up to town an hour before office or shop is opened for business, and waste that time in aimless wandering about the streets in all sorts of weather, tiring himself or herself out, or getting drenched with rain, and laying the foundations for future illness, before the day's work is begun.

The Council has at last decided that the issue of transfer tickets shall be limited to places to or from which there are no direct services, and that such tickets shall be available for change of cars at specified points only. It is to be hoped that these tickets will in all cases be cancelled on the second car; cases have been known of 3d. transfer tickets issued in the morning at Woolwich being used on the Tooting and Merton lines late at night on the same day; and, in some cases, of transfer tickets, issued three weeks previously, still remaining uncanceled, though the holder rode on the cars daily without being called upon for another fare. Inspection appears to be woefully deficient. The chairman of the Highways Committee stated:—"The tramways have been of late systematically defrauded, not only by a section of the public, but by members of our own staff. People crowding off the cars have handed the fare to the conductors, but no tickets have been given. In some cases there has been no attempt to collect fares, but a hat has been handed round for the benefit of the driver and conductor." He also stated that "the loss from non-collection of fares and fraud had been estimated at from 5 to 15 per cent. of the takings." Though these figures represent from £125,000 to £375,000 a year, the one-time correctly named Progressive party has recently, on each occasion that reform was proposed, carried its opposition to the means of preventing these frauds to the extent of dividing the Council in several party divisions.

The expression "wrecking the tramways" has taken a new meaning, and the thanks of the general public—all tramway passengers included—will be given to Mr. G. H. Hume if, during his chairmanship of the Highways Committee, he will still more courageously root up the abuses which have nearly destroyed the tramway enterprise, and stop the dry rot that has developed in the system.

It should be recognised that under present conditions of

travel on the tramways, with the maximum possible loading of cars twice a day—two hours in the morning and two hours in the evening, which are the real business traffic hours—the maximum carrying capacity of the present County Council routes cannot much, if at all, exceed 600,000,000 passengers a year, and that to safely provide for all costs and charges, the average fare per passenger must be 1.16d. at least, which would represent with rather over 12 passengers per car-mile an average of 14d. per car-mile in revenue.

The irregularity of the services on some lines, as on the Tooting and Merton and Norbury routes, for instance, should be remedied. On these lines it is not unusual to see two or more cars for the same destination following each other in quick succession, with long intervals between the next following ones, the result of which is the filling of motor-buses to overcrowding, and consequent loss to the tramways. A nominal six minutes' service should not produce ten-minute intervals without a "Selection by the Band."

Fares on the L.C.C. tramways bear no relation to distance or cost of operating. From Abbey Wood, Kent, to Waterloo Bridge, on the Victoria Embankment, either by way of Blackfriars, New Kent Road, New Cross and Woolwich, or by Westminster Bridge, Kennington, Camberwell, New Cross and Woolwich—a distance of over 14 miles—the ordinary fare is 3d. only (or less than a farthing per mile); while, as has been seen, a person taking a workman's ticket can travel 19 miles for 2d.

In Glasgow, where the tramways cost less than 42 per cent. of the cost of construction and equipment of the London lines, the fare is about $\frac{1}{2}$ d. per mile, or twice what it is in London. Glasgow has also repaid the total capital expenditure on its tramways.

If the London County Council were to make all fares 1d. for any distance up to 2 miles, with $\frac{1}{2}$ d. additions for every additional mile or part of a mile, and give workmen return tickets for single fares, the tramways would be at once placed on a paying basis without injustice to anybody.

SOME NOTES ON STAFF ORGANISATION IN ELECTRICITY WORKS.

BY G. W. STUBBINGS.

THE present article is intended as a contribution to the discussion on the organisation of the staffs of electricity undertakings, and is written with a view to inquiring whether a particular system, the adoption of which is becoming more general, is capable of improvement. The system in question can be briefly defined as one in which the staff consists of a chief engineer with four departmental assistants concerned respectively with the secretarial, commercial, generating, and distributing section of the undertaking, each being directly responsible to the chief engineer. The writer's remarks are intended to apply to stations of moderate size, having an output of the order of 10,000,000 units per annum.

It will be interesting first to trace the development of the organisation of the staffs of electricity works, and to see how the particular system referred to was evolved. In the early days of electricity supply, when the technical skill required to run a works was considerable, and the business was fairly small, the chief was mainly concerned with technical matters, and was, in fact, the man who ran the job. With the development of the undertaking it became necessary for the chief engineer to have an assistant, such assistant being an all-round man, competent, in the absence of the chief, to supervise all branches of the work, and *au fait* with all the details of the plant. As the scope of the undertaking became further extended, it became clear that the multiplication of general assistants was impracticable. In the first place, as more and more purely managerial work devolved upon the chief, he was able to devote less and less time to technical work; and, secondly, the money available for salaries necessitated the limiting of the number of general assistants to one, the chief assistant engineer. More

recently, the system of having departmental assistants, directly responsible to the chief, has been evolved. The remarkable characteristic of this system is, of course, the abolition of the chief assistant. This radical departure from previous practice has worked very much better than would be expected. It possesses the great advantage of cheapness, as the saving to the undertaking, even after duly increasing the salaries of the departmental officials in recognition of their extra responsibility, is considerable. The advocates of this system consider that the cost of retaining the services of an official additional to the chief engineer, capable of, and possessing the necessary qualifications for, controlling all departments of the undertaking, would be prohibitive, at any rate, for stations of moderate size, and that unquestionably money is better expended in increasing the salaries of the departmental assistants. On the other hand, with this system, there is no one, in the absence of the chief, to assume complete responsibility, as it obviously creates difficulties to assign such a post to either the works or the distribution engineers if these officials be of approximately equal status. The chief assistant seems, moreover, the right man to undertake such work as the designing and preparation of schemes for not only extensions, but also for the various minor alterations and improvements that are continually taking place in an up-to-date works.

The functions of the four departmental assistants may be briefly considered. The secretary or chief clerk takes charge of work quite separate from engineering, and such work falls naturally into a division by itself. The status usually assigned to this official need not, therefore, be discussed.

The case for the commercial assistant or publicity manager is not, perhaps, so clear. There has been a great tendency lately to magnify the importance of this official, but in a moderate undertaking the wisdom of such a course seems to be questionable. The smaller part of publicity work, that of canvassing new consumers, or introducing small heating and cooking apparatus or small motors, does not call for a very highly-trained or highly-paid official. Regarding the supply of electricity to large power consumers, there is no doubt that the personality and business experience of the representative of the undertaking will be an important factor contributing to success, and it seems quite clear that in moderate sized undertakings no better person can be found for this task than the chief. His status, address, technical skill and business ability will carry greater weight than that of a junior official, and as such negotiations are comparatively rare, the undertaking could not afford to retain the services of an official possessing qualifications for such work comparable with those of the chief. It seems clear, therefore, that the publicity manager need not be a man of very great importance, and, indeed, the suggestion of amalgamating the clerical and commercial departments is worthy of consideration for the smaller undertakings. A larger salary could be paid to the secretary, who would in such case be a man of commercial as well as secretarial experience.

In a system of staff organisation recently described in this journal, the official in charge of the publicity department was designated consumers' engineer, and was responsible for not only commercial work, but also for the test-room, installation and public lighting departments. It seems difficult to justify the amalgamation of four sections so totally dissimilar; the first commercial, the second scientific, and the last two concerned with maintenance work. The only sort of explanation that can be found for such a combination is that the work with which these sections are concerned is external to the works and above ground, as in no other characteristic do they agree. With a department of so heterogeneous a character, the official in charge can hardly be expected to be *au fait* with all phases of the work; and as his abilities will presumably be of a commercial character, the men really responsible for the other sections suffer in status. If, on the other hand, the consumers' engineer is chosen for his ability to supervise testing, installation, or public lighting maintenance work, there is no guarantee of his commercial ability, and the suggestion to amalgamate this section with the clerical department seems the more reasonable. The

writer is not aware whether this arrangement is a usual one, but, considered from a rational standpoint, it appears, owing to the varied nature of the work concerned, to be as defective a scheme as could be devised.

The works department is another which is divided naturally from the others, and the duties and scope of the responsibilities of the works superintendent are well defined. It is becoming more and more realised in these days that the greatest need for supervision is in the boiler house, and it therefore seems advisable that in moderate undertakings the works engineer be chosen more for his boiler house than his engine room experience.

The fourth department to be considered is usually known as the distribution department, and the responsibilities of the official in charge are frequently very varied, comprising as they usually do everything left over from other departments. In various concerns, mains, public lighting, testing, installation, tramway overhead equipment, and occasionally fire alarms are under the control of the distribution engineer. Obviously, it is expecting a good deal to require a moderately-paid official to have had experience in all these branches. His first requirement is naturally to be a skilful mains engineer, and presumably the greater part of his experience will be concerned with mains work. Some of the other sections, such as wiring or tramways overhead equipment work, have a natural and close connection with mains work; but in the case of testing of instruments and meters, the connection is not so obvious. The arrangement is, however, common, and in practice works very well.

The assistants of these four officials will be similar in experience and general qualifications to their departmental chiefs, and such men will have in view either promotion to the post of their immediate superior, or a similar position elsewhere.

An examination of the scope of the control of, and the qualifications requisite for, each of the four officials considered, draws attention to the fact that in none of them is there any great need or desirability of any particular scientific technical ability. The station and distribution superintendents are the only two officials who can really be called engineers, and with both, the side of engineering with which they are most concerned is applied, as opposed to scientific. As before remarked, the assistants of these officials will approximate to them in technical character, and thus it happens that in many central stations there is no one with any particular scientific ability, and, according to the usual arrangement, there is no one who need have such a qualification. In running a central station, scientific questions are continually cropping up, but owing to the engineering officials having applied themselves largely to other matters, the scientific knowledge that they acquired early in their career, if any, has probably got rusty or obsolete. This is regrettable, as often leading to mistakes which, though of small importance, could be avoided, and frequently necessitating reference to manufacturing firms for technical advice. There is no particular harm in this latter circumstance, but it is not as it should be. The question therefore arises as to the advisability of having a further official, whose chief qualification shall be scientific and technical ability, directly responsible to the chief engineer, and who will take charge of all work of a technical or scientific character. Such an official, who might be designated technical assistant, would primarily be responsible for the testing and maintenance of all meters and instruments, and would carry out other testing work such as that of fuel and water; he should also be a good draughtsman, competent to carry out such drawing work as is required in a station of the size under consideration. Such an official may be considered a kind of glorified meter superintendent, but the great difference between this official and the meter superintendent is not only in status, but in salary. If it be assumed that by restricting the scope of the responsibilities of the mains engineer, and by abolishing the commercial assistant, as suggested, a considerable sum of money is liberated for the salary of the new official, the undertaking would be able to obtain a really first-class man. Such a post would enable the chief engineer to rely upon at least one man of his staff to keep his scientific knowledge up to date, and such a man, having the requisite status, could be, and probably would

be, consulted on subjects coming within the scope of his particular knowledge.

It has long been a matter of observation to the present writer that, under present conditions, there is little prospect of advancement in central station work for men whose abilities are rather scientific than inclining to running or maintenance work. Many a young man has started a central station career with a brilliant scholastic record—not necessarily of the academic order, but quite conforming to the ideals of Prof. Perry. Such men, seeing how little their qualifications are valued in the career they have chosen will frequently allow their knowledge to become rusty, and will endeavour to make themselves capable shift engineers or mains superintendents, quick and decisive in times of breakdown. Possessing qualifications in one direction, it is exceedingly unlikely that they will exhibit them in another, and such men become mediocre and nonentities. If it be recognised that there is no place in a central station for men such as have been described, these would simply be instances of their having chosen unsuitable careers; but this can hardly be the case. With three-phase distribution, even an ordinary meter superintendent should have a moderate scientific knowledge thoroughly to understand his work. There is little doubt that if a definite place were found for them, men would be attracted to central station work who would be found invaluable. The engineers in charge of large test rooms are, of course, important officials, but such posts are rare. The writer's remarks refer to stations of moderate output.

In considering the question forming the subject of this article, the writer has endeavoured to take up a more or less detached standpoint—such as that of a shrewd business man, knowing nothing of electricity, who has had central station routine thoroughly explained to him. The suggestions may not be considered altogether practicable, but the writer hopes that, as they are somewhat original, they may be found a little interesting.

SECOND REPORT OF THE COMMITTEE FOR THE INTERCONNECTION OF THE LANCASHIRE AND CHESHIRE ELECTRICITY SUPPLY SYSTEMS.

WE have received from the hon. secretary a copy of a report just issued by the Committee which has been dealing with the interconnection of the Lancashire and Cheshire electricity undertakings. The first report was published in our issue of October 13th, 1916; the report now issued gives practical shape to the matters discussed in the earlier one, and so far as the first portion, dealing with interlinking, is concerned, is signed by—

Mr. S. L. Pearce, *Chairman*.
Mr. B. Welbourn, *Vice-Chairman*.
Mr. J. A. Robertson, *Hon. Secretary*.

Sir John A. F. Aspinall, Messrs. R. Blackmore, S. E. Britton,
H. Dickinson, E. H. Edwardes, John Purrett,
S. J. Watson, P. P. Wheelwright, and W. J. H. Wood,
Members of Committee.

Introduction.—1. The interim report presented by the Committee in September, 1916, to the supply authorities and the Board of Trade formed the basis of the conference held in the Council Chamber of the Town Hall, Manchester, on March 2nd, 1917, which was presided over by Mr. G. H. Roberts, M.P., Parliamentary Secretary to the Board of Trade.

2. The conference revealed a striking degree of unanimity with the principles set out in the interim report, and as a result of the invitation extended by Mr. Roberts to the conference, the Committee have worked out the essential details of the scheme which are embodied in this report.

3. The Committee now have pleasure in submitting their second report, which may conveniently be divided under the following headings:—

- (a) The constitution of the proposed joint board.
- (b) The powers of the proposed joint board.
- (c) The basis for determining the charges for electricity supplies between participating authorities.

(d) The basis for allocating the capital charges on interconnecting mains and transformers against the revenue accounts of the participating authorities.

(c) Miscellaneous provisions.

The Committee have also come to the conclusion that the interconnection of the several supply undertakings is but the first step to be taken in the reorganisation of the existing interests with a view to securing an adequate, cheap, and reliable supply of electrical energy for industrial and all other purposes.

They have therefore added a further section to the present report, setting forth their considered opinion in regard to:—

(f) The conferment of additional powers upon the joint board in regard to the establishment and control of all future power stations, and the further control of existing power stations where deemed desirable in the national interests.

(g) The relation of the joint board to the existing Government departments, or to any new electricity tribunal that may hereafter be set up.

Constitution of Proposed Joint Board.—4. The Committee propose (with the assistance of fresh legislation) the establishment of a joint board, representative of the local authority and company interests.

Every authorised distributor of electrical energy shall be entitled to representation on the joint board.

The basis of local authority representation shall be the "population" of the area supplied under statutory powers, viz.:—

One representative for a local authority with a population not exceeding 25,000.

Two representatives for a local authority with a population in excess of 25,000 but not exceeding 50,000.

Three representatives for a local authority with a population in excess of 50,000 but not exceeding 100,000.

Four representatives for a local authority with a population in excess of 100,000 but not exceeding 200,000.

Five representatives for a local authority with a population in excess of 200,000 but not exceeding 350,000.

Six representatives for a local authority with a population in excess of 350,000, but not exceeding 500,000.

Seven representatives for a local authority with a population in excess of 500,000 but not exceeding 700,000.

Eight representatives for a local authority with a population exceeding 700,000.

The basis of company representation shall be "capital outlay," in comparison with the other undertakings.

A schedule sets forth a list of the "authorised distributors" included in the groups of the interim report; the joint board if constituted at the present time would comprise 35 undertakings, with a membership of 90, but any undertaking hereafter eligible shall be entitled to representation.

In the event of one or more of the companies being excluded for any reason from the joint board, it shall be competent for the joint board to enter into working agreements with such companies.

A revision of the representation of the joint board shall be made every five years.

5. Recognising the disadvantages that would accrue from too large an administrative body, the Committee propose that the joint board shall be divided into district boards, whose members shall be those representing the undertakings corresponding to the groups.

Each district board shall elect a chairman from amongst its own members.

The engineer of each undertaking shall be entitled to attend the meetings of the respective district boards.

6. A central executive of 20 members shall be elected from the district boards.

Each member shall be elected for a period of three years, but shall not remain a member of the central executive if he ceases to be a member of the participating authority by whom he was elected.

The central executive shall elect a chairman from amongst its own members.

Powers of the Proposed Joint Board.—7. The Committee propose that the 35 authorities (local authority and company) at present exercising statutory powers shall be constituted by Act of Parliament as a joint board for the purpose of jointly exercising each and all of the following general powers:—

(a) To co-ordinate and prescribe the running hours of the existing generating stations in such a way as to yield the most economical operating conditions.

(b) To determine the basis of charges to be made between the various authorities constituting the joint board for:—Bulk supply, stand-by supplies, reciprocal supplies.

(c) To allocate all charges against revenue account arising out of the expenditure of moneys on linking-up mains, transformers, and such other works as may be required for interconnecting purposes.

(d) To allocate the administrative expenses of the joint board between the various participating authorities, such allocation being based on their respective incomes.

(e) To act in an advisory capacity in regard to all proposals for future extensions of generating plant and linking-up mains, transformers, and such other works as may be required for interconnecting purposes that may be put forward from time to time by one or other of the several authorities direct to the proper Government tribunal.

(f) To empower the joint board to make working arrangements between the power companies and the local authorities, and between one local authority and another, for the use of the existing mains, and with reference to the laying of new linking-up mains within the areas of the several undertakings participating in the joint scheme of operation, and in such other areas as it may be found necessary to lay linking-up mains.

(g) To appoint such officials as may be necessary to carry out the powers and instructions of the joint board.

(h) To form district boards representative of the undertakings included under the groups, or such modifications thereof or additions thereto as may hereafter be considered necessary, and to delegate to the district boards the powers set forth below, and such other matters as the joint board may from time to time decide.

(i) To form a central executive of the joint board elected from the several district boards, and to invest such central executive with the powers set forth below, and to deal with such other matters as the joint board may from time to time decide.

(j) To invest the authorities constituting the joint board with compulsory powers to obtain wayleaves for electric mains, and overhead lines.

(k) To invest the authorities constituting the joint board with compulsory powers to lay mains in undedicated streets.

(l) To invest the authorities constituting the joint board, with compulsory powers to erect overhead lines crossing public roads.

(m) To invest the joint board with powers to make regulations in regard to all technical matters affecting linking-up mains, transformers, and such other works as may be required for interconnecting purposes in order to secure uniformity and reliability of supply.

(n) To carry out such further powers as may be delegated to them from time to time by the proper Government tribunal.

(o) To apply to Parliament for any alteration or extension of their powers, including the granting of new powers.

(p) To issue precepts to the participating undertakings for the purpose of meeting the administration expenses of the board.

(q) To apportion the costs, charges, and expenses—Parliamentary or otherwise—preliminary and incidental to the setting up of the joint board, on the basis of the capital outlays of the participating undertakings.

8. In the event of it being shown to the satisfaction of the joint board that any undertaking has been adversely affected financially by the operation of the above powers, it shall be incumbent upon the joint board to allocate the charges between the participating authorities so as to reimburse the undertaking so affected.

9. The authorities constituting the joint board shall be empowered to enter into agreements with any authority, company, or person for the following purposes: Bulk supplies, stand-by supplies, reciprocal supplies, provided that no such powers shall be exercised within the area of an authority exercising statutory powers except with the consent of such authority. In the event of the consent being unreasonably withheld, an appeal may be made to the proper Government tribunal to dispense with such consent.

10. The Committee propose that the joint board shall delegate the following powers to the district boards:—

(a) To appoint their representatives to act on the central executive of the joint board.

(b) To co-ordinate and prescribe, subject to the approval of the central executive of the joint board, the running hours of the existing generating stations within their group in such a way as to yield the most economical operating conditions.

(c) To determine, subject to the approval of the central executive of the joint board, the charges to be made between the various undertakings within their group for: Bulk supplies, stand-by supplies, reciprocal supplies.

(d) To make recommendations from time to time to the central executive of the joint board with regard to the interconnecting of two or more of the existing undertakings within their group, or with one or more undertakings of another group.

(e) To allocate, subject to the approval of the central executive of the joint board, the charges against revenue account arising out of the expenditure of moneys on linking-up mains, transformers, and such other works as may be required for interconnecting purposes between the various participating authorities within their group.

(f) To receive and consider the recommendations of any undertaking in the matter of extensions to their generating plant, and to report thereon to the central executive of the joint board, provided that nothing herein is intended to prevent any authority, after its application has been adjudicated upon, from applying direct to the proper Government tribunal under its existing or future rights for powers to borrow money, or to otherwise raise capital for generating plant extensions.

(g) To carry out such further powers as may be delegated to them from time to time by the joint board.

Note.—It shall not be competent for the district boards to incur any administrative expenditure without the direct sanction of the joint board.

11. The Committee propose that the joint board shall delegate the following powers to a central executive elected from the several district boards:—

(a) To draw up such rules and regulations as may be necessary from time to time for the guidance of the several district boards in giving effect to the various powers delegated to them.

(b) To control the co-ordinated and prescribed running hours of the several groups of undertakings respectively controlled by their district boards.

(c) To formulate the basis of the charges to be made between the various undertakings in the respective groups, and between one group and another, in regard to bulk supplies, stand-by supplies, reciprocal supplies.

(d) To consider the recommendations made to them from time to time by the several district boards in regard to the provision of interconnecting mains, transformers, and such other works as may be required for interconnecting purposes, and, if approved, to support the necessary application on their behalf to the proper Government tribunal.

(e) To receive, approve, or otherwise, the reports of the district boards from time to time respecting all proposed applications for extensions to generating plants, provided that nothing herein is intended to prevent any authority, after its application has been adjudicated upon, from applying direct to the proper Government tribunal under its existing or future rights for powers to borrow money, or to otherwise raise capital for generating plant extensions.

(f) To sanction, or revise, the proposed allocation of all charges against revenue account arising out of the expenditure on linking-up mains, transformers, and such other works as may be required for interconnecting purposes made by the several district boards.

(g) To apportion the administrative expenses of the joint board between the various participating authorities, and to refer same to the joint board for confirmation—the basis of such apportionment to be the gross revenue of the participating undertakings.

(h) To report to the Government department or tribunal on any application made to them by any single authority who are at present exercising statutory powers, or who may hereafter apply for such statutory powers, to raise money for generating plant extensions.

(i) To recommend to the joint board the appointment, from time to time, of such officials as may be necessary to carry out the powers and instructions of the joint board.

(j) To appoint a committee of engineers to whom all technical and engineering matters shall be at first referred for a report, provided that the said committee of engineers shall be entitled to seats on the central executive committee, but shall have no voting powers thereon.

(k) To carry out such further powers as may be delegated to them from time to time by the joint board.

12. Should any dispute or difference arise between any undertaking and the district board, or between a district board and the joint board, the same shall be referred to the proper Government tribunal for a decision—which shall be final and binding on the parties concerned.

13. Under the foregoing paragraphs it will be observed that the Committee do not propose to invest the joint board with any financial powers to raise capital from time to time. In this respect, their present proposals differ from those set forth in the interim report, which contemplated the raising of capital for purely interconnecting works, *e.g.*, linking-up mains and transformers, &c.

On further consideration the Committee have come to the conclusion that under existing conditions there are no material advantages to be gained in relieving each undertaking of its statutory obligation to raise the necessary capital for interconnecting mains extensions within its own area, provided always the scheme is initiated or approved by the joint board, the important point being the correct allocation of this expenditure between participating authorities.

14. The Committee further recognise that the position of the companies under the proposals contained in this report will require special consideration by reason of the fact that their electrical output is now given under one or other of the following headings:—

(a) Bulk supplies to authorised distributors.

(b) Bulk supplies to authorised distributors, and individual supplies to large power users in the area of the latter.

(c) Supplies given in districts, the provisional orders relating to which have been transferred to the companies for stated periods.

(d) Districts in which the companies have taken out and now hold the provisional orders.

(e) Districts in which no provisional order had been taken out prior to January 1st, 1908, and which the Lancashire Power Co. are supplying by virtue of their Acts.

(To be continued.)

Australian Bureau of Science.—A meeting of the Advisory Council of the Commonwealth Bureau of Science and Industry was held in Melbourne last month, with the object of establishing the bureau on a permanent basis. It is proposed to appoint permanent directors. The Prime Minister (Mr. Hughes) stated that the bureau had already done much good work. It was engaged at present on a number of scientific problems in connection with the metal industry.—*Melbourne Age*.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Employment of Disabled Soldiers.

The letters from "E. M. F." and Alfred Bridges in the current number of the REVIEW prompt me to write this, my first letter to any paper.

I agree with you that it is an insult to offer employment to a man disabled through the war in the worst paid profession in the country. The company advertising no doubt feel that since a discharged man will possibly receive a pension, he may be able to live on his income, and as regards intelligence of officers, the number that apply for a position in a power station must be the means of gauging it.

It is claimed that the station man gets less pay than a man in another trade calling for less skill. For this condition the station man is to blame, since he lacks organisation; and at this moment, when the opportunity is put forward in the Station Engineers' Branch of the E.T.U., the difficulty of getting many men to see the advantages is a point which does not show the station man in a favourable light if a comparison of intelligence is made.

Every profession has its association, which grants certificates of efficiency to its members, thus keeping those undesirables out, who might through influence enter into competition with them for their job.

A switchboard job, while things run smoothly, can be done as a matter of routine by any one of normal intelligence, and it is upon this theory that rates of pay are fixed.

It is hardly likely that any undertaking, private or municipal, would put any difficulty in the way of such an organisation as the S.E. branch, since it would assure a proper degree of efficiency, and a desire to study and become the possessor of a licence or certificate among the staff. When one sees advertisements in the REVIEW for shift engineers at 35s. per week and ticket inspectors on the street railways at £3, one cannot help but see the excuse for the public thinking the position of the engineer is a soft one, calling for no special skill at all.

If the claim of a high standard of intelligence among power station men be true, there will not be one outside the Station Engineers' Branch of the E.T.U. in another two weeks; then, and not before, they may expect to get white men's hours and pay.

I can quite understand the attitude of the switchman and shift engineer towards an ordinary union, but in the revived association mentioned they will find a remedy for their ills. I advise all interested to find out the time and place of the next meeting and go.

Megger.

[With regard to the pension question, which is likely to assume some prominence during the next few years, we desire to enter a strong protest against the policy referred to by our correspondent as a possible explanation of the advertisement under discussion. Any employer who pays a man at a lower rate than his services are worth because he has a pension is putting a corresponding part of that man's pension into his own pocket, defrauding the State and the pensioner. We do not accuse any one of having done this; but we fear that cases of the kind may be met with, and we trust that our readers will unhesitatingly show them up.—*Eds. ELEC. REV.*]

The Psychology of Shift Work.

In your issue of the 3rd inst., Mr. A. H. Holt, in his letter on "The Psychology of Shift Work," suggests as a possible remedy of its evils, the formation of a Staff Engineers' section of the E.T.U.

This, I am proud to say, to all intents and purposes already exists, Station Engineers' Branches having been formed in London (three), Manchester, Glasgow, and Birmingham, and they are under consideration, if not already actually formed, in many other large towns.

Speaking for Birmingham, this branch caters for and includes a very large number of staff engineers, and I strongly advise Mr. Holt to get in touch with the Manchester Branch.

Birmingham,
August 13th, 1917.

Thos. N. Morris, Secretary,
Electrical Trades Union.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Large Lifting Magnet.

An improved Phoenix lifting magnet, 62 in. in diameter, recently tested at Messrs. STEEL, PEECH & TOZER's works, unloaded a truck-load of steel turnings in 7 minutes, which work ordinarily takes four men five hours to do; it filled four large furnace boxes in four lifts with $3\frac{1}{2}$ tons of metal; a truck load of tube scrap, weighing 7 tons 7 cwt., was emptied in $6\frac{1}{2}$ minutes. It is considered that the magnet would lift a solid ingot weighing 70 tons. The magnet

weighs 65 cwt. and requires about 50 amperes at 220 volts; the controller enables the load to be partly discharged if desired, and a safety device can be fitted to ensure the load being maintained even if the main current is interrupted.—*Iron and Coal Trades' Review*.

Pocket Lamps.

Amongst a variety of designs for pocket lamp cases, MESSRS. ROSE BROS., of 25, Milton Street, E.C. 2, have introduced a "trench lamp" finished in khaki enamel, in which light is obtained only by lifting the top, as here illustrated. Short-circuiting is impossible. This case takes the standard three-cell battery. It will be

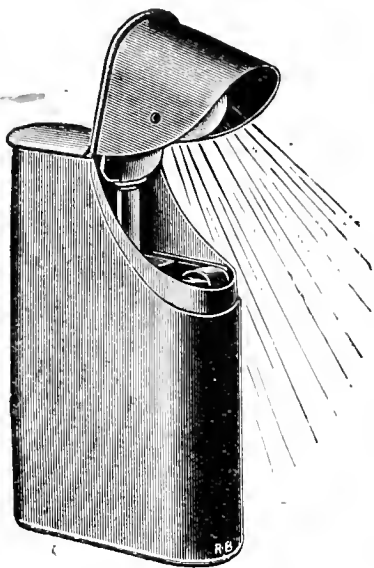


FIG. 1.—TRENCH LAMP.

noticed that the top forms a hood over the lamp, preventing the escape of the rays in undesirable directions, and there is no possibility of the battery being accidentally run down by pressure on the lamp in the pocket. They are also making a pocket accumulator lamp, in which the cells are packed with glass wool; when the cells have been charged, the acid is drawn off, making the lamp unspillable. Other items, in addition to their usual lines, are new types of medical coils and a stock of general accessories, bell-wire, &c.

A Large Self-cooled Transformer.

Oil-insulated, self-cooled transformers contained in fluted tanks were, until recent years, limited to about 500 kw. capacity, and units larger than this were usually of the oil-insulated, water-cooled or air-cooled type. However, with the development of the outdoor sub-station there was created a demand for large transformers that would operate in any climate and under all kinds of

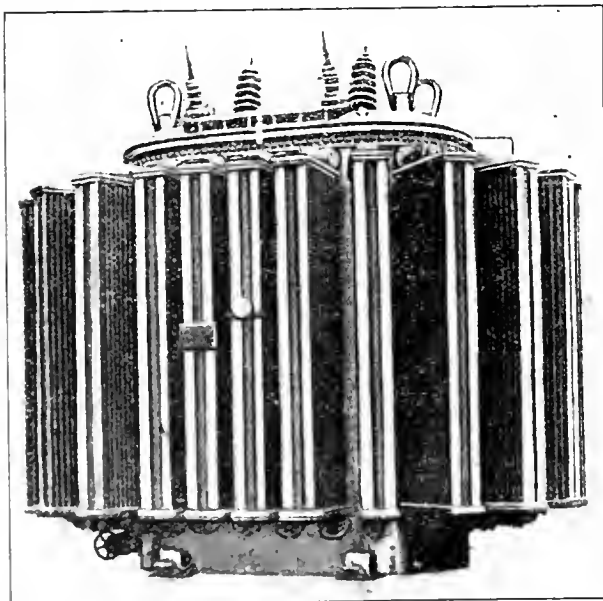


FIG. 2.—RADIATOR-TANK TYPE OUTDOOR TRANSFORMER.

weather conditions without an attendant. This gave new life to the self-cooled oil-insulated type of transformers, and new designs were developed. The result is that the sizes of self-cooled oil-insulated transformers have been increased until they have reached the proportions of the one shown in the illustration. This unit is said

to be the world's largest self-cooled transformer, and was built by the GENERAL ELECTRIC CO., Schenectady, N.Y. Six of these units have been constructed for the Carnegie Steel Co. They are single-phase, 25-cycle, 8,000-K.V.A. each, giving a total capacity of 48,000 K.V.A., and step the voltage down from 44,000 to 6,600.

The unique feature of these transformers is the construction of the external radiators, which consist of a number of vertical flattened tubes rigidly welded into headers which are flanged for bolting to the tank. The 24 radiators give a radiating surface of 800,000 sq. in. As the oil is heated in the containing tank, it rises to the top of the tank and out into the radiators, while the cool oil flows in at the bottom, thus producing automatic circulation of the oil through the radiators. All seams and joints in the tank and radiators are welded to prevent oil leaking. The radiators are self-draining and have no pockets, preventing the accumulation of air at the top or moisture and sediment at the bottom.

The transformer winding is of the circular-disk-coil interleaved type mounted on the centre leg of a three-legged core.—*Elec. World*.

Indian Ink Eraser.

An eraser has been introduced with which Indian ink can be completely cleaned from tracing cloth. It is claimed that it leaves no trace of the ink, and does not injure the cloth. The article is being sold and manufactured under the trade name "Rasindia," by MR. E. H. ANDERSON, at 272, East 199th Street, New York, U.S.A.

LEGAL.

ALLEGED UNLAWFUL POSSESSION.

At the Mansion House Police Court on the 10th inst., Wm. James Mansell 33, an electrician of Woodley Road, Stoke Newington, was charged, on remand, before Sir John Knill, with being in the alleged unlawful possession of one electrolier, an electric standard, and fittings, supposed to have been stolen.

MR. HENRY WELLS, acting secretary of the General Electric Co., Ltd., said the fittings were of their manufacture, but he could not say that they had been stolen from them.

MR. DOUGLAS (Chief Clerk): Do you sell wholesale or retail?

WITNESS: Wholesale. They had not got prisoner's name on their books as a customer. The value of these articles was about £9.

SIR JOHN KNILL said he was satisfied that prisoner was not honestly in the possession of the articles, and sentenced him to 14 days' hard labour.

GENERAL ELECTRIC CO., LTD., AND THE BRITISH GENERAL ELECTRIC CO., LTD., v. J. OSSAWA & CO.

ACCORDING to a Sydney newspaper, on June 22nd, in the Australian Courts, Mr. G. E. Flannery appeared for the plaintiffs, and Mr. F. R. Jordan for the defendants, of York Street, Sydney, in this matter, in which the plaintiffs applied for an injunction restraining the defendants from infringing the former's trade mark.

His HONOUR made the following orders in terms of the statement of claim, viz.:—(1) That the defendants be restrained from infringing the trade mark on certain electrical apparatus of the plaintiff, the General Electric Co., Ltd.; (2) that the defendants be restrained from passing or attempting to pass the defendants' goods as the plaintiff company's goods; (3) that the defendants deliver up all apparatus in their possession which offend against the above injunction.

REFUSAL TO GRANT A LEAVING CERTIFICATE.

THE refusal of the Bristol Corporation to grant a leaving certificate to H. J. Bridge, a wireman employed in the sales department of the electricity department, formed the basis of an appeal to the Bristol Local Munitions Tribunal, when the chairman of the Tribunal found that reasonable grounds had been established for the withholding of the certificate. The complainant alleged that the Corporation acted unreasonably in refusing the certificate, inasmuch as they did not comply with the Fair Wages Clause; he was an electrical fitter, a member of the A.S.E., and was paid at the rate of 11d. an hour for 53 hours, which was equal to a wage rate of 45s. 10d. per week of 50 hours; in addition, he received a 4s. war bonus. The district rate for an engineer's fitter in a "shore shop" in the Bristol district had been 50s. a week of 53 hours since the award of the Committee of Production, which came into operation on April 1st, 1917. The complainant contended that there was no distinction in that district between an electrical fitter and any other fitter, and that the rate should be 50s. a week of 53 hours.

The respondents contended that the engineers' rate above-mentioned was not applicable to their establishment; the work done was similar to that of the local electrical contractors, whose electrical fitters were paid at 10d. an hour for a 50-hour week; and as they were paying complainant 11d. an hour, they were paying more than the district rate, and therefore complying with the Fair Wages Clause; also the award of the Committee of Production had no application to their establishment.

The judgment stated that the award did not apply to the shops of electrical contractors, and that the respondents had not

infringed the Fair Wages Clause: they had reasonable grounds for refusing a certificate to the complainant, and the complaint was dismissed.

COLLIERY ELECTRICIAN FINED.

At the Wigan County Police Court, on August 3rd, Clifton Ramsdale, electrician, was summoned by the Wigan Coal and Iron Co. for failing to examine electrical apparatus at a mine. Mr. T. ELLIS appeared to prosecute, and said the defendant was employed by the prosecuting company as an electrician. On July 9th the defendant should have inspected Aspull Moor pumping pit, but he said some men were employed in the pit shaft, and therefore he could not make the examination. That might have been so, said Mr. Ellis, but defendant could quite easily have reached the apparatus another way. He entered in his log-book that an examination had been made, and made the entry "All in order" for that date. A fine of 40s. was imposed.—*Wigan Observer*.

SOUTH LONDON ELECTRIC SUPPLY CORPORATION v. CHARLES A. BURBROOK.

At Lambeth County Court, before Judge Hodges, last week, the South London Electric Supply Corporation brought an action against Charles Alfred Burbrook, of 19, Bellevue Gardens, Clapham Road, to recover £4 4s. 2d. for fixing electrical fittings. His Honour gave judgment for the plaintiffs for £3 14s. 8d., with costs.

SOUTH LONDON ELECTRIC SUPPLY CORPORATION v. MRS. L. BOWMAN.

At Lambeth County Court, before Judge Hodges, last week, the South London Electric Supply Corporation brought an action against Mrs. Bowman, of 31, Athenfold Road, Clapham, to recover 11s. 6d. for work done.

Defendant's daughter stated that the fittings were damaged when they went into the flat, and her mother was not responsible for their repair. When the inspector called his attention was drawn to them, and he said he would send a man to do the work.

Judge HODGES: You would not have had them repaired if you knew you had to pay for them?

WITNESS: No.

Judge HODGES said he thought a mistake had been made, and gave judgment for the defendant, with costs.

A DEFECTIVE PORTABLE LAMP.

At Falkirk, on Monday, before Sheriff Moffatt, the Greenock and Grangemouth Dockyard Co., Ltd., Grangemouth, were charged with having on June 7th in their yard, being a factory to which the Factory and Workshops Acts applied, allowed a portable electric lamp to be used by a ship's caulker, now deceased, on board a ship under construction, the lampholder of which was in direct metallic connection with the guard, contrary to the Electricity Regulations, and particular Regulation 13.

Evidence was given for the prosecution that there was no doubt the lamp which the deceased caulker had used was a violation of the regulations. For the defence, evidence was given by several witnesses, including the company's electrical engineer, that a large number of caulkers and riveters had been drafted from Glasgow in order to expedite the work of a particular ship, and the wastage of portable lamps on that ship was extraordinary. Several of the damaged lamps were produced in Court. One witness deposed that he had seen the lamps wilfully thrown at workmen, and he had also seen them placed in position as targets, and washers and nuts thrown at them. The workmen also wasted their employers' time, for when new lamps could not be provided they remained idle until the broken ones were repaired.

A representative from a Glasgow firm of makers spoke to supplying lamps to the company which did not conform to Regulation 13. The lamps were cheaper in the proportion of 2s. 9d. to 7s., and they did not question an engineer's order.

The SHERIFF found the defenders guilty, and imposed a fine of £3. He remarked that he was impressed with the difficulties of the company in carrying out work of vital and great national importance. It would never do for the company to stop work because they could not obtain lamps which conformed to the Government Regulations. That was not common sense, and it might be a question whether representation should not be made to the Home Secretary to have the Regulations made easier at such times. There seemed to be no doubt about the wilful breaking of lamps, and the desire of the workmen to waste their employers' time. He trusted that no such evidence regarding workmen would be given in that Court again, and thought that if the men could be found who had committed the damage allowed to, they should be severely dealt with.

The Metric System.—The British Chamber of Commerce in the Argentine, which has a membership of over 250 British companies and merchants trading with the Argentine, has sent a memorial to the Prime Minister stating that, in the opinion of the Chamber, it is highly desirable, in the interests of British trade abroad, that the decimal metric system of weights and measures should be made compulsory throughout the Empire forthwith.—*Times Trade Supplement*.

WAR ITEMS.

Exports to Switzerland.—The "London Gazette" announces that, by Order in Council, the exportation to Switzerland of celluloid wares, insulating materials, presspahn, and tin wares, with other items, has been prohibited.

Trade with China.—The "London Gazette" for August 10th contains a list of additional firms in China and Siam to whom articles may be exported.

Australia.—The Federal Government has revoked the ban placed by the Federal Attorney-General, under the provisions of the Enemy Trading Act, on the Sterling Telephone and Electric Co., Ltd., and Conrad William Schmidt.

Exports Prohibited.—The "London Gazette" for August 14th contains amendments to the schedule of articles of which the exportation is prohibited. Amongst the additions to the schedule are the following:—Malleable castings—chain fittings, conduit fittings, lamp fittings, pipe flanges, stove fittings, tramway fittings; chemicals—mixtures and preparations containing ethylic alcohol; manufactures of raw hides—pinions, &c., suitable for textile machinery; metal valves of all descriptions.

Foreign-Controlled Companies.—The fourth report of the Enemy Influence Sub-Committee of the Unionist War Committee has just been issued. It deals with the disclosure of the identity of foreign-controlled companies. The report mentions that in deciding what steps should be taken to prevent foreign-controlled companies in the future from passing themselves off as British concerns, care must be taken not to discourage the investment of foreign capital in the business of this country. The Sub-Committee expresses the opinion that it would be reasonable to require that where a company or corporation carrying on business in the United Kingdom is actually under foreign control, unless the existing title of the company clearly and correctly designates its foreign nature, the fact should be disclosed in its title by adding the words "foreign-controlled," so that everyone having dealings with it, and the public generally, may be aware of such foreign control. In order to ensure the observance of the law, the Sub-Committee recommends that the directors and secretary of every company or corporation should be required to make proper returns, stating the position of the company, to the Board of Trade.—*Financial Times*.

Air-Raid Warnings.—Sir G. Touche asked the Home Secretary whether he was aware that, following the intimation that electric power stations desiring to receive telephonic air-raid warnings by day, such as had always been given by night when there was less risk to machinery and fewer hands employed, should apply to the police authorities, the Associated Municipal Electrical Engineers of Greater London made application, and received a reply suggesting that the object would be met by the arrangements for giving a general public warning when enemy aircraft were reported to be approaching the London area; if he was aware that the public warning was rendered inoperative in the works in consequence of the noise of the machinery and other causes, and if he would reconsider the refusal to give direct warning by day as well as night.

Mr. Pratt said the application from the electrical engineers was received before arrangements were made for a public warning in London, and when the public warning had been arranged for it was suggested that it might suffice for their purposes. He had not received any representations to the contrary from the Association, but he was communicating again with the Association.

Trade Within the Empire.—The Prime Minister has appointed a Committee of Ministers to report on the best methods and machinery by which to give effect to the resolution passed by the Imperial War Conference in favour of special facilities being accorded for the exchange of the products and manufactures of the Empire. It is understood that the Government departments which will be represented on the Committee, of which Mr. Walter Long is chairman, are the Treasury, Foreign Office, Colonial Office, India Office, Ministry of Reconstruction, Board of Trade, Ministry of Shipping, Board of Agriculture, and the Ministry of Labour.

Employment Exchanges.—The Civil Service Correspondent of the *Daily Telegraph* states that Mr. Hodge, Minister of Labour, has decided on a new scheme which will have an important bearing on the future usefulness of the Employment Exchanges, and undoubtedly will commend itself to employers and workers. Over the United Kingdom, until now, only about 20 local advisory committees have been established. In future there will be an Advisory Committee attached to each exchange. The committees will be empowered to discuss anything they choose, and to advise and make suggestions as they think fit. It is estimated that about 300 of these Advisory Committees will be set up all over the kingdom. London will have one Central Committee, but with sub-committees in close touch with each exchange. Under Mr. Hodge's scheme all trades and industries will be represented in one omnibus committee, composed of one-half employers and one-half workers.

Labour Disputes.—Numerous resolutions, it is stated, have been received by the Executive Council of the Amalgamated Society of Engineers from branches and district committees expressing dissatisfaction at the inadequacy of the Committee of Production's award relative to the wages in the engineering and foundry trades. As the result, the Executive Council has sent a letter to the Committee on Production, in which it states it is essential that the Committee should be made conversant with the state of feeling manifesting itself throughout the country among the members with reference to the award, as they deem the advance of 3s. a week totally due to the increased cost of living. The executive has received a communication from Dr. Macnamara to say that the Board of Admiralty has decided that the award shall be applied to workmen in the Royal dockyards, and that instructions have been issued to that effect.—*Daily Telegraph*.

Exemption Applications.—At Rochdale, Mr. G. Webster, tramways manager, appealed for J. Crossley (36, Class A, single), electric wireman, and four married motormen, three Class A and the other B1, and all under 32 years of age. Mr. Webster said he had lost 43 drivers out of 88, and was still 14 short. He was trying to obtain substitutes wherever possible. Crossley was conditionally exempted, and the others put back to November 15th.

At Burnley, an electrical engineer, now in the Army, appealed for an engineer, married, 29, C1, but previously rejected. Exemption to September 30th was given.

At Slough, the Military appealed against absolute exemption held by W. C. Hayward (38, A1), electrician. Hayward was stated to have entire charge of an electric plant. Appeal allowed, certificate cancelled, and three months' temporary exemption allowed, with no further appeal without leave.

At Hereford, Messrs. Harding Bros. appealed for H. C. Owens, electrician; exemption until October 15th.

At Hastings, Mr. Wordley appealed for R. C. Merrifield (40, A1), electrician, and a member of the Fire Brigade; three months' conditional exemption.

At Rammarsh, the Mexborough & Swinton Tramway Co. appealed for the retention of two motormen; one, aged 28, had his exemption confirmed; the other appeal, referring to a discharged soldier, was deferred for further information.

An appeal was made by the Military to the Herefordshire Appeal Court for J. Langford (33, B1), electric light attendant, who had been exempted locally. Respondent was put back to October 1st, with an examination by the Central Medical Board in the meantime.

At Oldham, exemption was claimed for a Corporation tramcar driver (32, B1). It was stated that he was 22 days below the age limit for men employed on work of public utility. He was given exemption until November 1st.

At High Wycombe, an appeal was lodged by E. H. Milner (39, C1), electrical engineer; on his remaining a Special Constable, he was given three months' temporary exemption.

At Castleford, the Military appealed against exemption held by C. J. Cox, electrical engineer, passed for general service. Several firms wrote stating that they were dependent upon Mr. Cox for repairs, &c., and the appeal was disallowed; and the exemption allowed to remain in force.

At Gloucester, conditional exemption was conceded to an electrician (20, C1), said to be the only man left capable of looking after the plant at several theatres. The Military representative intimated that he would appeal against the decision.

Before the County Appeal Court, exemption was claimed by Mr. Albert Wilcox (39, C2), electrical engineer, of Farnham Common. It was certified by the Acting Tuberculosis Officer of the Bucks. County Council that appellant had tuberculosis of the lungs. Six months' temporary exemption was granted.

BUSINESS NOTES.

Electrical Trade with the British West Indies.—The following particulars of the imports of electrical goods into the British West Indies and British Guiana are taken from a report by the Canadian Trade Commissioner at Barbados, which is published in the July 2nd issue of the "Weekly Bulletin" of the Canadian Department of Trade and Commerce:—

Although electricity has been introduced into Barbados, Trinidad, British Guiana, and Jamaica, for lighting and for power for tramways, it has not come into general use, and there is a wide field for its expansion for lighting and domestic purposes. For the whole of the West Indies the value of the imports of electrical apparatus and fittings amounts to only £35,000 a year. This, however, does not include machinery or the large quantity of copper wire required by the tramway, electric lighting, and telephone companies. The value of wire used considerably exceeds the value of electrical apparatus. Of the requirements for electrical goods of all kinds, the United States is at present the largest supplier, but the bulk of these goods came from the United Kingdom previous to the war. The United States has now practically all the trade of Trinidad and Bermuda, about two-thirds that of Jamaica, and more than half that of British Guiana. The United Kingdom comes next, supplying the greater part of the trade of Barbados, about one-third

of that of Jamaica, and practically all the trade of the Windward and Leeward Islands.

There are only three cities in the West Indies that have electric tramway services, namely, Kingston (Jamaica), Port of Spain (Trinidad), and George Town (British Guiana). It is understood that after the war the existing mule tramway system in Barbados will be replaced by an electrical system; the rails and some of the machinery required have already been imported.

Electric motors are being gradually introduced into the larger sugar factories, engineering establishments, cotton ginneries, and also for dental and other minor purposes where electric current can be obtained. In the last few years electric fans have been installed in the principal commercial and public offices. In all the principal hotels and private residences electric bells are now fitted.

Throughout the larger islands complete telephone systems are to be found.

As regards the electric fittings used in the West Indies, &c., it is to be noted that the electric lighting system in Barbados follows the British practice in using the bayonet type of lampholder, but in British Guiana, Trinidad, and Jamaica, the American screw-base type is in use.

In the Windward and Leeward Islands electricity has not been introduced to any extent. Attempts to introduce electric cookers into the larger islands have, up to the present, met with little success.—*Board of Trade Journal*.

Catalogues and Lists.—MESSRS. STERNS, LTD., "Royal London House, Finsbury Square, E.C. 2.—Leaflet relating to "Balagrip Bricks" for balata belts, and "Excelsior Sternoline" for use in screw and automatic lubricators.

THE CREDEBA CONDUITS CO., LTD., Birmingham.—Three showcards executed in colours, showing "Creda" electric fires in the nursery, in the bathroom, and in the trenches—very effectively.

MESSRS. ROSE BROS., 25, Milton Street, E.C. 2.—Special catalogue of pocket lamp cases, pocket accumulator lamps, dry batteries and accumulators, bulbs, &c.

Book Notice.—"Science Abstracts." A and B, No. 235 Vol. XX, Part 7. July 30th, 1917. London: E. & F. N. Spon Price 1s. 6d. each net.

Bankruptcy Proceedings.—FREDERICK BROWN, 8, Stafford Street, Llanelly.—Order of discharge, as from July 6th, 1919.

G. J. T. J. PARETT, 11, Priory Road, Keynsham.—Notice is given of intended dividend. Last day for receiving proofs, August 28th, 1917. Official Receiver, Mr. C. H. King.

Private Arrangements.—BASIL CHARLES COUSENS, 81, Bold Street, Fleetwood, and 6, Albert Square, and Wyre Dock, Fleetwood, electrical instrument maker.—A meeting of the creditors was held at Preston, when a statement of affairs was submitted showing liabilities totalling £1,184. The net assets were £895, disclosing on paper a deficiency of £289. It was stated that the debtor had, owing to proceedings and judgment, consulted his solicitor a few days before the meeting, and it had been considered desirable to protect the assets for the benefit of all concerned. Owing to his being engaged on Government work he was not present at the meeting. There was no offer before the meeting, but several creditors expressed the opinion that it would be better if the debtor could make some proposal. It was decided to confirm the deed already executed in favour of Mr. Todd (Preston), a Committee of Inspection being elected. The following are the creditors:—

British Thomson-Houston Co.,	£27	Falk, Stadelmann & Co.,	£13
"Bankers",	286	Great Grimsby Salt Co.,	16
Bowcock & Wilkinson	57	Heath & Co.,	91
Baxendale & Co.,	18	Munroe & Co., Ltd.,	11
Baxendale Bros., Ltd.,	486	Mason, J. W., & Co.,	23
Cookson, Ltd.,	14	Penman, Dr.,	18
Close, Albert	33	Preston & Sons, Ltd.,	12
Callender's Cable Co.,	33	Potter, John	23
Edelshaw & Sons	16	Parkinson, N.,	14
Fleetwood Trawlers	14	Whittington & Wilson	16

Fire.—Considerable damage was caused by an outbreak of fire at Silvertown early on Saturday morning at the Winchester Street Works of the India-Rubber, Gutta-Percha, and Telegraph Works Co. The outbreak was discovered in a huge building of four floors, and, owing to the inflammable nature of its contents, the two upper floors were quickly involved.—*Financial Times*.

Advance in Prices.—The Sterling Telephone and Electric Co., Ltd., announce that from the 13th inst. all list prices are further advanced 20 per cent., with certain specified exceptions.

Liquidation.—KORTING BROS., LTD., 53, Victoria Street, London, S.W. 1.—This company has gone into voluntary liquidation for the purpose of getting rid of all enemy connections. The business has been sold as a going concern, with all assets and liabilities, to a new company under the name of Kortling Bros. (1917), Ltd., which will carry on the business as an entirely British concern, at the same address.

Company Directors.—The B. of T. has published in the *London Gazette* of August 14th a schedule prescribing the form in which the particulars required by Section 2 of the Companies (Particulars as to Directors) Act, 1917, are to be sent to the Registrar of Companies, and an amended form to be used in making the list of members and summary of capital required by Section 26 of the Companies (Consolidation) Act, 1908, as amended by the former Act.

Trade Between the United Kingdom and Canada.—The Imperial Trade Correspondent at Winnipeg (Mr. W. J. Healey) reports that the Winnipeg Board of Trade (*i.e.*, the Chamber of Commerce) has appointed a new Standing Committee with the object of promoting trade between the United Kingdom and Canada. This Committee, which is to be known as the Imperial Trade Committee of the Winnipeg Board of Trade, is prepared not only to answer all questions by British manufacturers bearing on the trade within the Empire, but to receive, and have properly displayed, samples from any British manufacturer. By this means, it is thought, importers in Western Canada will have an opportunity of handling British-made goods which are suitable for that territory. Samples submitted can usually be sold, and the proceeds, less a small commission to cover incidental expenses, remitted to the exporter. The Committee will also endeavour to establish connections between the importer and manufacturer, or the importer and agent. Communications from the British firms should be addressed to the Secretary, Imperial Trade Committee of the Winnipeg Board of Trade, Winnipeg.—*Board of Trade Journal*.

Trade Announcement.—MESSRS. GRINDLAY, ROSS, AND Co., Ltd., Glasgow, announce their removal to Adelphi Engineering Works, Reid Street, Bridgeton, Glasgow. Telephones: Bridgeton 1721 and 1722. Telegrams: "Grindlay," Glasgow.

Plant for Sale.—Nuneaton Corporation has for disposal a complete electrical plant, suitable for a private installation. Full particulars are given in our advertisement pages to-day.

LIGHTING AND POWER NOTES.

Australia.—Consideration is being given by the Sydney City Council to the question of acquiring a coal mine to provide coal for the municipal electric supply station. A coal-bearing property is being investigated.—*Melbourne Age*.

The Sydney City Council has been advised that the High Commissioner for Australia has been notified that it is impossible to sanction priority for a steam turbine plant for the Council, and suggesting that the Council should reduce the supply of power to private customers, and thus provide adequate supply for national and public purposes.

Balls Head, Sydney, N.S.W., is to be transformed into the largest coaling depot in the Southern Hemisphere, at a cost of about £500,000; stocks of coal of 50,000 tons and upwards will be carried, as well as stores of oil fuel, &c. The colliers will be discharged by mechanical grabs, and the coal sent to the stacks by means of electrical conveyor belts. Electrical weighing machines are included in the plant, and will work in conjunction with the conveyors.—*Colliery Guardian*.

The Wollongong Council has been informed by the Public Works Department that a feeder can be run from the Port Kembla—Cordeaux transmission line, enabling an electric supply scheme to be started.—*Sydney Evening News*.

The Warrnambool (Vic.) T.C. and Water Trust has decided to provide for a future municipal electricity supply in the town by installing new 150-H.P. high-speed engines at the water supply pumping station: until the electric supply is installed, the new plant will be utilised for pumping only.—*Melbourne Age*.

Bacup.—At a meeting of the T.C., Councillor J. H. Lord said there was a general satisfactory increase month by month in the demand for electricity; they had not been able to meet the Rawtenstall Corporation with regard to the question of a bulk supply, but were asking for a conference, so that the matter might be settled.

Canada.—In a recent article, by Mr. W. R. Bonnycastle, in the *Electrical News*, the author draws attention to the power requirements of Vancouver City, advocating that the city should secure a power site at Bridge River, 138 miles away, where an operating head of 1,400 ft. could be obtained, and, with storage facilities, 500,000 H.P. could be developed. The cost of the development would be \$45 per H.P. at the power house, and at Vancouver \$70-90, depending on the energy delivered. This development could supply a large portion of the province, and is said to be considerably less costly than those proposed for Winnipeg.

A company is erecting a large plant at Shawinigan Falls, Quebec, for the purpose of manufacturing carbonyl and other abrasives. A contract has been made with an electric power company to supply 20,000 H.P. to the new enterprise. It is expected that the construction of the plant will be completed by the end of the year, and that a staff of 300 men will be employed at first.

Colchester.—PROPOSED NEW STATION.—The Electricity Committee has under consideration a scheme for erecting and equipping a generating station on the river; the existing works would be converted into a main distribution sub-station.

Continental.—SPAIN.—In discussing the future of the electro-chemical and electro-metallurgical industries in Spain, *La Energia Electrica* concludes that the principal Spanish rivers and their feeders could supply 1,200,000 H.P. for their development, of which only 400,000 H.P. is at present utilised.

The Sociedad Hidroelectrica del Pindo has been granted the use of the whole of the water power obtainable from the River Dobra, Orvieda Province, for utilisation for industrial purposes.

Greasbro'.—PROVISIONAL ORDER.—The U.D.C. has decided to make an application to the B. of T. for a Provisional Order to authorise the supply of electricity for public and private purposes within the urban district.

Hereford.—ELECTRICITY PRICES.—The Electricity Committee has recommended that, with the exception of reverting to the previous daylight schedule of prices, plus the advances, it will be unnecessary to raise the prices of electricity further. The Finance and General Purposes Committee had recommended increased charges to all classes of consumers.

Harrogate.—The T.C. is endeavouring to get permission from the military authorities to keep all the public electric lights in operation during the coming winter.

Boiler By-Product Plant.—The Electricity Committee has recommended the Council to make application to the L.G.B. for sanction to borrow £1,710 for the installation of a by-product steam boiler plant, in accordance with the designs and specifications of the borough electrical engineer.

India.—ELECTRIC POWER IN COLLIERIES.—The collieries of India, and especially those in Bengal, have, during the past few years, been gradually adopting electricity as a motive power in place of steam. Companies owning a number of collieries have recently effected an economy by installing units at a central station and distributing electricity to the various collieries.—*Colliery Guardian*.

Leeds.—PROPOSED LOAN.—Application has been made by the Electricity Committee to the L.G.B. for powers to borrow a sum of £25,000 for mains extensions, and also a similar amount for the erection and equipment of sub-stations.

London.—MARYLEBONE.—The general manager of the electricity supply department reports that the output of electricity for the four weeks ended July 26th last was 878,150 units, as compared with 836,900 units during the corresponding period of 1916.

Manchester.—ELECTRIC COOKING AND HEATING APPLIANCES.—In the current year's estimates of the Corporation's Sanitary Committee, £250 is provided to cover the expenditure of the Air Pollution Advisory Board for chemical analysis and research work in connection with electricity, gas, and coal cooking, and heating appliances. The Committee reported that an application had been made to the Committee of the Privy Council for Scientific and Industrial Research for a grant in aid of the work, and that a reply had been received stating that the Privy Council had promised the sum of £150, subject to certain conditions.

Marsden.—The U.D.C. has considered a letter from the Yorkshire Electric Power Co. on the lighting question, and a special meeting is to be convened to discuss the matter with the company.

Middleton.—BULK SUPPLY.—The Corporation has had under consideration the report of the electrical engineer on the proposal to convert the electricity works into a transformer and distribution station, to deal with a bulk supply of electricity from Manchester, stating that under the proposed arrangement an increased output of 70 per cent. above the capacity of the present plant could be immediately provided to meet the future demands, and an estimated saving in wages, maintenance cost, and repairs, &c., of over £900 per annum could be effected, whilst the saving in the amount of coal consumed in the generation of the electricity at Manchester, as compared with Middleton, would be 1,500 tons per annum. The town clerk has been instructed to communicate with the Coal Controller on the matter.

New Zealand.—The revenue of the Auckland Corporation electricity department for last year was £60,326, and the gross profit was £34,033. In his annual report, the city electrical engineer states that there was an increase of 10 per cent. in the output as compared with the previous year, which would have been much greater if conditions had been normal and materials available.—*Auckland Weekly News*.

Perth.—PRICE INCREASE.—The Corporation Gas and Electricity Committee has agreed to recommend an increase in the gas rate, and an all-round increase of 40 per cent. on the electricity rates.

Peterborough.—PRICE INCREASE.—The T.C. has decided to further increase the price of electricity, as from September 30th, by 10 per cent., making a total additional charge on the pre-war rates of 20 per cent., and to notify the Electric Traction Co. that the rates paid for current are to be revised three months hence.

Sheffield.—Arrangements have been made for the transfer to Sheffield of 28,000 kW. of plant which is to be installed in the emergency power house at Blackburn Meadows, and the general manager has been authorised to place contracts for the necessary machinery, boilers, and works, at a total estimated cost of £560,000. This includes plant, &c., already ordered. Mains are to be extended at an estimated cost of £2,092.

Sunderland.—The T.C. has decided against the recommendation of the Electricity Committee that the services of the borough electrical engineer should be temporarily lent to the B. of T. Coal Mines Department.

The T.C. has decided that no services for the supply of electricity be laid unless the consumer first provides a priority certificate of a sufficiently high category to enable the Electricity Department to purchase the material required for the work.

Tasmania.—According to the *Melbourne Age*, the Lake Margaret hydro-electric plant is to be extended by the Mount Lyell Co., so as to make available 8,000 H.P. additional to the present installation, at a cost of about £70,000, the aggregate expenditure in this connection being approximately £230,000. At the request of the Government, the Mount Lyell Co. has investigated a scheme for generating electricity on the King River. The results indicate that it appears "economically feasible" to install a 30,000-H.P. plant. Additional power from the Lake Margaret installation will, in the first instance, be used for the electrolytic production of speller.

Whitworth.—The Council has been in communication with the Rochdale Tramways Committee, with a view to obtaining electricity from the overhead wires for street lighting purposes, and has been informed that the scheme would be impracticable, as the voltage in the wires varied considerably, and at times was very low.

TRAMWAY AND RAILWAY NOTES.

Australia.—The Brighton (Vic.) Council has decided to apply for an Order in Council authorising the construction of electric tramways in its territory.

According to the *Melbourne Argus*, the net profit of the Melbourne Tramways Board for the first year's operating of the cable tramway system will be about £350,000. Last year, under the Melbourne Tramway Co.'s management, the revenue from traffic was £805,000; this year the total earnings will be, approximately, £841,000, and with earned interest and income from other sources £857,000. Though the income of the Tramway Board will be considerably more than was received by the Tramway Co., its expenditure will be heavier, as wages, fuel, &c., have considerably increased, and the law costs, consequent on the arbitration proceedings over the purchase of the Melbourne Tramway Co.'s cars and other equipment, will mean additional expenditure. The Tramway Co. last year paid £312,000 in dividends, and transferred £97,858 to reserve, &c. The Board will probably be able, with an extra income of approximately £35,000 for the year, to meet the increased cost of labour and materials and show a net profit of about £350,000; these accumulated profits will be invested until such time as Parliament directs what shall be done with them.

Bradford.—TRAFFIC RECEIPTS.—In the week ended August 14th, the receipts on the Corporation tramways were £7,653, an increase of £299 on the corresponding week of last year. For the 126 days of the current year the income has been £137,631, an increase of £12,620 on the corresponding period (127 days) of last year, whilst last year's figure was an increase of £270 over 1915.

Continental.—SPAIN.—The installation of mechanical communication between Coruna and Santiago has been mooted for over 20 years, and now active steps are being taken to realise a scheme. A company has been formed to construct an electric tramway to link the two cities, the funds being provided by prominent individuals in both the provinces in which the cities are situated.

A company is in course of formation for the construction of an electric tramway in the Asturias, the Diputación and Municipalities of Oviedo, Noreña, and Pola de Siero having agreed to make a yearly subvention of 70,000 pesetas for 10 years.

Doncaster.—The Corporation tramway receipts for the four days of the Bank Holiday period totalled £761, as against a total of £439 last year. The Bank Holiday Monday figure was exceeded by the Saturday total of £286, which was a record day in takings.

Leeds.—The tramway receipts for the week ended August 14th were £10,719, an increase of £21 over those of the corresponding period of last year. The passengers carried were 2,320,000, an increase of 35,000. The receipts for the 18 weeks of the current financial year have been £197,913, an increase of £20,414 over the corresponding period of last year.

WOMEN INSPECTORS.—The threatened trouble on the city tramways, owing to the appointment of six female inspectors, has been settled. The female inspectors are to be retained, but the Tramways Committee undertakes to appoint as future inspectors, former employes who return from the Army but are unfit for drivers, if they are suitable for the work, or other male employes. In any case, the appointments are but a war-time measure.

Manchester.—TRAFFIC CONGESTION SCHEME.—The Special Committee of the Corporation, which has been considering the question of traffic congestion in the central area, has prepared a scheme which will be submitted to the City Council at the September meeting; the scheme provides for the laying of two new tramway tracks to ease the severe congestion in Piccadilly, London Road, and Oxford Street, provision of tramway terminals, and the purchase of property, &c., estimated to cost between £1,000,000 and £1,500,000.

MANCHESTER AND SALFORD AUGUST HOLIDAY TRAFFIC.—The three days' receipts of the Manchester Corporation tramways were £10,921, against £9,763 for the corresponding period in 1916 and £8,503 in 1915. The 1917 daily figures were:—Saturday, £4,106; Sunday, £2,189; and Monday, £4,335; while Salford's tramway receipts for the same period amounted to £5,313, against £3,051 in 1916.

Newport (Mon.).—The Light Railway Commissioners have submitted to the B. of T. for confirmation an order made by them for the construction of a light railway.

New Zealand.—The Wellington City Council has decided, owing to the shortage of labour, to adopt a scheme for the curtailment of the tramway services, and to impose a minimum fare of 3d.—*Auckland Weekly News*.

Sheffield.—The Overhead Line Superintendent (Mr. S. W. A. Sturman) is to act on a Committee of Overhead Line Engineers, which is to consider the question of standardisation of overhead line materials. The Committee has been appointed by the Municipal Tramways Association. The general manager has disposed of five sets of second-hand magnetic brake fittings, taken off cars purchased from the London County Council, to the Rotherham Corporation Tramways, at £10 per set.

The Corporation Tramways Committee has considered the question of wages to be paid to women engaged as labourers in the car repair shops at the Queen's Road works, and authorised the payment of the same rate per hour—viz., 6½d.—as is paid to the men, plus the amount of war allowance paid to the women of 7s. per week.

TELEGRAPH AND TELEPHONE NOTES.

Australia.—On June 23rd, Mr. Justice Powers made known his award in the plaint of the Commonwealth General Division Telephone Officers' Association against the Public Service Commissioner and others. The proposed award is that the rates of pay shall be:—Telephonists, first year, £51; second, £72; third, £90; fourth, £102; fifth, £114; sixth, £126, with a further sum of £6 a year to all who have acted as telephonists for six years or more, and are employed in central exchanges in capital cities to do trunk-line work. Telephonists of 21 years and over shall be paid a minimum of £110. Monitors, first year, £150; second, £156; third, £162; fourth, £168; fifth, £174. Supervisors, first year, £180; second, £186; third, £192; fourth, £196. Telephonists at work in any central city exchange between 10 a.m. and 6 p.m. shall not be required to work for any time exceeding 3½ hours without a break of 10 minutes, or a break for meal, or exceeding 2½ hours if they are required to stand continuously at their work. All work performed in excess of the roster hours of duty in any one week shall be deemed overtime, and paid for at the rate of time and a-half. For duty on Sundays, officers shall be allowed a day off in the next week, and half a day's pay shall be paid at the rate of time and a-half. For duty on holidays, officers shall be paid at the rate of double time, but not double time in addition to the ordinary pay for holidays. The award will not come into operation until the expiration of 30 days after it has been laid before the Commonwealth Parliament.—*Sydney Morning Herald*.

Fleetwood.—At Fleetwood Petty Sessions, on August 9th, G. Kearsley, E. Banks, L. Eaves and F. Stanton were summoned for damaging telegraph insulators by throwing stones. Kearsley was fined £5. Banks £1. Eaves £1, and Stanton 5s.

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—MELBOURNE.—October 10th. Department of the Navy. Pumping plant and equipment for the Commonwealth Naval Dockyard, Cockatoo Island, Sydney. Specifications from the Director of Navy Contracts, Melbourne.

Keighley.—August 21st. B. of G. Electric fittings and accessories for lighting the main block at the infirmary. Mr. S. Green, Clerk to the Guardians.

Kettering.—August 28th. Electricity Department. Supplying and laying 751 yards of lead-covered cable, with three-core pilot; feeder pillar, dividing boxes, switchboard instruments and stoneware troughing. See "Official Notices" to-day.

London.—BERMONDSEY.—Sept. 7th. B.C. 500-KW. rotary converter. See "Official Notices" August 3rd.

H.M. OFFICE OF WORKS.—August 20th. 400 miles of bell wire. See "Official Notices" August 10th.

Manchester.—August 18th. Supply, &c., of two electrically-driven turbo-pumps with automatic control and switch-gears, &c., for the Waterworks Committee. The Secretary, Water Department, Town Hall.

Portsmouth.—August 28th. Tramways Committee. Six months' supply of engine-room stores, insulating material, &c. See "Official Notices" August 10th.

Rathmines.—August 29th. U.D.C. 500 tons of coal for the electricity works. Particulars from the Electricity Department.

CLOSED.

Heywood.—T.C. Supply of 300 tons of coal: Mr. John Chadwick.

Peterborough.—T.C. Coal for the electricity works: Fairweather & Son, £1 1s. 7d. per ton.

Sheffield.—The T.C. has accepted the tender of Dewhurst's Engineering Co., Ltd., for the supply and delivery of 500 steel boiler tubes, also the tender of the Stirling Boiler Co. for a similar quantity of boiler tubes. Items covering transformers of 2,500 and 5,000 K.V.A. capacity respectively are to be added to the schedule in the contract with the British Electric Transformer Co., Ltd., for the supply of transformers, accepted on August 1st, 1916.

NOTES.

Thoughtlessness in Power Plants.—The thoughtless man in the power plant is the type that opens the valve on the wrong boiler and traps a fellow employé inside in a cloud of sizzling steam, who blows down the boilers with the blow-off connection open to a dead boiler with men working inside, who unthinkingly closes the wrong switch or grabs hold of a live high-voltage circuit, or numerous other things that could be mentioned. He is thoughtless because he is so busy thinking about what he did yesterday or what he expects to do to-morrow, or puzzling his brains about problems foreign to his work, that he has no time to keep his mind on what he is doing, and as a result jeopardises the lives of his fellow workers and the equipment under his care.

Not long ago several painters were painting the ceiling and walls of a large power house. At this particular time they were working above the switchboard. To keep the board and wiring from being spattered with paint, they had draped a large piece of canvas over the board and busses. About this time a friend dropped in to visit the chief, who had also just come in. He gave one glance at the canvas over the switchboard, and then asked the chief what would happen if one of the circuit-breakers should open on a heavy short-circuit. The chief saw the point, and started to draw the switchboard operator's attention to the dangerous condition, when the thing happened.

The system was 600-volt direct-current, and the circuit-breakers were mounted at the top of the board. The old canvas, soaked with paint, oil, benzine, &c., was hung on the top of the board and draped down over the front, probably not being over two inches from the carbon contacts of the breakers. It seems only an instant after the breaker opened before the canvas was a mass of flames. The smoke and fumes blinded the men, who were working directly above, so they were unable to do anything to save themselves, and to add to the situation, one of them dropped a small iron bar, which went end first through the canvas and fell across the bus-bars. There was a flash and a roar as the circuit-breakers for the machines blew out and shut the whole system down. The men, terror-stricken, jumped to the floor. Two of them were seriously injured, one having both legs broken and another an arm broken in two places besides several ribs; the rest escaped with minor injuries. The switchboard operator had allowed the painters to cover up the board according to their own discretion, and had paid little or no attention to how they did it, because he was busy laying out a wiring diagram for a friend's garage.

The absent-minded man has no business in the modern power plant, and if he is unable to take enough interest in his work to keep his mind on what he is doing, he had better look for a less exacting vocation, where the results of his mistakes are not of much consequence.—E. W. MILLER, in *Power*.

Electric Announcer at Dutch Auctions.—The Office of the United States Commercial Attaché at the Hague reports that at the regular trade auctions, held in the Netherlands, instead of having an auctioneer call for bids, there is a large dial, provided with an index hand. The face of the dial is marked with prices increasing in clockwise fashion. The hand is set at a price above that which the goods offered will probably bring, then is slowly moved to lower and lower figures until some trader indicates his willingness to buy. Electric push-buttons are connected with the dial, which the traders press when a price satisfactory to them is shown by the dial. As the trader presses his button his number appears on the face of the dial, and the lot of goods is sold to him at the price indicated by the index hand. There is no noise or confusion, and the auctions are finished in a remarkably short space of time.—*Journal of the R. S. A.*

Trade with Italy.—The following inquiries for agencies for United Kingdom firms from persons and firms in Italy, some of whom formerly represented German and Austrian firms, have been received at the British Chamber of Commerce for Italy, 7, Via Carlo Felice, Genoa. The inquirers are desirous of negotiating for agencies now, irrespective of whether United Kingdom firms are able to give deliveries at present. All communications regarding the inquiries should be sent to the Secretary of the Chamber, as above, quoting the reference numbers:—

An Italian firm at Bari wishes to represent manufacturers of motors, machinery, and tools for agricultural, electrical, and building purposes (1,401).

A firm of engineers at Genoa would represent firm manufacturing

or exporting electrical materials, steel, tools, general machinery, and engineering goods; also chemicals (1,404).

An engineer, who is manager of a mining company, is prepared to take up the representation of manufacturers of industrial machinery in general, particularly for shipbuilding (1,406).

A Bologna agent (British subject) wishes to obtain agencies for manufacturers or merchants who are interested in trade with Italy (1,407).—*Board of Trade Journal*.

German Electrical Plant Failure at Sydney.—We read in the *Sydney Morning Herald* that on June 15th, at Sydney, the Lord Mayor gave an explanation regarding the use of German electric light machinery by the City Council. He said that the machinery, which was supplied under a German contract, was giving only 80 per cent. of the power anticipated. The City Council had retained a sum of between £1,000 and £5,000 owing to the fact that the machinery had not been successful. Immediately the order for the duplicate set was cancelled the Council took steps to make a contract with a British firm for supplying a set, and this machinery was now running. The Lord Mayor added:—"There is no machinery lying in bond or in any place in Australia of German origin, or of German manufacture, for which the City Council has paid, and has not taken delivery. Secondly, there is no machinery of German origin or manufacture, intended for the Sydney Council, in bond in Sydney or any other place in Australia for which the City Council has not paid; and thirdly, so far as is known, there is no machinery of German or any other origin or manufacture for disposal in Sydney, or in any other place in Australia, which could be used by the City Council in increasing its output."

According to the *Sydney Daily Telegraph*, it had been alleged that German machinery was available in bond, and might be obtained by the City Council with a view to increasing the output and retaining the services of the men who were recently discharged.

Ald. Meagher said that a contract was entered into in the year 1913 for a 5,000-KW. turbo-alternator to be made in Germany, the amount quoted being several thousand pounds less than any other tender, British or American, besides which the plant was the most economical in fuel. In the light of subsequent events it appeared, however, to have been a factor in the dumping process carried out by Germany, as, about the time named, contracts in Sydney, Melbourne, Shanghai, and South Africa were simply swamped by German machinery, tendered for at cut prices.

The turbo-alternator referred to was put to work in April, 1914. For a few weeks it was highly successful and extra economical in operation, and on the strength of the experience acquired a duplicate set was ordered from the same people. Some few weeks after ordering the duplicate set the original set broke down deplorably, incidentally causing the extinction of all the lights in the city.

The contractors were advised by cable, and arrangements made immediately for supplying replacement parts, which had not arrived when war was declared. On the declaration of war the order for the duplicate plant was immediately cancelled. Later on certain replacement parts arrived. Unfortunately, on opening up the machinery, some two or three weeks after, it was found that the moving parts were touching the fixed parts, and there was a narrow escape of another breakdown similar to the original one occurring. The result is, declares the Lord Mayor, this machinery is only giving 80 per cent. of the power anticipated.

Foreign Trade.—THE JULY FIGURES.—The official returns of imports and exports during last month contain the following electrical and machinery figures:—

IMPORTS.	July, 1917.	Inc. or dec.	7 months, 1917. Inc. or dec.
Electrical goods ...	99,968	- 28,010	- 139,782
Machinery ...	654,942	- 29,351	- 477,633
EXPORTS.			
Electrical goods ...	246,932	- 103,035	- 493,263
Machinery ...	1,913,086	+ 152,032	+ 1,006,570

Trade with Canada.—Mr. C. Hamilton Wickes, His Majesty's Trade Commissioner in the Dominion of Canada and Newfoundland, gives some hints to traders with that Dominion in the report dealing with the trade of Canada for 1916, just issued. He states that in the course of a recent visit to the Western Provinces he was impressed by the prevalent desire among business men for improved commercial relations with the United Kingdom, and for a larger trade in British goods. In appointing agents to represent them in Canada, he says, British firms should investigate thoroughly the standing and reliability of the persons whom they contemplate employing. The assistance of the Department of Commercial Intelligence of the Board of Trade may be invoked in this connection. The majority of Canadian importers in goods, handled directly or indirectly through the retailer, look for credit such as is customarily extended by the established American manufacturers. It is no use for British manufacturers of such goods to insist on "cash against documents," or "before shipment." British shippers should also make themselves familiar with Canadian Customs regulations and tariffs.—*Financial Times*.

Educational.—UNIVERSITY OF LONDON.—UNIVERSITY COLLEGE.—The new session for 1917-18 of the Faculty of Engineering commences on October 1st. In addition to the degree and diploma courses, special courses can be arranged, and post-graduate and research work is provided for. A Goldsmid entrance scholarship (£90) will be competed for in September. See our advertisement pages for particulars.

Industrial Reconstruction.—The Employers' Parliamentary Council has issued a memorandum on industrial reconstruction, in which it deals with the interim report on "Joint Standing Industrial Councils" presented to the Prime Minister by the Sub-Committee on "Relations between Employers and Employed" (reviewed in our issue of July 6th).

The memorandum states that the first point that prominently presents itself in the report is the assumption, or implication, that the Labour Unions represent the whole of the workpeople of the country, which is not the case. It may be true that in certain industries the Unions do, in a large measure, if not fully, represent the workpeople employed therein; but, taking the workpeople throughout the country, the overwhelming majority are not members of Labour Unions. Nationally speaking, therefore, the Unions represent only the minority, and can speak and act only in the name of that section of labour that is organised.

The report does not make note of the privileged position of Labour Unions under the Trade Disputes Act. The Employers' Parliamentary Council submits that freedom and security for industry are impossible until all combinations of capital and labour are subjected to the ordinary law of the land, and conspiracies for "paralysing the country" by means of general strikes and lock-outs are rigorously suppressed. The repeal of the Trade Disputes Act must be regarded as a condition precedent to the establishment of that close co-operation between employers and employed which has now become, more than ever, vitally essential to industrial prosperity.

The Sub-Committee submits proposals for "the formation of Joint Standing Industrial Councils in the several industries, where they do not already exist, composed of representatives of employers and employed," and gives examples of the questions with which the Councils should deal. The memorandum points out that it may be doubted whether any industry is completely and perfectly covered by organisations either of employers or employed; and whether it is possible or practicable to bring within the scheme those industries where no organisation exists, or where the organisation is imperfect. At present the Sub-Committee insists that "the Councils should be composed only of representatives of Trade Unions and Employers' Associations, and that new organisations should be admitted only with the approval of the particular side of the Council of which the organisation would form a part."

When confronted by the questions: "Is it intended that decisions reached by the Councils shall be binding upon the bodies composing them? If so, is such binding effect to be conditional upon the consent of each Employers' Association or Trade Union affected?" the Sub-Committee can only answer that agreements reached by the Councils will "carry with them the same obligation of observance as exists in the case of other agreements between Employers' Associations and Trade Unions." The significance of this will be appreciated by Employers' Associations which have had experience of the "binding character" of such agreements as those referred to. It is idle to suggest that the agreements reached by the Industrial Councils could be of any real or lasting consequence, or be considered as possessing any proper guarantee that their terms would be enforced, unless they were of a legal character with provision for penalties recoverable out of funds reserved to meet liabilities involved. The Sub-Committee suggests that "it may be desirable at some later stage for the State to give the sanction of law to agreements made by the Councils, but the initiative in this direction should come from the Councils." It is certain, says the memorandum, that this aspect of the question will arise immediately the Councils, if established, set to work; and it can be settled only in the practical way mentioned above.

As regards the restoration of Trade Union rules and customs suspended by the war, the Committee insists that "the definite co-operation and acquiescence by both employers and employed must be a condition of any setting aside of these guarantees or undertakings"; may it be assumed that "the lessons of the war" have convinced even the Labour Unionists responsible for the old and fatal policy that the rules and customs referred to can, in the very nature of things, never be restored? There are many indications that warrant this assumption; and if it can be made a matter of mutual agreement between Employers' Associations and the Labour Unions, the outlook for British industry will be full of hope and promise. If not—well, says the memorandum, the writing is on the wall, and there can be no mistaking its direful meaning.

Taking the report under review as a whole, the Employers' Parliamentary Council expresses its appreciation of the efforts made by the Sub-Committee to propound a solution of the problem by which the country will soon be faced. While many of the recommendations are, in the opinion of the Council, in themselves laudable, and to some extent practicable—as a matter of fact certain of the recommendations are already, and have for long been, in operation in several industries—others are of a nebulous character, suitable more for academic discussion than for practical experiment. The report will, however, serve the useful purpose of presenting the problem of industrial reconstruction on definite lines; and in this respect, says the Council, the recommendations of the Sub-Committee should be studied and digested by those concerned, with a view to a true and lasting solution being found.

Japan's Progress in the Electrical Industry.—Referring to his article in our last issue on Japan's progress in the electrical industry, Mr. Malcolm Chalmers points out that the Japanese returns for May, which have just come to hand, confirm his remarks as to this year's exports, particularly in the case of electric lamps. The exports of these lamps in the month of May numbered 702,107, valued at about £13,000, bringing the total for the year to date up to nearly 5 million lamps, valued at £97,000.

Fatalities.—An inquest was held on August 10th, at the Hensworth Workhouse, on the body of Walter Hodge, aged 55, who was killed whilst at work at the Hodroyd Colliery, Brierley, on August 8th. He went to work, as usual, in the sub-station, through which run live wires conveying current at 10,000 volts from the Yorkshire Power Co.'s system to the colliery works, and about 20 minutes later he was found by the electrician, Charles Lewis, lying dead under the landing, the ironwork of which he had started to paint.—*Leeds Mercury*.

Eric Grayson, a St. Helens boy, aged 10 years, was last week killed by shock in the glass bottle works of Messrs. Cannington and Shaw, St. Helens; it was stated at the inquest that he had no right in the works. Verdict: Death from misadventure.

A verdict of "Accidental death" was returned at the adjourned inquest on Samuel Cowsill (23), electrical wireman, of Lower Broughton, who died as the result of burns sustained whilst at work, as mentioned in our last issue.

At an inquest at Wallsend on two boys, 8 and 6 years of age, it was stated that the boys were found with their heads against a live rail, in which position they had been lying all night. A verdict to the effect that the boys were killed by shock while trespassing on the railway was returned.

Forth and Clyde Ship Canal.—In the *Times Trade Supplement* for August, the proposal of the Government to proceed with a scheme for constructing a ship canal between the Forth and the Clyde is discussed. It is stated that the distance by the most direct route would be 30 miles, and no locks would be needed except the sea-gates at each end. The purposes to be served by the proposed canal would be primarily of a strategic rather than commercial nature, the bottom width being 148 ft. and the depth 40 ft.

Volunteer Notes.—COUNTY OF LONDON VOLUNTEER ENGINEERS (FIELD COMPANIES).—Headquarters, Balderton Street, Oxford Street, W.

Orders for the week, by Lieut.-Colonel C. B. Clay, V.D., commanding:—

Officer for the Week.—Second Lieut. A. Ullmann.

Nest for Duty.—Platoon-Commander C. Campbell.

Monday, August 20th.—Technical instruction (searchlight) for No. 3 Company, Right Half Company, at Regency Street. Drill, No. 3 Company, Left Half Company. Signalling Class. Recruits' Drill, 6.30.

Tuesday, August 21st.—Lecture, 6.30. Physical drill and bayonet fighting, 7.30.

Wednesday, August 22nd.—Drill and elementary bridge construction for No. 1 Company, Left Half Company.

Thursday, August 23rd.—Drill and elementary bridge construction for No. 2 Company, Left Half Company. Ambulance Class.

Friday, August 24th.—Technical instruction (searchlight) for No. 3 Company, Left Half Company, at Regency Street. Drill, No. 3 Company, Right Half Company. Signalling Class. Recruits' Drill, 6.30.

Saturday, August 25th.—Commandant's Parade for Route March and Drill. Parade Putney Bridge Station, 2.45 p.m. Uniform.

(By order) MACLEOD YEARSLEY.

Electroculture.—Messrs. Harry W. Cox & Co., Ltd., of 159, Great Portland Street, W., have recently reprinted, in pamphlet form, the article on H.T. discharge apparatus and its application to electrocultural operations, which appeared in our issue of July 6th last. The pamphlet contains many useful hints to those who are studying this subject, and can be obtained by applying to Messrs. Cox.

Appointments Vacant.—Engineering staff for ordnance depôts, aerodromes, and military camps in the Southern Command; armature winder for the Keighley Electricity Department; shift engineer (50s.), shift driver (35s.) for the R.E., Wyke Valley district. See our advertisement pages to-day.

South African Institution of Engineers.—The following gentlemen have been elected officers for the ensuing year, the election of president being unavoidably deferred:—Vice-presidents, Messrs. E. G. Izod and C. D. Leslie; hon. treasurer, Mr. Edward Goffe.—*South African Mining Journal*.

New Insulation Material.—According to the *National Tidende* (Copenhagen) of July 21st, a Danish chemist has invented a process by which fish offal may be made to yield not only oil, but also a solid substance named "Corimite," which is specially suitable for electrical insulation. A company, capitalised at 70,000 kroner, has been formed to work the process, and production is expected to begin during the present year.—*Board of Trade Journal*.

Electricity for Cooking.—A Manchester correspondent writes that a Special Sub-Committee of the Engineers' Club, Albert Square, Manchester, having gone into the question whether gas or electricity should be installed for cooking purposes in the club kitchen, has recommended the adoption of electricity, and that a range, made by the Carron Co., will shortly be placed in position. It is stated that before deciding upon electric cooking the Sub-Committee inspected a similar apparatus in the works' kitchen at Messrs. Haworth's cotton mill, Salford, where the results are reported to be completely satisfactory, both as regards cost and quality of the cooking.

Dilution of Labour.—In the House of Commons, on Wednesday, in Committee on the Munitions of War Bill, Mr. Churchill announced that the scheme for the dilution of labour in private works must be dropped, in order to enable the Bill to pass before the adjournment. The leaving certificate would be abolished, subject to certain safeguards, including the requirement of a week's notice, and provision to prevent men from leaving munitions for private work. The amendments were welcomed generally, and new clauses having been agreed to, the Bill was read a third time.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station and Tramway Officials.—On the recommendation of the Public Works and Tramways Committee, the Burton T.C. has approved of an increase of £25 a year in the salary of the tramway manager, Mr. A. B. SLATER.

The Portsmouth Tramways Committee recommends that the salary of Mr. W. R. SPAVEN, general manager, be increased from £500 a year to £550 forthwith, and to £600 in a year's time; and that the salary of Mr. V. G. LIRONI, the resident engineer, be increased from £400 to £450 now, and to £500 in a year's time.

The Hereford Electricity Committee has recommended the payment of 100 guineas as an honorarium to Mr. KEIR, city electrical engineer, for the additional work he has had thrown upon him in consequence of extensions to the generating plant, &c., which have been carried out under his supervision. The Committee also recommends that the salary of Mr. G. H. WATSON, assistant electrical engineer, be increased from £156 to £203 a year.

At the annual meeting of the South African Institution of Engineers, Lieut.-Colonel DOBSON, D.S.O., was presented with the Institution's gold medal for the 1915-16 session.

Mr. F. BAILEY, of Bolton, has been appointed assistant station superintendent at Salford at a commencing salary of £200 per annum.

Mr. A. BOOTHROYD, of Huddersfield, has been appointed manager of the Holmfirth District Council's electricity undertaking.

Referring to the note in our issue of August 3rd with regard to an award for improvements in soldering irons, we are informed by Mr. J. WILKINSON, tramways electrical engineer, that the inventor was not, as stated, a member of the Hull tramway staff.

The Stockport T.C. has granted £200 to the electrical engineer for services rendered in connection with the extensions to the electricity works.

Mr. E. JORDAN, of the South Lancashire Tramways Co., was on Wednesday last presented by the engine-room staff with a wristlet watch, on the occasion of his leaving the company to join H.M. Forces. Mr. E. H. EDWARDS, the general manager, made the presentation.

General.—Mr. C. CLARE ATCHISON, who was until recently the manager of the Rochdale Corporation electricity works, retiring owing to ill-health, is now engaged on war work at Bristol, being Dilution Officer there.

The marriage took place at Blackburn last week of Captain GORDON DOUGLAS COE, R.G.A., only son of the Rev. Gordon Coe, Vicar of St. Matthew's, who performed the ceremony, and Miss Lilian Harwood McAdam. Captain Coe was employed at the Blackburn Corporation electricity works at the outbreak of war.

Roll of Honour.—The death at sea is reported of Mechanical Staff-Sergeant ALFRED HENRY MARSHALL, of the Mechanical Transport Section of the A.S.C. He was 29 years of age and a native of Scarborough, but was well known as an electrical engineer and motor engineer in York and Newcastle, where, though not in business on his own account, he had charge of the working staffs of large undertakings. Whilst in charge of a workshop overseas, and a member of the motor ambulance, he invented and constructed a single-wheel stretcher carrier for use in the narrow trenches. The conveyance was adopted by the military authorities. He was invalided home in April, 1916, and again in January of this year, and after a period as supervisor of a workshop he sailed for the Eastern front in April.

Private F. CLOUGHTON, Essex Regiment, who has died of wounds received in action, was with Messrs. Siemens.

Private L. HARDING, King's Liverpool Regiment, one of three soldier brothers, has been killed in action in France. He joined the Army on the outbreak of war, and before enlisting was employed by Messrs. Siemens Bros. Dynamo Works, Ltd.

Company-Sergeant-Major J. MEARY, East Lancs. Regiment, who was with the Salford Corporation tramways, has been awarded the D.C.M. and the Military Medal. At the Town Hall, last Friday, the Mayor, in pinning the medals on the sergeant-major's breast, remarked that it was the first occasion that he had had the honour of attaching a dual award to a Salford soldier.

Lance-Corporal W. HOLLIDAY, Manchester Regiment, killed by a shell, was formerly employed by the British Westinghouse Co., Ltd.

Bombardier B. CLARKE, R.F.A., killed in action, was an electrical engineer with the Carbonic Gas Co., Manchester.

Private R. AMBROSE, King's Liverpool Regiment, died of wounds, was employed by Messrs. I. Frankenburg & Sons, Ltd., cable manufacturers.

Sapper J. SUTTON, R.E. (Signallers) is in hospital from the effects of gas poisoning. He was electrician to the Derwent Valley Water Board, Bamford.

Gunner G. WILSON, R.G.A., a former Burnley tramcar driver, has been mortally injured in France.

Private W. CLARE, West Yorkshire Regiment, killed in action, was formerly on the staff of the Halifax Corporation tramways.

Private E. NORBURY, Northumberland Fusiliers, who has fallen in action, was on the staff of the Manchester Corporation tramways.

Lieutenant W. A. BOISSIER, Royal Marine Artillery, formerly in the Derby Corporation electricity department, has fallen in action. He was a son of the Rev. F. S. Boissier, Vicar of Denby, and enlisted whilst in business for himself as an electrical engineer.

Private H. S. FITCHETT, Northants Regiment, reported missing since the battle for the Dunes in Belgium, was formerly on the staff of the Northampton Tramway Co.

Sergeant G. ADAMS, R.F.A., who was prior to the war engaged at the Rugby works of the B.T.H. Co., has been awarded the D.C.M. for bravery in action in Mesopotamia.

Signaller J. B. SPENCER, Royal Warwickshire Regiment, killed in action, joined the regiment last September from the staff of the B.T.H. Co. at Rugby, where he acted as Assistant Scentmaster.

Bombardier A. COODE, Rugby Howitzer Battery, who enlisted whilst an engineer with Messrs. Willans & Robinson, of Rugby, has been severely wounded in France.

Major R. C. MATHER, son of Mr. Colin Mather, Wrenwood, Hilton Lane, Prestwich, Manchester, is in hospital for the second time, suffering from shell-shock. He was previously wounded in August last year. Major Mather is connected with the well-known engineering firm of Mather & Platt, Ltd., Park Works, Manchester.

Private T. EVANS, K.O.Y.L.I., who was an employé of the Yorkshire (W.D.) Electric Tramways Co., is reported to have died from gas poisoning.

Private A. MARTIN, who was employed in the Glasgow tramways department, has been killed in action.

Lance-Corporal J. SANDS, Border Regiment, killed by a sniper whilst on patrol duty, was before enlistment employed by Messrs. Charles Macintosh & Co., Ltd., electric wire and cable makers, Manchester.

Lance-Corporal T. WALLWORK, Loyal North Lancashire Regiment, who has died of wounds, had been previously awarded the Military Medal for conspicuous bravery. Prior to enlisting he was employed by Messrs. Eckstein, Heap and Co., Ltd., electrical engineers and manufacturers, Manchester.

Will.—According to the *Times*, the late Mr. JOHN HENRY TUCKER, electrical fittings manufacturer, Birmingham, left £230,760, of which £161,552 was net personalty.

NEW COMPANIES REGISTERED.

Harris Plating Works, Ltd. (148,189).—Private company. Registered August 10th. Capital, £8,000 in £1 shares. To take over the business of electro-platers and polishers carried on at 222-8, Goswell Road, and 2, President Street, London, as the Harris Plating Works, also to carry on business of tube makers, japanners, enamellers, electricians, &c. The subscribers (each with one share) are: E. W. Harris, 224, Goswell Road, E.C.; electro-plater; J. A. Watts, 75, Billiter Buildings, E.C., engineer. Permanent directors: E. W. Harris and J. A. Watts (chairman). Registered office: 2, President Street, Goswell Road, E.C.

High-Speed Machinery Co., Ltd. (148,199).—Private company. Registered August 10th. Capital, £2,500 in £1 shares. Mechanical, electrical, sanitary, hydraulic, motor, gas, water, telegraph, and telephone engineers, machinists, &c. The subscribers (each with one share) are: J. P. Annacker, Springfields, Powys Lane, Palmer's Green, N., engineer; F. B. Spear, Hazlewood, Fairview Road, Sutton, sales manager; B. Strachan, Fairport, Hillcroome Road, Sutton, merchant. The first directors are: Joseph P. Annacker, Karl Johann Almfelt, Francis B. Spear, Balfour Strachan, and Howard W. Whitworth (all permanent subject to holding 250 shares each). Solicitors: Chamberlayne, Hacking & Co., 45, Parliament Street, S.W.

Marconi International Code Co., Ltd. (148,204).—Private company. Registered August 10th. Capital, £5,000 in £1 shares. To take over from the Wireless Press, Ltd., all inventions, patents, and rights acquired by that company, or to which that company is entitled, under various agreements recited in an agreement between this company and the Wireless Press, Ltd., to compile, print, publish, and deal in codes, newspapers, magazines, and books, &c. The subscribers (each with one share) are: W. W. Bradfield, Marconi House, Strand, W.C., electrical engineer; H. W. Allen, 51, Braxted Park, Streatham Common, S.W., chartered secretary. The first directors are: Godfrey C. Isaacs, Captain H. Kiall Sankey, Chas. V. Daly, Wm. W. Bradfield, and Hy. W. Allen. Qualification, one share. Remuneration, as fixed by the company. Registered office: Marconi House, Strand, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Enterprise Manufacturing Co., Ltd.—Mortgage debenture dated August 3rd, 1917, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: A. P. Grange, Litchford, Warrington.

White, Jacoby & Co., Ltd.—Particulars of £1,500 debenture created March 29th, 1917, filed pursuant to Section 83 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £630. Property charged: The company's real and personal property, including uncalled capital.

Europe & Azores Telegraph Co., Ltd. (39,452).—Capital £200,000 in £10 shares. Return dated July 18th, 1917. All shares taken up £55,080 paid; £144,920 considered as paid. Mortgages and charges: Nil.

CITY NOTES.

**Kalgoorlie
Electric Tram-
ways, Ltd.**

The report of the directors for the year 1916 states that the gross receipts for the year amounted to £31,703, against £33,526 for the previous year, whilst the net profits earned, before charging depreciation, were £1,121, against £7,205. There had been a considerable amount of labour agitation in Kalgoorlie during the year and several strikes had taken place. The decrease of £1,823 was largely accounted for by the falling-off in the workmen's traffic to and from the mines. The company's agreement with its employees under the arbitration award given in 1913 expired during the year. In July the Tramways Employees' Association presented a new log of wages and working conditions which the company could not see its way to accept. The matter was referred to the Arbitration Court. During the year the cars travelled 581,085 car miles, as against 593,434 car miles in the year 1915, and carried 2,052,685 passengers, as against 2,192,135 in the year 1915. The earnings per car mile in 1916 were 12.98d., as against 13.52d. in 1915, with an expense of 10.27d. per car mile, as against 9.93d. in 1915. The expenses per cent. of earnings in 1916 were 79.14 per cent., as against 73.44 per cent. in 1915. The number of units consumed in 1916 was 680,785 (£7,801), as against 692,935 (£7,940) for the year 1915. The "A" debenture stock had been further reduced by the sum of £700 during the year under review, and the amount of stock outstanding at the date of the accounts was £47,300.

At the meeting on August 9th Mr. OLIVER WETHERED presided, and stated that the period had been one of difficulty and anxiety; the mines—on which the prosperity of Kalgoorlie necessarily depended—were passing through a very trying time. In 1916 there were 1,331 less men employed on the mines than the year before, and this meant a loss of about £4,000 a week in wages alone throughout the district. There were 1,121 less men employed in 1915 than in 1914. As in most other labour centres, the men at Kalgoorlie were demanding higher wages and improved conditions of working, with threats of strikes if their demands were not acceded to. The Judge of the Federal Arbitration Court had stated that a company's falling revenue, or its financial position, would not be taken into consideration by him when arriving at what he considered a fair rate of wages to be paid to its employees. Unlike other businesses, it was not possible for them to call on the public to share part of the extra expenses put upon the company, and, although the cost of every article used in the running and upkeep of the tramway might be doubled or trebled, the fares must remain the same, and the cars must run according to schedule. The Transcontinental Railway had been delayed in construction owing to the shortage of freight and the difficulty of obtaining rails; but the latest information from the office of the Commonwealth Government was that it would be completed next month (September). Its completion might favourably affect the situation, but some good discovery of gold in the district would do far more. Meanwhile they were doing their best to reduce costs to the lowest figure through their loyal and capable representatives. The report and accounts were adopted unanimously.—*Financial News*.

**Marconi's
Wireless
Telegraph
Co., Ltd.**

MR. GODFREY ISAACS presided at the meeting of this company on August 9th, in the absence of Senatore Marconi. He said that capital account had undergone no change during the year. The general reserve, with the additional amount which was being placed to the credit of this account, was now represented by the round sum of one million pounds sterling; it had been built up entirely within the last five years. The cash at bankers and in hand at the end of the year showed a very substantial reduction, which was accounted for largely by the great increase of sundry debtors, debit balances, and expenditure on foreign developments which arose from the normal conditions of their business. The investments showed little change. The company had that day invested in 5 per cent. war loan the sum of £200,000. The shares in associated companies and patents showed a small increase both in the balance sheet and in their par value. The latter figure was now represented by £2,487,450. Turning to the profit and loss account, the balance of contracts, sales, and trading account was less than that of the preceding year, as likewise was the balance of the net profit, but it must be borne in mind that during the year 1915 they had some large contracts of an exceptional nature to carry out. Last year they had done considerable business with the Admiralty, and nothing could have been more agreeable than the relations between the company and that department; the high officials with whom they had had to deal at the Admiralty had told him how deeply they were indebted to the company for its consistently admirable and prompt work on their behalf. The relationship between the Admiralty and the company had continued to be equally agreeable to the company, and he had every reason to believe it had been at least equally satisfactory to the Admiralty. The Marconi International Marine Communication Co., Ltd., had shown a very substantial development, and its progress this year was even greater than it was last. They regarded that business as a very sound industrial investment which was not likely to

return less than 15 per cent. per annum, and they had every reason to hope to see an improvement even upon that. These very satisfactory results were due simply to increased volume of business, and not to increased charges. The Russian company had continued to do a very large business, and had paid a dividend for 1916 at the rate of 17 per cent., but ever since the outbreak of war the rate of exchange had been very much against this country, and it had, therefore, been quite impossible to bring home very large sums of money which had been accumulated in Russian roubles unless they were prepared to face a very substantial loss. They had, however, written off from their profit and loss account whatever sum was represented by loss at the end of each year, as though they had brought their money home. The rate of interest on money ruling in Russia had been very low indeed; the opportunities for development of manufacturing businesses were never better. They therefore adopted a policy of investing their money in other factories closely allied with their own business. These businesses were being conducted largely by those who were responsible for the very able and successful management of their Russian company, and were proving very profitable investments. They would have no difficulty in realising upon very advantageous terms if they wished to do so. Their view, however, was that factories in Russia would have even better prospects after the war, and there was, therefore, every advantage in continuing to leave their money where it was for the present. The French company had declared an increased dividend for the past year both on the ordinary shares and upon the founders' shares, and continued to do a very satisfactory and progressive business. The Compagnie Universelle de Telegraphie et de Telephonie sans Fil, the shares of which were acquired by this company in furtherance of its programme prior to the war, was about to be transformed. The American company showed improvement in 1916, but, of course, continued to be handicapped very seriously in consequence of their Transatlantic stations being unable to work owing to the stations on this side being required for war purposes. The principal revenue of the American company was expected from its Transatlantic service, and very considerable expenditure was made upon the stations for that purpose. The whole of this money had been idle since the outbreak of war. The consequence was that, instead of very substantial revenue being obtained from this source, a yearly loss had resulted. Owing to the United States entering the war the Transatlantic stations and all the other American stations had passed temporarily into the hands of the American Government. Fair compensation would be paid, and negotiations were being actively carried on with a view to settling the terms. The same applied to the Transpacific service, which had been started and which was being successfully conducted. The immense number of orders which had been placed with the company by the United States Government should result in a very satisfactory year's work indeed, notwithstanding the closing of their telegraph services. The company had been very much occupied for some time past in the conduct of legal proceedings against infringers of their patents, and the results had been highly satisfactory. The most recent action was one in respect of the De Forest Valve Patents, which the Court held to be a complete infringement of the Fleming Patent, which was the property of the company. The Canadian company had had to contend with the abnormal conditions created by the war. However, their accounts would show an improvement over the preceding year. The Compania Nacional de Telegrafia sin Hilos, of Madrid, in which the Spanish and General Wireless Trust Co. were so largely interested, was making much more satisfactory progress. The Belgian company's business continued to develop very satisfactorily, but as they were unable to have any communication with their head office, it was impossible for them finally to close their accounts. Referring to the Locker-Lampson case and a circular which had been forwarded to the shareholders, he said that at every annual meeting subsequent to 1912 he had been prevented from saying anything about the business which Mr. Marconi and he carried out in America, inasmuch as the action had been commenced and the matter was *sub judice*. This was the first year that he had been free to speak. A circular of an extremely damaging nature had been sent to 12,000 shareholders in all parts of the world. That circular must be answered. Mr. Isaacs proceeded to recount the circumstances in which, in order to carry through the reconstruction of the American company, at the request of Mr. Marconi he made himself personally responsible for £500,000 of new capital, while the English company guaranteed the remainder of the £1,100,000 required. He detailed the subsequent history of the dealings in the shares, the excitement in the market owing to the loss of the *Titanic*, which created a great demand for American Marconi shares, the outbreak of war, which prevented the inauguration of the Transatlantic service when it was on the point of starting, the inquiry into the company's contract with the Postmaster-General for a chain of Imperial wireless stations, and the litigation, lasting three and a half years, which was brought against the directors and others, and eventually withdrawn. The circular issued by Mr. J. W. Hamilton was fully dealt with, Mr. Isaacs declaring that he had never received one penny profit from the transactions that were criticised, and that the company had never gone into the market to offer shares in any of its

subsidiary companies. He also read a letter from Mr. Marconi stating that it was impossible to over-value the services which Mr. Isaacs had rendered to the company, and that if the shareholders, contrary to his expectations, supported the threatened renewal of personal attacks upon him (Mr. Isaacs) and the other directors, he would terminate his connection with the company by resigning from the board. Neither Mr. Marconi nor he could tolerate this sort of persecution for ever, and he would ask them, therefore, to pass a resolution expressing their complete confidence in the chairman and managing director and the board, and with the way in which they had conducted the affairs of the company in the past and were conducting them to-day. The Transatlantic service had been closed down, in no sense on account of any fault on the part of anybody or any complaint of any kind whatsoever, but solely because the exigencies of war to-day had demanded it. The company would, of course, be entitled to full compensation from the Government. Since the issue of the report and accounts negotiations had been opened with a view to settling two important items under the four heads of claims upon the Government: (1) for remuneration and compensation in respect of the use of the company's high power stations since the beginning of the war, the staffing and management of those stations, and other services in connection therewith; (2) their claim in respect of the withdrawal of the Post Office from the contract for the Imperial chain of stations. Notwithstanding all their efforts, they were not able until the previous night to get anything in the nature of a definite suggestion out of the Post Office. As regarded the Imperial contract, there had been many negotiations, and on several occasions they had, by request, postponed any public move in the Courts with a view to further negotiations for a settlement. Negotiations, however, were now proceeding afresh, and they appeared to be nearer to a settlement than ever before. Should they again be disappointed, they had determined at a very early date to convene an extraordinary general meeting. With regard to the claim upon the War Office, this dealt with a question of patent rights, and having regard to the immense work which the War Office had to perform in these times, it would not be fair to complain of that department finding itself unable to deal with their claim until after the war. With regard to the Admiralty, they had been given the assurance that everything possible had been done and would be done to expedite the matter. He felt sure that all those shareholders who had been interested in the company for many years would warmly approve the appointment of Mr. Allen and Mr. Bradfield to the board. He moved the following resolution:—"That the report of the directors submitted, together with the annexed statement of the company's accounts at December 31st, 1916, duly audited, be received, approved, and adopted."

Mr. HENRY S. SAUNDERS seconded the resolution, and said that the work done by Mr. Godfrey Isaacs in America had received the full support of the directors, who had congratulated him on the wonderful service which he rendered to the company when he was over there.

Mr. J. W. HAMILTON, who said he represented by proxy over 300 shareholders, then addressed the meeting amid considerable interruption. He moved an amendment to the effect that the adoption of the report be postponed, and that the meeting be adjourned in order to allow a committee of investigation to be appointed, with authority to inquire into the charges which had been made in the Locker-Lampson action, and into the conduct of the company's affairs.

The amendment, however, was not seconded, and the report and accounts were unanimously adopted.

Mr. REGINALD WOODWARD moved a resolution expressing the complete confidence of the shareholders in the chairman, the managing director, and the board, and the manner in which they had conducted the affairs of the company in the past and were conducting them at the present time.

This was seconded by Mr. HORACE BOOT, and a shareholder having suggested as an addendum "that the greetings of the shareholders present be sent to Mr. Marconi," the proposition, with this addition, was carried with acclamation.

The CHAIRMAN next moved the declaration of final dividends of 5 per cent. on the cumulative participating preference shares and 10 per cent. on the ordinary shares.

Mr. SAMUEL GEOGHEGAN seconded the motion, which was unanimously agreed to.

The retiring directors and auditors were re-elected.

An extraordinary general meeting was then held, at which the CHAIRMAN proposed the following resolution:—"That the articles of association of the company be altered as follows:—By substituting the following article for article 77, that is to say—77. The remuneration of the directors shall, as from January 1st, 1917, be at the rate of £4,000 per annum, and in addition thereto in any year in which the dividend or dividends and/or bonus declared and paid for such year on the ordinary shares of the company shall be in excess of £7 per cent. on the nominal value of such shares, the remuneration of the directors shall be increased by the sum of £200 in respect of each 1 per cent. paid by way of dividend and/or bonus on the ordinary shares in excess of £7 per cent. as aforesaid. The remuneration of the directors shall be divided between the directors in such proportions as they may from time to time determine."

Captain H. RIAL SANKEY seconded the resolution, which was passed unanimously, and a vote of thanks to the chairman closed the proceedings.—*Financial Times*.

Oldham, Ashton & Hyde Electric Tramway.—Interim dividend of 5 per cent. per annum (6d. per share) on the ordinary shares, as last year.

W. T. Henley's Telegraph Works Co., Ltd.—Interim dividend on the preference shares at the rate of $4\frac{1}{2}$ per cent. per annum, less income-tax, and on the ordinary shares at the rate of 10 per cent. per annum, less income-tax, for the half-year ending June 30th.

San Luis (Mexico) Tramways Co.—The accounts for the year ended March 31st show that, after providing for loan interest, &c., the debit balance of £10,137 brought forward was increased to £14,514.—*Financial Times*.

South Metropolitan Electric Light & Power Co., Ltd.—The transfer register and register of members of this company will be closed from August 18th to the 31st, 1917 (both days inclusive), for the preparation of warrants for dividends payable 31st inst., for the half-year ended June 30th, 1917, on the 7 per cent. cumulative first preference shares and the 6 per cent. cumulative second preference shares.

Lancashire Dynamo & Motor Co., Ltd.—Dividend of $2\frac{1}{2}$ per cent., free of tax, making $12\frac{1}{2}$ per cent. for the year, on the ordinary shares. The same rate was paid for 1915.

Brompton & Kensington Electricity Supply Co., Ltd.—Interim dividend for the half-year to June 30th on the ordinary shares at the rate of 8 per cent. per annum (less tax), the same as a year ago.—*Financial Times*.

STOCKS AND SHARES.

TUESDAY EVENING.

MATERIAL improvement has taken place in securities of the Mexican industrial companies. This is the main feature of the week in the foreign groups. Upon what ground it is based there seems to be some doubt felt in the Stock Exchange. The news from the country, most of it emanating from United States sources, is certainly less unfavourable; but it is only in this negative sense that the improvement can be expressed, so far as definite intelligence is available.

However, the bonds of the Mexico Tramways and of the Mexican Light and Power Companies have both risen several points. The shares have participated, and such offshoots as Pachuca 5 per cent. bonds are better at 27 $\frac{1}{2}$, while Monterey 5 per cent. debenture stock is changing hands fairly freely on the higher basis of 20 $\frac{1}{2}$. The strength is shared by Mexican Government, railway, and oil issues, from which it would appear that there is something more in the buying than the news warrants; and further information is awaited with keen curiosity.

Brazilians have been moving on a different plane, and Brazil Traction eased off to 49, although Rio Tramway bonds hold their prices steadily. Rio Firsts are 87, and the Seconds 77 $\frac{1}{2}$. San Paulo Firsts have been done lately at 89, while the 5 per cent. consolidated debenture stock last changed hands at 76. In the 5 per cent. debentures of the Southern Electric Tramways of Buenos Aires, bargains were marked early this month at 95 and a little over.

Victoria Falls & Power ordinary shares are unusually active, considering the time of year, at 19s. 6d.; and the preference have risen to 23s. 6d. Those happy folk who bought the ordinary shares at a few shillings each are in the fortunate dilemma of not knowing whether to take their profit or not. The shares look a very possible 10 per cent. investment, but, on the other hand, the profit is alluring. The preference do not seem to be over-valued, and there has been a little buying of the 5 $\frac{1}{2}$ per cent. second mortgage debentures because of their receipt of interest tax free, although it must be remembered that the issue is repayable at 103.

The Marconi meeting had a stimulating effect upon the price of the shares, and from 27 the price rose briskly to 32, this including the recently-declared dividend. The preference are a little better at 23, but it cannot be concealed that there is a certain amount of disappointment at the Government award being still left in the air. The cable market as a whole is good. Eastern ordinary at 144 $\frac{1}{2}$ is a point up; so are Indo-Europeans at 53 $\frac{1}{2}$. Chinas rose to 14 $\frac{1}{2}$. Anglo-American preferred at 98 is a shade harder. The only change in the telephone share list is a rise of $\frac{1}{2}$ in Orientals to 24. Telephone of Egypt debenture is up a point to 78.

The railway market is doing little more than mark time. No changes have occurred amongst the electrical stocks. Central London guaranteed assented preferred ordinary has been bought at 60 $\frac{1}{2}$ since we last wrote. The assented deferred stands at 60 $\frac{1}{2}$, while the non-assented is about 30. The assented ordinary stock, quoted in our price lists, is 61 $\frac{1}{2}$, the non-assented 41 $\frac{1}{2}$. A small amount of East London stock changed hands the other day between 31 and 34, and London Electric Railway £10 shares were offered and declined to £2

per share. The company's 4 per cent. debenture stock marked 69 early this week, the return at this price being £5 16s. per cent. on the money, which is a decidedly better yield than is offered by the debenture stocks of most other Home Railway companies. Underground Income bonds strengthened to 82.

Electricity supply shares are quietly firm. Westminster have risen to 6, pursuing their steady improvement; and City of London ordinary have gained $\frac{1}{2}$ at 12 $\frac{1}{2}$. Charing Cross hold their rise at 33; and Metropolitan advanced to 23. Amongst the manufacturing shares, British Insulated at 30s. 7 $\frac{1}{2}$ d. are $\frac{1}{32}$ up. British Westinghouse preference put on 2s. 6d., the debenture gained 2 at 67 $\frac{1}{2}$. Edison Swan 4 per cent. debenture is a point to the good, and India-Rubber shares jumped 7s. 6d. to 13 $\frac{1}{2}$ for the reason that the shares pay very handsomely, apart altogether from the fact that the dividends are distributed at present free of income-tax.

A correspondent writes to ask whether we consider advisable the sale of Chelsea Electric and an exchange purchase of Marconi shares. This is one of the conundrums which can only be answered by the statement that Chelseas are investment shares, while in Marconis there lie very considerable elements of speculation. Relatively, Marconis are much higher, because they are £1 shares standing at 3 $\frac{1}{2}$, whereas Chelseas, which are £5 shares, are about 2 $\frac{1}{2}$. Chelseas before the war were 4 $\frac{1}{2}$, while Marconis stood at 1 15/16.

The rubber market shows a good deal of strength, and this week the shares of nearly 40 different companies are marked ex dividend. The price of the raw material is steady at half-a-crown per lb. Iron and steel descriptions advance where they move at all; and in the base-metal section there is slightly more animation amongst tin shares.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.					
	Dividend	Price	Rise or fall	Yield	
	1915, 1916,	Aug. 14, 1917.	this week.	p.o.	
Brompton Ordinary	10 9	6 $\frac{1}{2}$	—	43 18 6	
Charing Cross Ordinary ..	6 5	8 $\frac{1}{2}$	—	6 13 4	
do. do. do. 4 $\frac{1}{2}$ Pref. ..	4 $\frac{1}{2}$ 4 $\frac{1}{2}$	8 $\frac{1}{2}$	—	6 13 4	
Chelsea	4 3	2 $\frac{1}{2}$	—	5 4 4	
City of London	8 8	12 $\frac{1}{2}$	+ $\frac{1}{2}$	6 4 3	
do. do. 6 per cent. Pref. ..	6 6	10	—	6 0 0	
County of London	7 7	11 $\frac{1}{2}$	—	6 4 5	
do. do. 6 per cent. Pref. ..	6 6	10	—	6 0 0	
Kensington Ordinary	7 10	6 $\frac{1}{2}$	—	6 11 7	
London Electric	8 8	1	—	NH	
do. do. 6 per cent. Pref. ..	8 4	3 $\frac{1}{2}$	—	5 6 8	
Metropolitan	8 8	2 $\frac{1}{2}$	+ $\frac{1}{2}$	5 9 1	
do. do. 4 $\frac{1}{2}$ per cent. Pref. ..	4 $\frac{1}{2}$ 4 $\frac{1}{2}$	8 $\frac{1}{2}$	—	7 4 0	
St. James' and Pall Mall ..	8 8	6 $\frac{1}{2}$	—	5 18 6	
South London	5 6	2 $\frac{1}{2}$	—	7 6 6	
South Metropolitan Pref. ..	7 7	21/6	—	6 10 3	
Westminster Ordinary	7 7	6	+ $\frac{1}{2}$	6 15 8	
TELEGRAPHS AND TELEPHONES.					
	Dividend	Price	Rise or fall	Yield	
	1915, 1916,	Aug. 14, 1917.	this week.	p.o.	
Anglo-Am. Tel. Pref.	8 8	9 $\frac{1}{2}$	+ $\frac{1}{2}$	6 2 5	
do. do. Def.	8 $\frac{1}{2}$ 1 $\frac{1}{2}$	22 $\frac{1}{2}$	—	6 16 4	
Chile Telephone	8 8	7	—	5 14 4	
Cuba Sub. Ord.	6 6	8 $\frac{1}{2}$	—	5 17 8	
Eastern Extension	8 8	14 $\frac{1}{2}$	+ $\frac{1}{2}$	5 10 4	
Eastern Tel. Ord.	8 8	14 $\frac{1}{2}$	+ 1	5 10 9	
Globe Tel. and T. Ord. ..	7 7	12 $\frac{1}{2}$	—	5 9 10	
do. do. Pref.	6 6	10 $\frac{1}{2}$	—	6 15 8	
Great Northern Tel.	22 24	96	—	6 13 4	
Indo-European	13 13	53 $\frac{1}{2}$	+ 1	6 1 8	
Marconi	10 16	3 $\frac{1}{2}$	+ $\frac{1}{2}$	4 15 10	
Oriental Telephone Ord. ..	10 10	2 $\frac{1}{2}$	+ $\frac{1}{2}$	3 12 9	
United R. Plate Tel.	8 8	6 $\frac{1}{2}$	—	6 0 9	
Western India and Pan. ..	5d. 6d.	1 $\frac{1}{2}$	—	1 12 0	
Western Telegraph	8 8	14 $\frac{1}{2}$	—	5 10 4	
HOME RAILS.					
	Dividend	Price	Rise or fall	Yield	
	1915, 1916,	Aug. 14, 1917.	this week.	p.o.	
Central London, Ord. Assented	4 4	61 $\frac{1}{2}$	—	6 10 1	
Metropolitan	1 1	22 $\frac{1}{2}$	—	4 8 6	
do. do. District	NH NH	15 $\frac{1}{2}$	—	NH	
Underground Electric Ordinary	NH NH	1 $\frac{1}{2}$	—	NH	
do. do. "A"	NH NH	5 $\frac{1}{2}$	—	NH	
do. do. Income	6 4	82	+ $\frac{1}{2}$	4 17 7	
FOREIGN TRAMS, &c.					
	Dividend	Price	Rise or fall	Yield	
	1915, 1916,	Aug. 14, 1917.	this week.	p.o.	
Adelaide Sup. 6 per cent. Pref.	6 6	5	—	8 0 0	
Anglo-Arg. Trams, First Pref.	5 $\frac{1}{2}$ 5 $\frac{1}{2}$	2 $\frac{1}{2}$	—	9 11 4	
do. do. 2nd Pref.	6 $\frac{1}{2}$ —	2 $\frac{1}{2}$	—	—	
do. do. 5 Deb.	5 5	67	—1	7 9 3	
Brazil Tractions	4 4	4 $\frac{1}{2}$	—1	—	
Bombay Electric Pref.	6 6	10	—	6 0 0	
British Columbia Elec. Ry. Pfee.	5 5	47 $\frac{1}{2}$	—3	10 10 6	
do. do. Preferred Nil Nil	Nil Nil	81	+ $\frac{1}{2}$	NH	
do. do. Deferred Nil Nil	Nil Nil	39	+ 2 $\frac{1}{2}$	NH	
do. do. Deb.	4 $\frac{1}{2}$ 4 $\frac{1}{2}$	55	—	7 14 7	
Mexico Trams 5 per cent. Bonds	Nil Nil	40 $\frac{1}{2}$	+ 4 $\frac{1}{2}$	NH	
do. do. 6 per cent. Bonds	Nil Nil	33 $\frac{1}{2}$	+ 3 $\frac{1}{2}$	NH	
Mexican Light Common	Nil Nil	15 $\frac{1}{2}$	+ 1	NH	
do. do. Pref.	Nil Nil	25 $\frac{1}{2}$	+ 3	NH	
do. do. 1st Bonds	Nil Nil	41	+ 1 $\frac{1}{2}$	—	
MANUFACTURING COMPANIES.					
	Dividend	Price	Rise or fall	Yield	
	1915, 1916,	Aug. 14, 1917.	this week.	p.o.	
Babcock & Wilcox	15 15	3 $\frac{1}{2}$	+ $\frac{1}{2}$	4 15 10	
British Aluminium Ord. ..	7 10	30/7 $\frac{1}{2}$	—7 $\frac{1}{2}$ d	6 10 7	
British Insulated Ord. ..	17 $\frac{1}{2}$ 20	12 $\frac{1}{2}$	—	7 15 0	
British Westinghouse Pref. ..	7 $\frac{1}{2}$ 7 $\frac{1}{2}$	21 $\frac{1}{2}$	+ $\frac{1}{2}$	5 11 6	
Callenders	20 20	1 $\frac{1}{2}$	—	7 0 6	
do. do. 5 Pref.	5 5	4 $\frac{1}{2}$	—	6 1 3	
Castner-Kellner	22 22	8 $\frac{1}{2}$	—	6 10 2	
Edison Swan, fully paid ..	— —	1 $\frac{1}{2}$	—	NH	
do. do. 4 per cent. Deb. ..	4 4	71 $\frac{1}{2}$	+ 1	5 12 0	
Electric Construction	7 $\frac{1}{2}$ 7 $\frac{1}{2}$	1 $\frac{1}{2}$	—	8 0 0	
Gen. Elec. Pref.	6 6	10 $\frac{1}{2}$	—	5 17 1	
do. do. Ord.	10 10	16	—	6 5 0	
Henley	25 25	16	—	7 16 3	
do. do. 4 $\frac{1}{2}$ Pref.	4 $\frac{1}{2}$ 4 $\frac{1}{2}$	4	—	5 12 6	
India-Rubber	10 10	17 $\frac{1}{2}$	+ $\frac{1}{2}$	7 6 19	
Telegraph Coe.	20 20	38 $\frac{1}{2}$	—	6 6 2	

* Dividends paid free of income-tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, August 15th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb. 1/6	..
a Ammoniac Sal	per ton £76	..
a Ammonia, Mariate (large crystal)	" £64	..
a Bisulphide of Carbon	" £28	..
a Borax	" £28	..
a Copper Sulphate	" £61	..
a Potash, Chlorate	per lb. 2/6	..
a " Perchlorate	" 2/-	..
a Shellac	per cwt. £11	..
a Sulphate of Magnesia	per ton £16	..
a Sulphur, Sublimed Flowers ..	" £25	..
a " Lump	" £25	..
a Soda, Chlorate	per lb. 104d.	..
a " Crystals	per ton 120/-	..
a Sodium Bichromate, casks ..	per lb. ..	..
METALS, &c.		
c Brass (rolled metal 2" to 12" basis)	per lb. ..	..
c " Tubes (solid drawn) .. ..	" ..	..
c " Wire, basis .. ..	" ..	..
c Copper Tubes (solid drawn) ..	" 1,73 to 1/82	..
g " Bars (best selected)	per ton £160	..
g " Sheet	" £160	..
g " Rod	" £160	..
d " (Electrolytic) Bars	" £137	..
d " " Sheets	" £162	..
d " " Wire Rods	" £145	..
d " " H.C. Wire	per lb. 1/5 $\frac{1}{2}$	..
f Ebenite Rod	" 3/-	..
f " Sheet	" 2/6	..
n German Silver Wire	" 2/3	..
h Gutta-percha, fine	" 6/10	..
h India-rubber, Para fine	" 3/2 $\frac{1}{2}$	1d. dec.
i Iron Pig (Cleveland warrants) ..	per ton Nom.	..
l " Wire, galv. No. 8, P.O. qual.	" ..	..
g Lead, English Pig .. ..	" ..	..
g Mercury	per bot. Nom.	..
e Mica (in original cases) small ..	per lb. 6d. to 8/-	..
e " " medium	" 8/6 to 6/-	..
e " " large	" 7/6 to 14/- & np.	..
d Silicon Bronze Wire	per lb. 1/9 $\frac{1}{2}$	..
r Steel, Magnet, in bars	per ton ..	..
g Tin, Block (English) .. ..	" ..	..
n " Wire, Nos. 1 to 16	per lb. 8/6	..

Quotations supplied by—

a G. Boer & Co.	g James & Shakespeare.
c Thos. Belton & Sons, Ltd.	h Edward Till & Co.
d Frederick Smith & Co.	i Bolling & Lowe.
e F. Wiggins & Sons.	l Richard Johnson & Nephew, Ltd.
f India-Rubber, Gutta-Percha and	n P. Ormiston & Sons.
Telegraph Works Co., Ltd.	r W. F. Dennis & Co.

Errors in Thermometry.—In a recent number of *La Nature*, the eminent French scientist, M. Le Chatelier, has an article on the measurement of high temperatures. He gives a brief description of the various methods at present in use, and devotes some space to a consideration of the thermo-electric (Le Chatelier) type of instrument. He mentions the necessity of the frequent regraduation of the thermocouples, which alter in use. Further, the sensitivity of the galvanometers used varies with time, either from loss of magnetism in the permanent magnets, or by changes in the verticality of the instrument. The moving coils, which are generally heavy, rarely have their centre of gravity exactly in line with the points of suspension. The result is a disturbing couple, which tends to modify the galvanometer readings. Very often errors are discovered, the exact cause of which it is difficult to trace. The most frequent trouble is that the wires of the couple come adrift when they are simply twisted together instead of soldered, or they break when heated in a reducing atmosphere. If contact ceases entirely, the trouble is easily discovered, but very often the wires continue to touch and allow the current to pass, but with a reduction in strength on account of the additional contact resistance, and the readings are therefore falsified without the observer being aware of the exact trouble. A cause of error, frequent in factories, arises through fine iron powder settling on the soft iron core, and damping the action of the moving coil slightly. This source of error is even more difficult of discovery than those mentioned above. Finally, in laboratory tests, when the couple wires are not immersed sufficiently in the substance to be tested, the thermal conductance of the wires cools the thermojunction and affects the readings.

National Union of Manufacturers.—The articles of association of the National Union of Manufacturers, which were completed in June last, show that the Union is the successor of the British Manufacturers' Association, 1915. Mr. George Terrell, M.P., is chairman of the Union, which includes among its objects the promotion of the trade, commerce, and manufactures of British industries, and the home, colonial, and foreign trades of the United Kingdom.

The Union also desires to effect co-operation and mutual help among British manufacturers and producers of all kinds of goods and commodities, and to encourage free and unrestricted communication between masters and workmen with a view to the establishment of amicable arrangements and relations, between them.—*The Times*.

DIRECT-CURRENT MACHINES: SOME NOTES ON ESTIMATING.

By "W. A. E. M."

WHEN no actual recent cost is available of an exactly identical machine, the estimating of a new size of generator or motor may entail a considerable expenditure of time, and often the costs that are at hand are not in sufficient detail

of labour or material, an up-to-date cost may be obtained. The value of the price-adjusting coefficient—let us call this k_a —providing for the advances in the markets will be found to be :—

$$1 + .0001 [x y + (100 - x) . z],$$

where x = per cent. labour cost of total cost, y = per cent. advance on labour, z = per cent. advance on material.

The adjoining graphs (fig. 1) show values of percentage advance on total cost per cwt. of material for the principal and heaviest items of material used in the machine, viz., copper and iron (or steel), according to the price advances per lb. and cwt. respectively.

The graphs (fig. 2) show values for k_a for various combinations of x , y , and z .

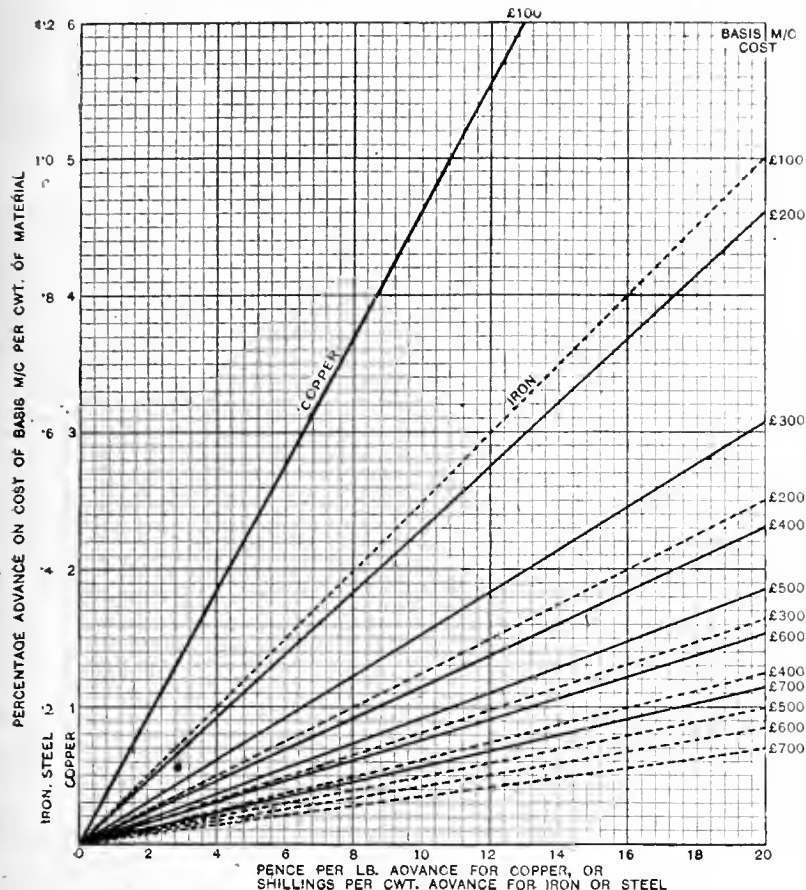


FIG. 1.

to lend themselves conveniently to manipulation, or admit of very close adjustments or *pro ratas* being made.

A handy *pro rata* rule is shown below for obtaining the approximate cost of a new machine, given the cost totals for labour and materials of the basis machine and dimensions of the armature core of the latter, and of the one to be estimated :—

$$\text{Cost of labour} = \sqrt{D^3} \times k_l,$$

$$\text{Cost of material} = \sqrt{L} \times D^2 \times k_m,$$

where D = diameter of core (external) in inches, L = length of core (between end plates) in inches, and k_l and k_m = constants for (cost $\div \sqrt{D^3}$), and (cost $\div \sqrt{L} \times D^2$) for labour and material; these will vary according to the particular maker.

The writer has found that quite good results can be obtained in predetermining costs in this way, especially where the basis machine or machines taken for the values of k do not deviate very considerably from the new machines in the core dimensions; and, on occasions when it has been found convenient, or considered desirable, to use the more lengthy and closer methods, the application of the approximate rule shown has often proved a very useful check.

By the use of a further adjusting constant, which, from an intelligent analysis of machine costs, can be approximately deduced for correcting the price for increases in cost

MULTIPLEXING IN CABLE TELEGRAPHY.

IN the *Journal of the Franklin Institute* for May, Brigadier-General George O. Squier, Chief Signal Officer, U.S. Army, states that the use of alternating currents in cable telegraphy offers the great advantage that multiplexing is made possible. Among the many schemes which may be utilised, the method of using separate cables for sending and receiving, transmitting several messages on one cable and receiving a corresponding number on another, seems to offer the best solution of the problem where the volume of traffic warrants it. Such an arrangement eliminates the artificial cable, which is an indispensable element in duplexing, and at the same time gets rid of all the troubles incidental to the accurate balancing of the duplex bridge.

The method proposed is shown schematically in the two accompanying figures (p. 166). In fig. 1 an arrangement is shown for transmitting three messages simultaneously on one cable. We have here three local transmitting circuits coupled to the cable, the frequency of each transmitter being different from that of any other, say, 6, 8, and 10 cycles. In each local transmitting circuit, two looped circuits are included, which are separately tuned to the frequencies of the other two transmitters, offering thereby a high impedance to the current flow of these frequencies, and thus preventing the transfer of current from one transmitting circuit to the others

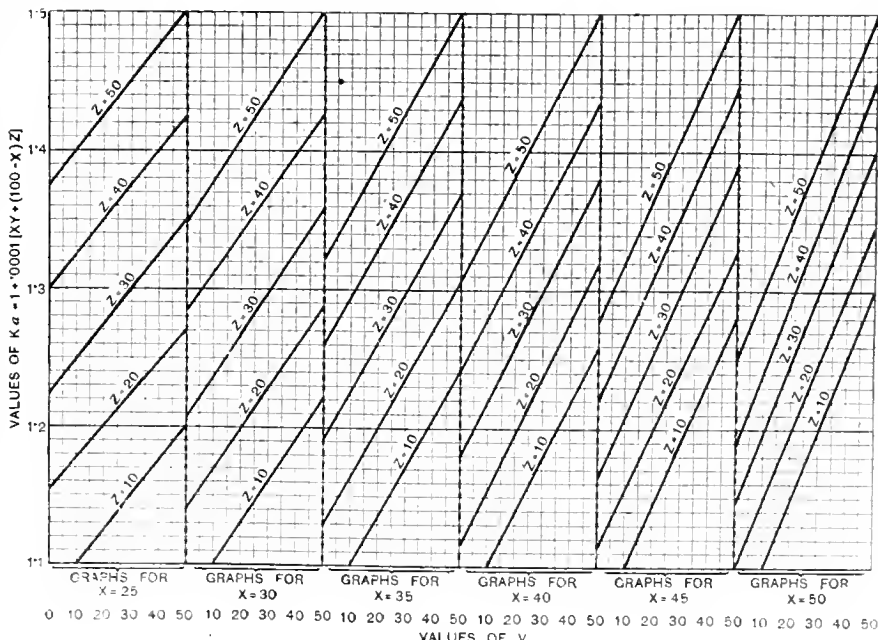


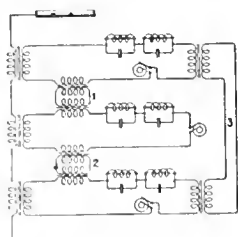
FIG. 2.

To further check any transfer of current from one local circuit to another, the intermediate circuits 1, 2, and 3 are introduced, through which E.M.F.'s of opposite phase to that induced by way of cable transformers are induced, thus balancing out any residual effect from one circuit on another.

In fig. 2 a receiving terminal of a cable is shown in which three circuits are used for the reception of three messages simul-

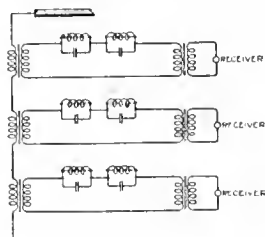
aneously. Each receiving circuit is coupled to the cable through an intermediate circuit. In each intermediate circuit, two loop circuits are included, which are separately tuned to the frequencies of the signals which are to be excluded from that particular receiver, each receiver responding accordingly only to a signal of one predetermined frequency and excluding the others. If desired, loop circuits may also be introduced in the receiver circuits, and thus further increase the selectivity.

In the arrangement described above, the disturbing effects of a local transmitter on the receiver, which are always present to a



Transmitting terminal.

FIG. 1.



Receiving terminal.

FIG. 2.

greater or less degree in duplexing, are entirely eliminated, and, as a consequence, detectors and amplifiers of very much greater sensitiveness may be employed.

For purposes of illustration, three transmitters and three receivers are shown, so that two cables could handle three messages both ways, but obviously the method outlined above is not limited to this number.

PERMANENT MAGNETS.*

By F. C. KELLEY.

By means of the hysteresis loop we are able to determine the two most important facts that we ought to know about steel for permanent magnets, namely, the remanent magnetism and coercive force: the height of the point where the curve cuts the vertical axis, and the breadth of the loop on either side of the zero point. The coercive force is the more important. Though the magnetic permeability of a specimen is inversely proportional to its carbon content, the amount of permanent magnetism retained is directly proportional to the carbon content.

The hard constituent called hardenite, which may be a solid solution of carbon in iron, or possibly a subcarbide of iron, is of the same percentage as pearlite, and is formed during any cooling that is so rapid that the particular pearlite structure has no time to form. This constituent appears to be the most important in magnets.

The shape and dimensions of a magnet have a great effect upon its retentivity, due to the fact that the poles of every magnet exercise a self-demagnetising influence on the body of the magnet.

The demagnetising effect in the case of slit rings has been shown to be nearly proportional to the width of the slit, or gap in the magnetic circuit. If the ring is provided with large pole pieces and the gap is narrow, the demagnetising coefficient may be greatly reduced. The amount of remanent magnetism increases regularly with the dimension ratio, that is, the ratio of the length to the diameter of the bars.

A laminated magnet has been found to be no more powerful than a solid magnet of equal weight and length.

Since the coercive force of magnets depends upon the way they are hardened, it is essential for magnets which are to have the greatest coercive force that they be quenched at a temperature above that at which they recalesce, and quenched quickly.

Magnetic material which has had previous working should be annealed slowly, and then quenched just a little above the point of recalescence. Mme. Curie tried experiments on the effect of quenching carbon steels of 0.06-1.20 per cent. C, and found that 770 deg. C. was the best temperature for quenching. If quenched at 975 deg. C. the remanence and coercive force both fell in value. She also found that the best magnet material, after hardening, if reheated to 905 deg., degenerated. By quenching first a little above and then a little below the point of recalescence, and going through this cycle several times, she found that the material could be improved, and that material which had become poor by over-heating could be repaired.

Barus and Strouhal found that annealing at a temperature which gave a blue tint produced the best results. They also found that for short bars a glass-hard state, produced by heating to a bright red, and quenching in cold water, gave the best results.

The tungsten steels which have proved best for magnets

fall in two groups: (1) Those containing 5 to 7 or 8 per cent. W with about 0.5 per cent. C, and (2) those containing 2½ to 3½ per cent. W with 1 per cent. C. Steels containing from 0.75 to 9.5 per cent. of chromium have high coercive forces; but there seems to be little advantage in adding more than 2½ or 3 per cent. Cr. Cast iron makes good magnets. Campbell, by quenching at 1,000 deg., found values of remanence from 200 to 229, and coercive forces from 48.9 to 52.8.

The method of magnetising bar magnets is to put them inside a long magnetising coil about twice as long as themselves. Short bar magnets may be put between the poles of an electromagnet, as may horse-shoe magnets. The field to which they are subjected should not be less than $H = 250$. Little depends upon the duration of the operation.

Permanent magnets age with time, or lose part of their magnetism. Causes for the decay of magnetism of magnets are mechanical shock, changes of temperature, contact with magnets or iron, and exposure to demagnetising forces. The lapse of time also apparently effects a deterioration. But in all magnets there seems to be a limit to this decay.

Permanent magnets are matured by repeated gentle heating and cooling, protracted gentle heating, repeated subjection to mechanical shock, and partial demagnetisation.

Barus and Strouhal found that by heating a glass-hard magnet in steam for 60 hours, then remagnetising, and steaming again, its remanence was reduced to a constant value. After this treatment it was dropped from a height of 1.5 to 0.5 m. on a wooden block, and it did not change over 0.54 per cent.

Mme. Curie found that heating magnets in steam caused a reduction of both coercive force and remanence, and that reheating to 200 deg. C. was disastrous, for about 50 per cent. of the original total magnetism was lost.

W. Brown found that glass-hard magnets resisted shocks much better than others, and that by prolonged reheating at 60 deg. a constant state was reached with a reduction of from 1 to 3 per cent. in best steels.

Krüse found that materials having the greatest coercive force had the least percentage loss from shock.

To produce permanent magnets which are both constant and powerful, a tungsten steel should be used, having from 5 to 8 per cent. of tungsten and from 0.4 to 6 per cent. carbon. Chromium up to 2 or 2.5 per cent. may be present, but the presence of manganese, titanium, copper, sulphur, and phosphorus should be avoided. For bar magnets the dimension ratio should be as large as possible. For horse-shoe magnets the gap between the poles should be short as possible, and the polar areas as large as possible.

The forging of magnet material should be done with little working of the material, and at a low temperature. After forging it should be normalised by raising to 900 deg. C., lowered to 750 deg. for a time, and then cooled off. To harden the magnets, they should be heated to 950 deg. C. for five minutes only, then lowered to 700 deg. C., and quenched in brine or oil at 20 deg. C. Some tungsten steels are better if quenched between 770 and 850 deg. C.

There is no advantage in tempering tungsten steel. Magnets of carbon steel of 20 diameters may be tempered to a straw tint, and those of 40 diameters to a blue tint. Any letting down below a straw tint impairs their power to resist decay and usage.

Magnets should be matured by boiling or steaming for 10-12 hours, or by heating them to 60 deg. C. for 20 or more hours. There is some advantage in letting them cool several times during the process.

The magnet should be magnetised by an electromagnet, or, if a bar magnet, by a magnetising coil, using the highest degree of magnetisation possible. There is some advantage in reversing the magnetism a few times, but in the final magnetisation the current should be turned off slowly to zero. There is an advantage in giving the magnet a slight mechanical shock. Some magnets which are to have extreme constancy are subjected to demagnetising forces.

Cr, Mn, Mo, and W are important additions in the manufacture of steels for permanent magnets, but the presence of a third element is necessary. While carbon is beneficial, highly satisfactory results are to be obtained with Si and vanadium, especially vanadium.

The following table represents some of the best alloys obtained for permanent magnets. The first section shows results obtained before rapping or ageing; the second after rapping:—

Composition.	Before ageing.		After ageing.	
	B (Ret)	in H	B (Ret)	in H
8 Mo, 0.3 V, 0.6 C	11,750	53.7 quenched	5,000	51.2 quenched
5 W, 0.5 C	11,700	59.0	5,200	52.5
5 Cr, 3 Mn, 4 Mo, 1 Si	11,350	55.8 as forged	5,300	61.7 as forged
1 Mn, 10 Mo, 0.5 C	10,750	58.4 quenched	5,400	57.5 quenched
2 Cr, 10 Mo, 0.5 C, 0.3 V	10,500	78.0	6,300	77.2
7 W, 0.3 V, 0.6 C	10,450	39.4 as forged	5,600	81.0
10 Mo, 0.3 V, 0.4 C	10,350	59.8 quenched	—	—
2 Mn, 5 Mo, 0.6 C	—	—	5,500	57.2 as forged
6 Cr, 0.81 Si	—	—	5,300	52.3 quenched
2 Cr, 14 W, 5 Mo, 0.3 V, 0.5 C	—	—	5,000	63.5
10 Mo, 1 V, 0.4 C	—	—	5,000	68.5

The general idea about permanent magnet material is that the harder it can be made the greater its permanence. Comparative tests on materials quenched in water or brine would be expected to show that the harder the piece, the less permeable, the lower its residual induction, and the higher its coercive force, but it is only true with certain steels under restricted conditions.

It is well known that the hardening capacity of steel decreases as its mass increases, yet the larger mass, and hence the softer piece, is magnetically most permanent.

It is well known, too, that the rate of cooling in oil is slower than in water, and does not give as great hardness. Yet experiments on steel, which was quenched both in water and in oil, show relatively soft oil-hardened pieces when compared with water-hardened pieces of the same size to have lower induction, lower residual and higher coercive force than the much harder water-quenched pieces.

Drawing the temper of steel has a very marked effect on the magnetic properties. Hardness may be relieved by drawing the temper, but this gives results directly contrary to those due to retarded quenching rates. That is, the maximum induction and residual magnetism are increased, and the coercive force is lowered. This is true whether the steel owes its original hardness to oil or water hardening, and it is also true that the effect of tempering is more marked on oil-hardened than on water-hardened pieces. That is, the augmented permanence in these alloy steels, due to oil hardening, is unstable, and this fact limits the possible commercial application of oil-hardening of magnets in manufacture.

Boiling in water has only a slight effect upon the magnetic tests, while drawing the temper at 205 deg. C. (400 deg. F.) seriously impairs the magnetic permanence. This is true of both the structural alloys and the commercial magnet alloys. At a drawing temperature of 315 deg. C. (600 deg. F.) the difference between oil and water-tempering is wholly wiped out, and nearly identical tests result.

REVIEWS.

Electrical Engineering Practice. Third Edition. By J. W. MEARES, F.R.A.S., M.Inst.C.E., M.I.E.E. London: E. and F. N. Spon, Ltd. Price 25s. net.

The author, in his preface, states that in re-writing this book for the third edition he intends it to fill the gap between the engineering pocket-books, which give a mass of highly-condensed information, and the specialised works, each dealing with a particular subject in detail. A book of this kind is by no means easy to write, owing to the difficulty of maintaining a due sense of proportion, and of avoiding giving prominence to one particular subject at the expense of others. The author of the book under consideration, while he cannot altogether be said to have escaped this defect, has nevertheless carried out his intention with a large measure of success, and has produced a work which should be a very valuable one, particularly to engineers whose connection with electricity is only secondary. The author's style is exceedingly clear and lucid, and his meaning can always be grasped at a first reading. This circumstance largely atones for the lack of diagrams in many places, which goes far to impair the utility of the work.

The book is divided into three parts, dealing respectively with elementary principles, installation work and domestic applications of electricity, and electrical plant and supplies. The first part is concerned with fundamental principles and elementary facts relating to the supply and applications of electricity, and suffers somewhat from a lack of logical sequence in the arrangement, and also from a lack of diagrams to explain the text. The author makes use of the hydraulic analogy to explain the relationship of electrical magnitudes, and his treatment is clear and convincing, but the corresponding treatment of the more complex magnetic units is poor. A lengthy description of the potentiometer could have been condensed to one quarter the present length if a diagram had been added. All the information given is, however, quite accurate and precise; as an example, in the section on instruments, the difference between "aperiodic" and "dead beat" is explained.

The second part of the book, dealing with wiring and the domestic applications of electricity, is a very good one, and contains a mass of valuable information. Modern interior lighting systems are fully treated, and the information regarding domestic heating apparatus is excellent, although the chapter would have been greatly improved by a more liberal use of illustrations. Installation work is dealt with fully, modern wiring systems and up-to-date methods of switching being described. The author would have done well to have pointed out the waste involved in indiscriminate "looping in," and to have indicated how this can be avoided by the use of modern accessories.

The third part deals with all remaining subjects covered by the title of the book, with varying degrees of thoroughness. The chapter referring to motors, welding plants, and electric furnaces is a good one, although the diagram of a motor starter on page 260 can hardly be said to represent modern practice. A chapter on smaller generating plant and accumulators follows. An interesting, but lengthy, account of systems of charging and tariffs divides this chapter from the remarks on larger plant for public supply. References are given for descriptions of automatic voltage regulators; a brief account of the most important of these would have been valuable. The few lines devoted to the motor converter seem

quite inadequate, considering the importance of this machine. The author has discussed modern tendencies in power-station development at some length, referring, for example, to the recent proposals and experiments in connection with the gasification of coal before burning under boilers, and the recovery of by-products. There is no reference in this chapter to the remarkable efficiency of the Ljungström turbine in the smaller sizes; and the subject of K.H.T. switchgear can hardly be said to have been touched upon. Excellent chapters follow on the application of water power, electric traction, electric vehicles, and electricity in mines. Transmission schemes are next dealt with, together with the subject of underground cables. The treatment of the latter subject shows the lack of balance that has been before referred to. While three pages are devoted to an excellent section dealing with up-to-date practice in the manufacture of cables for very high voltages, giving a clear explanation regarding graded insulation and intersheaths, the wider subject of cable-laying systems is dismissed in two pages. A good chapter on specifications and depreciation follows, and the final chapter is devoted to the subject of testing. In many ways this is the least satisfactory in the whole volume. The treatment is generally scanty, while the reference to the induction method of fault localising is so superficial as to be misleading. The same can be said of the paragraph on meter testing, in which one-quarter load is given as the lowest load to which meters should be tested. If this final chapter had received fuller treatment, even at the expense of some of the earlier chapters of more limited interest, it is safe to say that the work would have been considerably improved.

The book contains over 100 tables, and a useful list of these is given at the beginning. Extracts from wiring rules and standard specifications are given in the sections dealing with various aspects of installation and other work. These rules and specifications might well have been reprinted in full as an appendix. The value of the book is considerably enhanced by numerous cross-references and by the provision of an excellent index. The book can be recommended as a valuable work of reference, covering a wide field, and containing an immense amount of useful and up-to-date information.—G. W. S.

The Range of Electric Searchlight Projectors. By JEAN REY. London: Constable & Co., Ltd. Price 12s. 6d. net. (Translated by J. H. Johnson.)

Searchlights play so important a part in the work of our land, sea, and air forces that the appearance of this book is particularly opportune, especially as no treatise has hitherto been available making it possible for artillery officers to calculate the range of searchlights with some approximation to the ease and accuracy with which they calculate the range of their guns or—more generally—making it possible for any user of a searchlight to determine the distance at which the latter will illuminate effectively a stated objective. The problem is not altogether simple, and its solution involves many indeterminate variables (especially those dependent on atmospheric conditions); nevertheless, the author's work represents a material advance in range measurement from the practical point of view.

The study of the range of electric searchlights comprises the determination of luminous flux emitted by the arc; the extent of distribution of this flux as received and reflected by the mirror; the calculation of the amount of light projected at a distance, allowing for the size of apparatus and focal length of mirror. Knowing the amount of light projected at a distance by the searchlight, it is possible to calculate approximately the range of illumination by taking into account the coefficient of atmospheric absorption. It then becomes possible to determine for any given searchlight the probability of being able to illuminate a certain object at a given distance, provided that one knows the average degree of atmospheric transparency for the district.

The author handles the subject along these lines, dealing first, in Chapter I, with determination of the luminous flux emitted by any arc, pointing out the distinction between theoretical and practical results, and giving a number of useful formulæ and data. The theoretical illumination obtained with a specified reflector is next considered. A series of reflectors ranging in diameter from 0.3 to 2 metres is assumed, and the luminous flux corresponding to three different focal lengths is determined in each case, (a) for a series of low voltage arcs, (b) for a series of high voltage arcs. High voltage increases the luminous flux received by a given reflector, but necessitates the use of special carbons, difficult to obtain. In this chapter, again (as, indeed, throughout the book), the author shows clearly the corrections to be applied to theory in order to allow for the conditions of practice, and presents many useful formulæ and experimental data.

The efficiency of an electric searchlight (Chapter III) may be defined as the ratio of luminous flux projected at a distance by the apparatus to the flux emitted by the arc and received by the reflector. The author considers quantitatively each source of loss. A mirror in good condition should reflect 85 per cent. of the light falling upon it. In addition, there are shadow and shutter losses. The total efficiency in small and large searchlights respectively may be 65½ per cent. and 73½ per cent. without flashing shutters, or 51½ per cent. and 67½ per cent. with shutters.

Chapter IV gives data and curves for calculating the practical illumination from searchlights at a standard distance of 1,000 metres, knowing the theoretical illumination and the total efficiency of the searchlight. There seem to be a few misprints on page 44. The influence of current, voltage, and diameter of positive carbon on practical illumination is discussed, and it is shown that high-voltage, heavy-current searchlights have certain intrinsic advantages.

Although, for practical reasons, Mangin reflectors are used to a less extent than formerly, they have important optical advantages, and the author is justified in devoting Chapter V to consideration of the special results obtained with Mangin searchlights.

Having considered all the internal elements which affect the range of a searchlight (viz., power of the arc, diameter of reflector and focal length, efficiency of reflectors and searchlight), the author deals in the second part of the book with the external factors affecting range, viz., transparency of atmosphere, distance at which objective is placed, dimensions and nature of the objective, its colour and the colour of the background; finally, the distance at which the observer is from the searchlight and objective. The effect of transparency acts on the double range between searchlight, objective, and observer. This fact, the influence of form and colour of objective, and the limitations of visual acuity have all an important bearing on the fact that an airman (or working party, &c.) within an enemy beam may be so strongly illuminated as to feel certain that he is discovered whereas he may be absolutely invisible to the enemy observer. Striking instances of this sort are mentioned by the author, and it seems highly important that everyone in our forces should realise that he is not necessarily visible to the enemy although he is under comparatively brilliant illumination (*e.g.*, one and a half times that provided by the full moon at its zenith).

In Chapters VI *et seq.* the author starts from a formula of M. Blondel's for the range of searchlights (apart from visual sharpness). To facilitate the practical application of this formula the conception of "equivalent illumination" is introduced, *i.e.*, the illumination of various objects, under various test conditions, which renders them just visible (or clearly visible, as the case may be) assuming that the coefficient of reflection, diffusion, and physiological effect of contrast is the same for all objects. In other words, instead of attempting the very difficult operation of measuring this coefficient for each class of object, the author eliminates it entirely, and replaces it by empirical "equivalent illuminations." The latter are fictitious values, since they imply that the limit of visibility of the human eye for different illuminated objects corresponds to different quantities of light falling upon the retina. Once the table of equivalent illuminations is determined (and the author gives values for a whole series of land and sea objects), it is possible to calculate for the same objects the ranges under the conditions met in practice. Graphic diagrams are given to facilitate application of the general formula.

The question of atmospheric transparency is discussed at length, and typical data are given. The genesis and use of the graphic diagrams are well explained, and the curve sheets, abacs, and so forth are drawn clearly to large scale on folding plates. The examples and practical problems of ranges given in Chapter VIII should make the reader thoroughly competent to deal with any problem of his own. Throughout the book, data and curves relate to modern methods, appliances and constructions of war, and to climatic conditions in all the principal war zones of Europe on land and sea. Chapters IX and X deal with variation in ranges according to the size of searchlight and atmospheric transparency, and with visual acuity. The book presents in compact form a clear working exposition of the best methods and data at present available for determining the range of searchlights, and does not fail to point out where further data should be accumulated as opportunity arises.

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

- 10,941 "Electric battery lamps." J. A. WARD. July 30th
- 10,962 "Electric switches." E. L. RANKIN. July 30th.
- 11,031 "Electric motor control systems." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). July 31st.
- 11,034 "Power-operated switches." IGARIC ELECTRIC CO. (Cutler-Hammer Manufacturing Co., U.S.A.). July 31st.
- 11,043, 11,046 "Electric circuit controllers." IGARIC ELECTRIC CO. (Cutler-Hammer Manufacturing Co., U.S.A.). July 31st.
- 11,048 "Circuit breakers." C. LORIAN. July 31st
- 11,060 "Process for manufacture of electrolytic compounds." I. BROWN and T. SUTCLIFF. August 1st
- 11,064 "Electrode clamp connector." A. OATIS. August 1st.
- 11,065 "Telegraph systems." AUTOMATID TELEPHONE MANUFACTURING CO. and H. H. HARRIS. August 1st
- 11,071 "Motor compass." W. THOMPSON. August 1st.
- 11,073 "Electric vibrators." W. J. F. BENNE & O. D. LUCAS. August 1st
- 11,078 "Spark plug for internal combustion engines." B. HOBBS and LEO LOUGHERY. August 1st

- 11,079. "Secondary electric batteries or accumulators." CHLORIDE ELECTRICAL STORAGE CO. & H. DEAN. August 1st.
- 11,081. "Electric batteries." G. N. ANTONOFF. August 1st.
- 11,112. "Electric induction apparatus and submarine detectors." H. V. CUTNIBERT-KEESON. August 2nd.
- 11,149. "Starting devices for electric motors." W. P. HAMLYN, J. SUGDEN and THE BRITISH THOMSON-HOUSTON CO. August 2nd.
- 11,154. "Electric batteries." G. N. ANTONOFF. August 2nd.
- 11,160. "Means for utilisation of light of electric lamps." G. CAMPBELL. August 2nd.
- 11,217. "Electric arc lamps with rotary arcs, and wireless telephony and telegraphy." A. GARBARINI, G. GAUTHIER & L. MAUCLAIRE. August 3rd.
- 11,222. "Dynamo-electric machines." N. PENSABENE and CROMPTON & CO. August 3rd.
- 11,225. "Generating power." WESTINGHOUSE MACHINE CO. August 3rd. (U.S.A., August 11th, 1916.)
- 11,236. "Motor control systems." BRITISH WESTINGHOUSE ELECTRIC and MANUFACTURING CO. (Westinghouse Electric & Manufacturing Co., U.S.A.). August 3rd.
- 11,230. "Machines for trimming ends of flexible and other insulated wires." ENFIELD CABLE MANUFACTURING CO. & D. WISE. August 3rd.
- 11,231. "Electric batteries." G. N. ANTONOFF. August 3rd.
- 11,235, 11,236. "Ignition dynamos." C. T. MASON. August 3rd. (U.S.A., September 15th, 1916.)
- 11,240. "Make-and-break devices." F. B. DEHN (Pittsfield Spark Coil Co.) August 3rd.
- 11,287. "Electrical couplings or connections." K. E. L. GUINNESS. August 4th.
- 11,289. "Self-regulating dynamos." A. H. MIDGLEY and C. A. VANDERVELL & CO. August 4th.
- 11,298. "Means for supporting electrodes in ionic tubes." F. P. DRIVER and OSRAM-ROBERTSON LAMP WORKS. August 4th.

PUBLISHED SPECIFICATIONS.

1914.

- 16,203. TUBULAR ELECTRIC INCANDESCENT LAMP FLOATS OR FOOTLIGHTS. Chalfier. July 15th, 1913.

1916.

The numbers in parentheses are those under which the Specifications will be printed and abridged, and all subsequent proceedings will be taken.

- 3,029. ELECTRIC BATTERY LAMP. J. E. Hamilton. July 25th, 1916. (107,773.)
- 5,445. ELECTRIC CURRENT REGULATORS, MORE PARTICULARLY FOR USE WITH ARC LAMPS. E. C. R. Marks (H. Goldberg). April 13th, 1916. (107,777.)
- 6,965. METHOD OF AND APPARATUS FOR THE LOCALISATION OF FOREIGN OBJECTS IN AND THE RADIO-THERAPEUTIC TREATMENT OF THE HUMAN BODY BY THE X-RAY. C. Baese. May 17th, 1915. (100,491.)
- 7,995. TELEGRAPHY. E. S. Heurtley. June 6th, 1916. (Cognate application, 11,465/16.) (107,783.)
- 8,320. ELECTRICAL REGULATORS OR RHEOSTATS. Switchgear & COWANS, and D. Rodway. June 13th, 1916. (107,788.)
- 9,568. DEVICE FOR LOCATING, CAPTURING, AND DESTROYING SUBMARINES AND LIKE VESSELS. S. Rushforth. July 7th, 1916. (107,792.)
- 9,660. LIGHTNING CONDUCTORS. G. E. Taylor. July 1st, 1916. (107,799.)
- 9,673. REVOLUTION-DIRECTION INDICATORS AND COUNTERS. T. Kelly. July 10th, 1916. (107,802.)
- 9,833. ELECTRIC OSCILLATING OR WIRELESS SYSTEMS AND APPARATUS. Indo-European Telegraph Co., A. H. Morse & H. R. Rivers-Moore. July 12th, 1916. (107,815.)
- 9,942. ELECTRICAL RESISTANCE APPARATUS. P. H. Dawe. July 14th, 1916. (107,822.)
- 9,949. ENGINE-ROOM TELEGRAPHS. J. W. Ray. July 15th, 1916. (107,823.)
- 10,036. ELECTRICALLY-DRIVEN VIBRATORY APPARATUS AND THE LIKE, ESPECIALLY FOR USE IN THE TREATMENT OF EAR TROUBLES. Sterling Telephone & Electric Co. and F. G. Bell. July 17th, 1916. (107,825.)
- 10,386. ELECTRICAL CONNECTORS OR JUNCTION PIECES. G. H. Collins & H. F. Collins. July 24th, 1916. (107,831.)
- 10,588. ATTACHMENT OF AMMETERS AND VOLTMETERS TO SUPPORTS, PARTICULARLY IN CONNECTION WITH MOTOR-DRIVEN VEHICLES. Walsall Electric Co. and V. Delebecque. July 27th, 1916. (107,835.)
- 10,589. AMMETERS AND VOLTMETERS. Walsall Electric Co. & V. Delebecque. July 27th, 1916. (107,836.)
- 10,875. AMMETERS FOR THE MEASUREMENT OF ALTERNATING CURRENTS AND ELECTRIC OSCILLATIONS. August 2nd, 1916. (Cognate application, 11,337/16.) (107,844.)
- 11,812. ELECTRIC LIFTING MAGNETS. A. West and A. West & Co. August 19th, 1916. (107,856.)
- 12,269. SOUND TRANSMITTING INSTRUMENTS. T. Chalmers. August 30th, 1916. (107,864.)
- 13,097. SPARKING PLUGS FOR INTERNAL-COMBUSTION ENGINES. T. Crosbee and Sons & H. W. Wilks. September 15th, 1916. (Cognate application, 13,809/16.) (107,873.)
- 14,246. IGNITION APPARATUS FOR INTERNAL-COMBUSTION ENGINES. K. E. L. Guinness. October 6th, 1916. (107,888.)
- 18,145. TERMINALS FOR ELECTRIC WIRES. Burney & Blackburne, and E. M. Cobb. December 18th, 1916. (107,924.)

1917.

- 5,524. TELEGRAPHY. E. S. Heurtley. (Divided application on 7,995/16. Cognate application, No. 5,533/17.) June 6th, 1916. (107,950.)
- 7,080. AUTOMATIC SELECTORS FOR TELEPHONE SYSTEMS. Siemens & Halske Akt. Ges. May 4th, 1916. (Addition to 23,336/13.) (106,506.)
- 8,531. ELECTRIC OSCILLATING OR WIRELESS SYSTEMS AND APPARATUS. Indo-European Telegraph Co., A. H. Morse & H. R. Rivers-Moore. July 12th, 1916. (Divided application on 9,833/16.) (107,958.)

The Orbit of Mercury.—Speaking at the summer meeting at the Hampstead Garden Suburb, last week, Sir Oliver Lodge said he had been working on the variations in the orbit of the planet Mercury. This orbit revolved slowly, and there was a discrepancy known to all the great astronomers. Le Verrier found that it amounted to 13 seconds. It had remained a puzzle, and some had believed that it was due to the proximity of another planet, which could not be seen by us, and which had been named Vulcan.

Sir Oliver Lodge said he believed the discrepancy was explained by the electrical theory of matter. The inertia of a body moving at a high speed was greater than if were at a standstill. Mercury, the fastest planet in the solar system, travelled 30 miles a second. One lb. of matter moving at 30 miles a second, the speed of Mercury, equalled one lb. plus the hundred-millionth part of a lb., and that fraction was not subject to gravity. This was, he thought, the probable cause of the variation of the orbit of Mercury.

THE ELECTRICAL REVIEW.

VOL. LXXXI.

AUGUST 24, 1917.

No. 2,074.

ELECTRICAL REVIEW.

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ELECTRICAL INTERCONNECTION IN LANCASHIRE AND CHESHIRE.

WE referred in our last issue to the second report recently issued by the Committee for the Interconnection of the Lancashire and Cheshire Electricity Supply Systems, the contents of which were briefly outlined. Further perusal of the report leads us to the conclusion that the proposals are in the main so obviously dictated by commonsense considerations, and so clearly intended to operate with the single aim of providing an ample supply of cheap electricity for industrial purposes, that only minor criticism can be advanced by those who sympathise with the end in view. The Committee is thoroughly representative of the area concerned, and our only regret is that the company representatives, who did not sign the "additional powers" proposals of the Committee, have not more clearly defined their views. The reason for basing local authority representation on the Joint Board, on population, and company representation on capital outlay, is not self-apparent; neither appears to bear such a close relation to the electrical "figure of merit" of a supply authority as, for instance, output sold, which is a general indication either of initiative or favourable conditions. On the basis chosen, the 35 undertakings concerned would be represented by 90 members, including 11 representatives from four companies; as mentioned last week, these would be divided into four District Boards, which would elect a Central Executive of 20 members, two of whom would be special representatives of the Lancashire Power Co., in addition to its possible District Board representation. The Central Executive would have powers to elect a committee of six advisory engineers, one of whom would represent the Lancashire Power Co.

The capital expenditure of the municipal undertakings concerned on power stations, mains, &c., is £7,425,266, of which 43 per cent., or £3,166,274, has been redeemed; the corresponding capital value of the companies immediately concerned in the present proposals (exclusive of goodwill and investments) appears to be £1,021,645, of which only £73,218, or 7 per cent., has been written off. Although these figures have little bearing on the interconnection proposals of the Committee, they are of interest as showing the financial status of the two classes of undertaking in the area.

In passing, it should be emphasised that under the various powers associated with its interconnection proposals, the Committee specifically safeguards the right of appeal of individual authorities

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

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Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates. — Per annum, postage inclusive, in Great Britain, £1 1s. 8d.; Canada, £1 3s. 10d. (\$5.80). To all other countries, £1 10s.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson, & Co., Gresham Street.

AUCKLAND N.Z.: Gordon & Gotch, Albert Street; The Mining and Engineering Review, 51a, Strand Arcade, Queen Street.

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MELBOURNE: The Mining & Engineering Review, 90, William Street; Gordon & Gotch, Queen Street.

MILAN: Fratelli Treves.

NEW YORK: D. Van Nostrand, 25, Park Place.

PARIS: Boyvean & Chevillet, 22, Rue de la Banque.

PERTH, W.A.: Gordon & Gotch, William Street.

ROME: Loescher & Co., Corso Umberto 1° 307.

SYDNEY: The Mining & Engineering Review, 273, George Street; Gordon and Gotch, Pitt Street.

TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.

WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

THE "ELECTRICAL REVIEW'S"
ELECTRICAL & ALLIED TRADES DIRECTORY
(THE RED BOOK),

1917 EDITION

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to the proper Government Tribunal, as well as their existing rights as distributors within their statutory areas, and, moreover, lays down the principle of compensation for those authorities who are prejudicially affected by the operation of the scheme. Presumably, the latter contingency may arise if heavy expenditure is incurred on plant for bulk supply, &c., at the request of the Board.

As regards the second portion of the report, dealing with the proposed additional powers to establish and control all future and existing power stations and high-pressure transmission lines, it is pointed out that the 35 undertakings concerned generated 421 million units during the year ended March, 1916, and that in five years' time this output would under normal conditions expand to 1,000 millions, the maximum load increasing during the same period from 138,429 kW. to 300,000 kW., representing an average annual increase of 32,000 kW. This can be met by increasing the capacity of existing stations in some cases, while in others it would be desirable to erect new stations. The Committee states the case for co-ordination of effort at considerable length, finally arriving at the conclusion that the Board should possess the power to erect new stations and to acquire the ownership, control, and operation of all or any power stations, existing and future, and all high-pressure transmission lines. While we do not doubt the validity of these proposals, which would, if carried into effect, extinguish power company business, though leaving the ordinary statutory company no worse off than a corresponding local authority under similar circumstances, their *raison d'être* is not very clear, at any rate, as regards the more immediate future, having regard to the proposed powers of the Board for interconnection purposes, which include "to co-ordinate and *prescribe the running hours of existing stations* and to act in an advisory capacity in regard to all proposals for future extensions of generating plant."

For all practical purposes, the supply authorities and the Board appear to be identical. What is to prevent the Board in its wisdom from deciding that the future generating plant extensions of, say, half-a-dozen adjacent authorities should preferably be carried out jointly by them—under existing legislative powers—and on a site selected by the Board? In effect the same result would be obtained as if the Board proceeded under its "additional powers," with the exception that in the latter case the Board, *i.e.*, the whole of the authorities in the Lancashire and Cheshire scheme, would raise the capital and presumably share in the proceeds, while in the former case, only the authorities directly concerned would be interested financially. In either case, the operation would be controlled by the Board.

The proposals under "interconnection" were, moreover, adopted unanimously, while the "additional powers" have apparently led to a little rift within the lute.

No doubt the Committee has decided that the principle at stake renders the course which it has chosen worth while, although the powers of the Board for interconnection purposes, if we have correctly interpreted them, appear to be ample for the immediate future, and such as would automatically lead up to the proposed "additional powers." However, the Committee has, no doubt, had in mind the probability of some comprehensive effort by private interests to control bulk electricity supply in the future, and the proposals embodied in the Board's additional powers may be justified as indicating an alternative which is much more desirable in the interests of cheap electricity supply.

IN a recent issue of the *Textile Recorder*, an article on "Power Costs. Costs a Vital Factor" discusses the alleged certainty of textile mill

power costing more in the future than in the past, whatever method of obtaining power be adopted, and goes on to point out that the advantages at present possessed by a mill, in which the machinery stands in the books at a low figure, will be reduced materially if fuel costs keep on increasing. The writer briefly urges the necessity of obtaining the best results with whatever method is adopted, though evidently with a leaning towards electric driving, in connection with which he says that "first and foremost we must have cheap current," *i.e.*, in the cotton trade; the price per unit must compare favourably with the cost per horse-power, "then we shall reap to the full the advantages enumerated." These advantages include reduced transmission losses, abolition of smoke, even turning, cheap structures, higher production, &c.

This is all very interesting, but what proportion do power costs bear to the cost of placing manufactured cotton on the market? That such costs are as vital as suggested is unbelievable, bearing in mind the many archaic power installations which have in the past competed, and presumably still compete, with modern steam and electrical installations. The explanation that power plant investments have been written-off in the older installations cannot apply in all cases, yet the older mills survive, despite high power costs. Perhaps we have been woefully misled, but we seem to remember a few years ago the manufacturers' argument that power costs were such an insignificant proportion of the total that the introduction of electric driving with a view to their reduction was not worth while.

This attitude is, indeed, so generally understood, that there is a disposition to avoid the question of costs of electrical driving, which, even if higher, would not materially affect the case for the electrical drive, because the possibility of obtaining from 5 to 10 per cent. greater output, with an improved product thrown in, altogether outweighs any small increase, if such should take place, in power costs. We need not here discuss the reasons for this result; they are well known, and have been proved in practice the world over, though many mill owners are still sceptical.

What we fear our contemporary does not appreciate is that the case for electric driving *with purchased power*, strong as it has been in the past, will be rendered practically impregnable by the disproportionate effect of increasing fuel charges on the "well-established steam boiler and highly-developed mill engine" or the "gas-power plant with by-product recovery apparatus, or the newly-established oil engine" as compared with that on the modern public supply station, with its relatively less costly and more efficient plant, advantages in diversity of demand, and ever-growing output, which tend all along to neutralise increasing fuel costs.

The striking feature of electrical production costs in the past has been their continual decrease, particularly in industrial areas, and despite the gradually increasing cost of fuel in pre-war times; the war has simply accelerated the rate of increase of fuel costs, to such an extent as to more than neutralise, for the time being, the normal reduction of average costs due to expansion of business, introduction of more efficient plant, &c., and as a natural result prices have risen, in many instances, though not necessarily permanently. Given a return to settled conditions, even with fuel at present prices, we see no reason why, with an expanding business and modern methods, production costs should not com-

mence to fall again as in the past, and reach a lower than pre-war level.

Surmise would be turned into certainty given the whole-hearted co-operation of the Lancashire mill owners; indeed, it is with a view to ensuring that an ample supply of cheap electricity shall be available to meet their prospective requirements that the recent proposals of the Committee for the Inter-connection of the Lancashire and Cheshire Electricity Supply Systems have been put forward. It is not stretching the matter too far to say that the best private plant will be at a discount when the schemes for electricity supply on a wholesale scale at present under consideration mature; the North-East Coast may be cited as an example of intensive electrical development, but Lancashire offers even greater opportunities for electricity supply.

Industrial Reconstruction. In our issue of July 6th we gave a cordial welcome to the interim report on "joint standing industrial councils" by the sub-committee on relations between employers and employed, of which Mr. J. H. Whitley is chairman. We are glad to see that the desire of the sub-committee that this report should be discussed without delay has been fulfilled to some extent already. Last week we summarised the views of the Employers' Parliamentary Council, which took the form of friendly criticism of the proposals put forward, and an expression of hope that the recommendations of the Sub-Committee would be of assistance in arriving at a true and lasting solution of the problem of industrial reconstruction; this week we are enabled to reproduce a memorandum of the Executive Council of the Federation of British Industries on the subject, produced in compliance with a request from the Ministry of Labour, which claims to be the first authoritative public pronouncement by employers on this important question. From a perusal of this valuable statement it will be seen that the Federation, which is by far the largest and most representative body of employers in the country, and embraces an extremely wide variety of manufacturing and producing interests, is heartily in accord with the general principles which underlie the recommendations, and that its comments mainly relate to the details of the proposed organisation, the necessity of which is amply emphasised; the Federation is not content with mere criticism, it proceeds to discuss the composition and functions of the respective councils, and submits a plan carrying the scheme a stage further, in that it provides a fourth link in the chain, a "National Industrial Council" consisting of representatives of employers and employed in all industries, and forming a final Court of Appeal to which all questions which could not be settled in the sectional councils would be referred. This proposition appears to us admirably to crystallise and define the fundamental ideas embodied in the conclusions arrived at by the Whitley Committee. At first sight the plan would seem to suggest that the Federation was somewhat obsessed with the idea of settlement of disputes, which appears in the forefront of the "duties" allotted to each class of council, and it must be admitted that in the light of past experience this would unfortunately be one of their most important functions; but an examination of the memorandum itself shows that the Federation regards the provision of facilities for co-operative action as of still greater moment, and agrees that harmonious relations between employers and employed are absolutely essential to the attainment of that efficiency of production upon which our commercial prosperity in the

future will wholly depend. The importance of securing efficient management in every branch of industrial activity, and of giving it free play in development, is also clearly recognised.

It will be observed, on comparing this memorandum with that which we abstracted last week, that while the latter saw many lions in the path, the former courageously faces the admitted difficulties, and cordially endorses the view of the Sub-Committee that the organisation of every trade is a first essential to their solution; at the same time, it is urged that such organisation must be voluntary, and unfettered by Government control in any form.

So far all goes well; but once more the question to which we have previously referred inevitably crops up: how will it be ensured that the agreements drawn up by these Councils, or other organisations, will be loyally carried out? The problem should not prove insoluble; pending its solution, we are glad to see that the movement towards organisation is making such satisfactory progress.

Reform in Education. The views enunciated recently by the Senate of the University of London, taken in conjunction with the report of the Committee appointed by the Treasury to consider the scheme of examination for Class I of the Civil Service, afford good grounds for hoping that the reforms so long demanded, besought, and advocated by our most eminent educational authorities are at last about to attain fulfilment. The memorandum of the Senate is uncompromising; the University of London has long held broad and enlightened views on the question at issue, and in this statement the Senate cuts at the roots of the evils which so long have hampered intellectual progress and development in this country, and have contributed so largely to the inception and the prolongation of the war. Had those in chief authority during the past 10 or 20 years been endowed with a well-organised and adequate training for their posts, instead of the narrow and lop-sided curriculum that was forced upon them, we should either have been spared the horrors of world-war or we should long ago have emerged from it victorious.

The Committee is not so downright in its condemnation of the methods of the past, but nevertheless its conclusions may be accepted as highly satisfactory. We do not wish to see classical studies suppressed, or even subordinated to science; what we claim is that the balance should be held justly, and that a due proportion of time should be spent by every student on the study of the world in which he lives and is to work. The revised scheme places modern languages on an equality with the dead languages, gives prominence to the study of English and general knowledge, includes a *viva voce* examination to test mental activity, and gives due weight to mathematics, science, and (a new subject!) engineering. All this is very good, and we trust that the proposals will be carried into effect without serious modification.

In this connection, we wish to draw attention to a small book, entitled "The Public School System in relation to the coming conflict for national supremacy," by Mr. V. Seymour Bryant—a Master of Arts who recognises that increased attention to science in education is indispensable to the training of the mind, and in this work lays bare the defects of our present system, indicating also the steps required to make it more efficient, so that, as Lord Rayleigh says in the preface, "the next generation of English public school boys will have more to show for their time spent in school than could be claimed for ours."

V.B. CABLE BREAKDOWNS IN THE TROPICS.

By D. M. W. HUTCHISON, B.Sc., M.I.E.E.

THESE few notes are being written in the hope that readers at home and abroad may give their experiences in similar cases to those about to be mentioned.

It is evident that if the cause of these breakdowns can be traced it will be far easier to prescribe a remedy. V.B. cable breakdowns are nearly always put down by the makers to decentralisation of the cores due to overload, but the opinion of those operating these cable systems is by no means unanimous on this point.

The writer has had personal experience of the breakdown of a complete network of V.B. cables, which had ultimately to be replaced entirely, and quite recently there came under his notice a case of breakdown of V.B. shaft cables in a tin mine: both of these cases occurred in the Tropics. Other cases of V.B. cable breakdown have also occurred in the Tropics within the writer's knowledge.

In the first case mentioned, 3-core jute-insulated V.B. cables—mostly .05, .025, .05, but some twice and four times the capacity—were laid solid in bitumen: there can be no doubt in this case that the cables were the best obtainable of their class, and that the laying was done carefully, as the cables were manufactured by a leading firm and laid under the supervision of their own engineer.

The fact remains that within five years of the network being put into commission it was necessary to order new cables, which replaced the original V.B. network two years later: the present cables are lead-covered, paper-insulated, and are giving satisfaction.

In this system there can at first have been no question of overload, although, when faults began to develop, it became necessary to overload parts of the network to continue the supply.

The faults were nearly all of the same type, and occurred in the cable itself: faults in joint-boxes were extremely rare. The fault when dug up was invariably found to be a short-circuit between cores, and there was, as a rule, no leakage to earth: in many cases it was evident that the fault had been developing for weeks, as the cores had almost disappeared, and the bitumen sheathing for several feet on each side of the fault was soft and sticky. A trial length of paper-insulated V.B.-sheathed cable gave better results, but developed trouble at a joint-box.

In the second case mentioned the cables were of the solid V.B. type double-wire-armoured, and supplied pumps in a mine: the cables ran in on the adit level and then passed down a vertical shaft to a depth of about 400 ft., being supported by slings and cleats. The work was supervised by an experienced engineer. Within about three years faults developed of the same nature as indicated above, the cores coming together and short-circuiting: these faults occurred both in the shaft and in the adit level.

In the writer's opinion, V.B. cables are quite unsuitable for tropical countries: taking the F.M.S., where he has had a good deal of experience, there is a regular day temperature in the shade of close on 90° F., and the temperature in the underground workings of a mine may be 110° F. or so. Possibly a good deal of the damage is done in handling the cables: it is, as a rule, impossible to get them in position without exposing them to the heat of the sun, and this may mean a temperature of 160° F., sufficient to soften the bitumen.

There is an idea very prevalent at home that lead-covered cables should be avoided in the Tropics, as there is a difficulty in obtaining skilled labour for jointing: this has been true in the past to a great extent, but has been got over largely by the help of European jointers who have imparted their art to Oriental mechanics.

In the town where the writer resides, plumbed joints are made regularly and successfully by Chinese jointers, trained locally, who also make lead fittings for the purpose.

In the writer's opinion, lead-covered paper-insulated cable takes a lot of beating, and as it can carry a lot more current for the same area of copper than other types without damage, it is especially suitable for mining purposes where it may be necessary on occasions to overload plant and

cables to cope with an emergency. For special positions, such as shafts in a mine where acid water is encountered, a double-wire-armoured cable protected by a bitumen sheath over-all, and with solid strand filling, should meet every requirement and should give no trouble once properly installed. The possibility of the lead parting under the strain of its own weight might be avoided by specially careful manufacture, and by the use of fairly short lengths looped in to horizontal joint-boxes in chambers excavated in the sides of the mine shaft. Cables with varnished cambric insulation, which are used largely in America, might also solve the problem, as this class of insulation is said to be non-hygroscopic and is mechanically strong.

FAULT LOCALISATION BY DROP OF POTENTIAL.

By H. E. BLAKE, A.M.I.E.E.

A PREVIOUS article on "Induction Methods of Fault Localisation" has elicited so many interesting comments and inquiries, that the writer is encouraged to ventilate the subject of drop-of-potential methods in the hope of a similar fruitful result. A comparison of notes by those engaged in the practical work of the distribution of electricity should be of the greatest benefit to the industry.

In utilising the drop-of-potential method, the ideal conditions for success are indicated by the following diagram:—

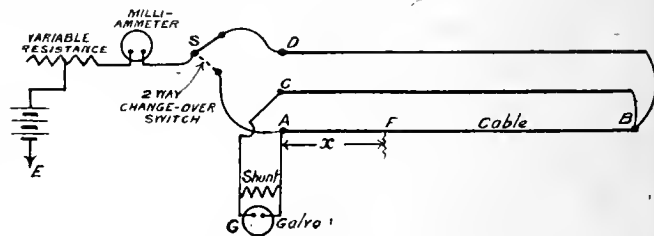


FIG. 1.

Obtain suitable readings on G by adjusting the resistance

$$\text{Then } x = l \times d_1 c_2 / (d_1 c_2 + d_2 c_1).$$

x = distance of fault from A,
 d_1 = galvo. deflection with S to A } Without altering
 d_2 = " " " S to D } galvo., shunt, or
 c_1 = milliamperes with S to A } variable resist-
 c_2 = " " " S to D } ance.
 l = length A B.

It will be noted that with two sound lines available between the ends of the faulty cable, it is unnecessary to know their length or sectional area, because, with the two-way change-over switch S to D, the drop is measured by G between F and B only, A F and C B automatically becoming extensions of the galvanometer leads. Similarly with S to A, the drop is then measured from A to F only, C B F becoming an extension of the galvanometer lead to C. The result eliminates all errors except those of contact resistance, which can be guarded against by clean connections, and those due to the slight difference in length between the inner and outer conductors of a concentric system, owing to the bridging of the outers, where the cable has been cut for services. The errors entirely eliminated by this method of connection are:—

1. *Due to fault resistance.* This may be high, low, or varying, without vitiating the test. In the case of a steady resistance, either high or low, deliberate readings may be taken on the galvanometer, as the drop is measured before the current passes to earth. In the case of a variable resistance, rapid readings should be taken, three or four times in succession, by means of the change-over switch, thus counteracting the error due to this cause.

2. *Due to the loop at the far end B.* By connecting as shown, no loop need be allowed for, as the measurements are taken on the faulty cable only, the loop merely forming part of the galvanometer leads.

3. Due to the cable connections to the apparatus. By connecting the galvanometer direct to the cable under test, as shown, this error is entirely removed. This constitutes a great advantage for this method over the Murray or Varley loop tests.

These ideal conditions for the use of this test most frequently arise on d.c. three-wire systems, where the negative conductor has developed its habitual fault due to osmosis, and the positive and neutral conductors remain sound; but faults on short lengths of distributor under the worst conditions of shorting may be localised by this method, by laying a length of twin cab-tire-sheathed cable in the gutter to represent the two testing lines.

The numerous adaptations of the drop-of-potential method of fault localisation for the infinite variety of conditions that arise in practice, after the fault has been analysed by megger testing from both ends, would require too long a demonstration. Suffice it to say that when only one sound line is available, the sectional area of lead and return must then, of course, be considered, and the loop at the far end allowed for. The writer has achieved highly-successful results by this method with a Paul Unipivot galvanometer of 50 ohms resistance and a scale range of 50 divisions each side of a central zero. The current to actuate this instrument is so small, that very careful milliampere readings are necessary to obtain an entirely accurate result on short lengths. The battery used was one of 4 volts, 20 ampere-hours, the variable resistance 0 to 2,000 ohms, and the galvanometer shunt resistance $\frac{1}{3}$, $\frac{1}{9}$ and $\frac{1}{27}$ of the instrument. An induction test with a telephone and search-coil should be made after the drop-of-potential test, to check the position of the fault, should it happen to be on a service, as the drop-of-potential test will only show the position accurately if it is on the straight run. A drop-of-potential test, however, saves walking over the whole of a long route with a search-coil.

With reference to variable fault resistances, where time allows of it, the faulty cable should always be broken down to earth before starting the test, in order to avoid this source of error entirely. If the fault resistance varies rapidly, the change-over switch is not quick enough to obtain two galvanometer readings with the same resistance in the whole circuit. In cases where a cable has shorted and sealed itself again (not an uncommon event on H.T. supply, especially where diatrium or similar insulation is used), only the outer conductor should be broken down to earth, as the inner may then be used as one of the sound testing lines. When using high pressure to break down cables to earth, which have re-sealed themselves, the desired result will be obtained more rapidly by raising the pressure gradually through a liquid resistance. If the high pressure is switched on instantaneously, it will merely blow its fuse at the moment it sparks through the insulation, which will re-seal itself again and again.

A breakdown on a feeder is often heralded by preliminary intermittent shorts a day or two before the event. These shorts are usually instantaneous, and it is impossible to localise them to a single feeder area, where no maximum pointers or relays are fixed in connection with the feeder ammeters at the generating station.

The following simple method, which has the important recommendation of economy in these days, will localise the trouble to one area, which can then be inspected and tested. A loop of tissue paper $\frac{1}{16}$ in. wide, in the shape of the upper half of a clamp connection, should be stuck across the scale on the face of each feeder ammeter—say, 30 amperes above maximum load. This will be severed or moved by the swing of the ammeter needle, and the feeder affected will thus be indicated.

With regard to the causes of faults on three-wire v.b. single cables d.c. laid solid in wood troughing, moisture is often first introduced by the pine knots in the cover of the troughing letting out their turpentine under the influence of damp and varying temperature, thus acting as a solvent on the bitumen beneath. There is a considerable deposit of turpentine in a pine knot, which is a hardening of the sap where the tree has branched.

When locating faults on a.c. concentric L.T. systems, the fact must be remembered that this system acts as a condenser, giving a high reading in volts from inner to earth,

with sound insulation. A fault dead to earth, on inner or outer, will bring the volts to zero of the affected winding, when measured to earth, and the volts between the unaffected winding and earth will rise to the same pressure as that between inner and outer. This should be borne in mind, in order to distinguish normal condenser effect from faults. The following results are of interest as an example of what may be expected under working conditions on a network clear of earths, without disconnecting consumers' wiring:—

Size and type of cable.	Insulation.	Length.	Volts.			Remarks.
			I to E.	O to E.	I to O.	
0.1 sq. in. concentric, paper-insulated, lead-covered.	0.5 Ω	1 yards	0	0	210	Drawn in iron pipes to this point.
	50,000 ω	325 "	100	76	210	
	50,000 ω	525 "	108	72	210	Laid solid in earthenware to end.
	20,000 ω	682 "	126	72	210	

THE EXAMINATION OF COMMUTATION CONDITIONS IN INTERPOLE MACHINES.

By FREDERICK MURGATROYD, B.Sc. Tech.

THE introduction of interpole machines simplified enormously the practical problems of commutation by establishing a constant brush position. To maintain a constant brush position it is necessary to have a fixed neutral at all loads. This, obviously, may be attained by providing—

- (a) A flux equal in magnitude and opposite in direction to the armature reaction flux.
- (b) A flux strong enough to neutralise the reactance flux existing in the coils undergoing commutation.

Both these functions the interpole is able to perform, with the result that a machine fitted with interpoles has many substantial advantages over the non-interpole machine. The necessary field ampere-turns are lowered, flux densities are reduced, higher peripheral speeds are made possible, brush thicknesses may be increased without excessive circulating currents resulting, higher ratings are made possible for the same frame, and sparkless commutation is obtained much more easily.

It is thus seen that in the running of interpole machines the engineer is primarily concerned with two factors, namely:—

- (a) Maintaining the correct brush position.
- (b) Maintaining the correct interpole field strength.

The object of this article is to discuss the methods by means of which these factors may be correctly ascertained.

Brush Position.—As stated above, the correct brush position for interpole machines is the neutral axis. There are several good methods of ascertaining this neutral position, but by far the best is the "kick" method. This consists in alternately switching the field "on" and "off," and in taking millivoltmeter readings, the ends of the instrument leads being held firmly on successive pairs of commutator segments which are a full pole-pitch apart. The armature must be kept stationary, of course, and all brushes must be lifted. The positions of the segments between which the millivoltmeter reading is zero, are the positions of two adjacent neutral points. A check test should be made by rotating the armature slightly so as to make the relative positions of armature slots and pole pieces different, and the above procedure should be repeated. If the second neutral point is different from that obtained by the first test, the mean of the two determinations should be chosen as the true one. However, if the machine is a generator, it may be more convenient to run it up to speed by means of its motor or prime mover, with brushes lifted and field excited. Then, if the ends of the millivoltmeter leads be placed at various points on the commutator near one of the neutral axes, the ends themselves

being as close together as possible, the point at which the reading on the voltmeter is zero is the true neutral. The neutral point having thus been found, the brushes should be carefully set, so that their centre lines coincide with this neutral axis. The brush spacing should then be checked up, and the brushes rebled to the commutator, if necessary, before starting up.

Commutation.—The actual disposition of current in the brush is a very complicated phenomenon. However, ideal commutation is quite a simple action, and as it is towards this ideal that we are always working, it is perhaps necessary that we should now state what this is. By "straight-line" or "ideal" commutation, we mean that, as any one coil becomes short-circuited by the brush at A (fig. 1), the current in the coil should begin to die away uniformly, until at the midway point B the coil carries no current. The current should then build up uniformly, until at the point C, where the coil becomes open-circuited again, it should be carrying its maximum current as at A, but in the opposite direction. When this condition is not fulfilled, there is an abrupt change of current in the coil when it open-circuits at C, and sparking ensues. Now this ideal commutation cannot be attained if the self-induction of the coil is not adequately compensated for by providing the correct number of extra ampere-turns on the interpole, the result being that the energy stored up in the coil has to be dissipated by a circulating current which passes through the coil and brush, destroying all the conditions necessary for ideal commutation. It may be taken as an axiom that, given good mechanical conditions, sparking in interpole machines is always due to these unbalanced circulating currents, and therefore to an incorrect interpole field strength. It is patent, therefore, that to be able to test for circulating currents is an absolute necessity, and this may easily be done by means of brush-volt curves.

Brush-volt Curves.—The brush-volt curve is a curve showing the variation in contact drop between brush and commutator throughout the brush thickness. It is obtained in the following manner:—Mark along the brush thickness a number of equidistant points as shown in fig. 2. For a $\frac{3}{4}$ -in. brush, $\frac{1}{8}$ -in. divisions are very suitable, and give seven readings. Readings are then taken whilst the machine is

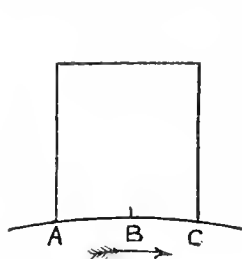


FIG. 1.

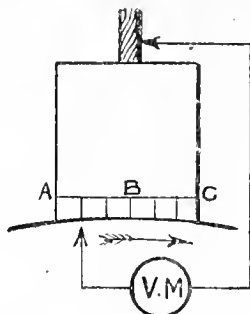


FIG. 2.

on load, by connecting a millivoltmeter between the top of the brush and points on the commutator immediately under each of the divisions of the brush in turn. It is very important to agree upon one standard method of connecting up the voltmeter, and the usual practice is to take the readings at the + brush in a motor and the - in a generator, the + of the voltmeter being connected to the brush and the - to the commutator. It is also advisable to standardise the direction of rotation, say, clockwise. The terminal of the + lead of the voltmeter may be a copper hook which is easily attached to, and detached from, the brush flexible. The - lead should terminate in a thick copper wire pointed at the end. The curve is constructed by plotting as ordinates the readings on the voltmeter, and as abscissae the corresponding points along the brush thickness.

Diagnosis of Commutation Conditions from the Brush-volt Curve.—Let us first assume that we have ideal commutation. Although each individual coil whilst shorted by the brush reverses its current from maximum in one direction, through zero, to maximum in the other direction, the current collected by the brush itself is quite constant, and

under a condition of ideal commutation the current density is the same at every point on the contact surface. Thus the contact drop is uniform, and ideal commutation may therefore be represented by the straight line shown in fig. 3a. Circulating currents upset this uniform current density, so that the straight line becomes inclined and curved. The five curves in fig. 3 illustrate typical results. Fig. 3a shows a condition of ideal commutation, as already described. Fig. 3b shows the curve obtained with a weak interpole, which, by retarding commutation, produces an excessive current density at the toe of the brush, and, as a general rule, sparking. The contact drop varies approximately as the

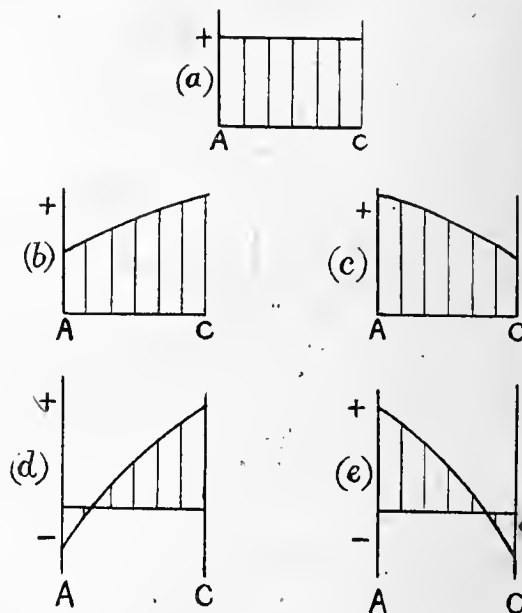


FIG. 3.

current density, and is seen to be low at A and high at C. Fig. 3c is the reverse of the above, and shows the curve obtained with a strong interpole field, which has the effect of hastening commutation, and thus producing a low current density at the toe, thereby lessening any tendency to spark. Fig. 3d shows the effect of a reversed interpole field, which would, of course, lead to vicious sparking, and fig. 3e, the effect of an excessive increase in the interpole field strength. The curves do not indicate the absolute current density at a point on the brush, because the current density is continually varying at any one point, so that the reading on the voltmeter is merely the average contact drop. Still, they do indicate the nature of the commutation conditions the brush is being called upon to withstand, and give a true indication as to whether the interpole flux is correctly adjusted, and if not, how it should be changed to produce a condition nearer to that of ideal commutation.

THE PRODUCTION AND DISTRIBUTION OF POWER, AND ITS INFLUENCE ON THE DEVELOPMENT OF IRISH INDUSTRY.

By J. F. CROWLEY, D.Sc.

(Abstract of paper read before the IRISH TECHNICAL CONGRESS, DUBLIN.)

NOTWITHSTANDING the many sources of power apparently open to us, over 90 per cent. of the power used in industry in the United Kingdom comes from reciprocating steam engines or steam turbines using coal as a prime source, and less than 10 per cent. is derived from all other sources. Coal, therefore, is our principal source of power, and it is important to inquire how we stand with regard to our supplies of it.

In 1905 it was estimated that "the available quantity of coal in the proved coalfields of the United Kingdom was 100,914,668,167 tons, and in the unproved coalfields 39,183,000,000 tons, at depths of less than 4,000 ft. in both cases, while the total figures for available coal in Ireland were given as 174,458,000 tons.

The amount of coal raised in the United Kingdom in 1903 was 230,334,469 tons. The average yearly output for Ireland between the years 1880 and 1902 was 115,500 tons, and for the past 12

years only 86,000 tons, with average yearly imports during the same period of 4,574,231 tons. Of the total coal raised annually in the United Kingdom, 63,805,000 tons are exported in one form or another, the remainder being consumed at home. Apparently, then, if we ignore the needs of future generations we can continue to use coal at our present rate for very a considerable time without any fear of exhausting our supplies.

There is another side to this matter, however. While our supplies of coal are very great, we cannot go on increasing our yearly output indefinitely, and the price of coal at the pit mouth is steadily advancing, while, on the other hand, our need of this important commodity is steadily growing. We must, therefore, seek some method of economising in the use of coal employed for power purposes, and may consider the following possible methods:—

- (a) A reduction in the amount of power used for industrial purposes.
- (b) The development of alternative sources of power.
- (c) Economy in the methods of producing, transmitting, distributing, and applying power.

In considering whether it is practicable to reduce the amount of power used in industry, the following table compiled from figures given in the Census of Production (1907) Report should be of interest:—

—	Excess of value of work done over cost of materials used in pounds.	Number of operatives employed.	Engines owned. Total H.P.	Net output per operative employed.	H.P. per operative employed.
England and Wales ...	602,994,000	5,808,269	9,097,869	104	1.56
Scotland ...	86,364,000	885,403	1,397,733	98	1.57
Ireland ...	22,777,000	291,304	259,407	78	.88

Column 1 gives the value of the total output of all the industries of the United Kingdom covered by the Census of Production, less the value of the raw materials purchased and the amount paid to other firms for work given out. This value is called the "net output," and is a figure of considerable value, as it gives without duplication the value added to the raw materials during manufacture.

Column 4 gives the "net output" per operative per annum, and judiciously employed is a figure of the greatest importance for comparing the efficiencies of various industries or groups of industries.

In a paper read in Manchester in 1912 I expressed the relation between the various quantities above referred to algebraically, as under:—

If M = the value in pounds of one year's raw material,
 S = the " " " " output,
 N = the number of operatives, and
 K_1 = a constant for a particular industry or group of industries,

$$\text{Then—} \quad M + K_1 N = S. \quad \dots \quad (1)$$

For the industries of the United Kingdom, taken as a whole, the constant K_1 has a value of 102.

Still following the method of treatment developed in the paper referred to, and since the "net output" has to provide all wages, standing charges and profits, we have—

If P = profits in pounds per operative per annum,
 C = cost of power " " " "
 R = rent, rates and taxes, maintenance, interest and depreciation in pounds per operative per annum,
 W = the wages in pounds per operative per annum,

$$P + C + R + W = K_1. \quad \dots \quad (2)$$

From the Board of Trade Reports on Earnings and Hours of Labour we obtain the average wages of all operatives in a given industry, and we thus obtain the value of W , which enables us to re-write (2) thus:—

$$P + C + R = K_2. \quad \dots \quad (3)$$

The following table, which gives the values of certain of the above figures for industries which are of special importance to Ireland, may be of interest:—

—	H.P. per operative.	K_1 .	W .	K_2 .
Lace ...	.28	98	£54.5	£43.5
Cotton ...	2.16	79	48.0	31.0
Wool and worsted, carpet, flock and shoddy ...	1.23	70	40.0	30.0
Elastic webbing ...	.36	68	37.0	31.0
Hosiery ...	.15	61	38.5	22.5
Silk ...	.58	55	34.5	20.5
Linen, jute and hemp (spinning and weaving) ...	1.09	61	31.5	29.5
Bleaching, dyeing, finishing, and printing of textile goods	1.83	101	54.5	46.5

As already pointed out, it is usual to take the values of K_1 for different industries, as indicating to some extent their efficiency as competing entities; I would suggest that K_2 , a figure that is available for all countries for which K_1 can be obtained, forms a better basis for comparing industries as trading bodies abroad, since high wages, while they increase the value of K_1 , have an adverse effect on ability to compete.

The only really practical test, however, is the price at which competitive articles are placed on a suitably chosen neutral market.

By a work first published in 1916, public attention was focussed on the fact that in comparing two similar trades in different countries, a high value of K_1 is almost invariably associated with a high horse-power per operative. The horse-power per operative for England, Scotland, and Ireland at the time of the last Census of Production, as given in a previous table, was 1.56, 1.57, and 0.88 respectively, the corresponding figures for K_1 being 104, 98, and 78. If we turn to America, we find figures for K_1 varying over a wide range of industries between one and a-half and three times as great as those for the United Kingdom with the horse-power per operative between one and a-half and six times as great.

It should be clear, then, that if wages are to improve and capitalists to receive an increased return on their investments, both essential to the advancement of industry, an increased amount of power must be introduced into industry; and instead of being able to effect coal economies in this direction, we must be prepared to meet fresh demands on our resources.

We may now consider our second alternative—viz., the development of other sources of power. First, as regards peat; the principal problems to be solved if peat is to be successfully used on a large scale for power purposes, are:—

- (a) The securing of rights over an area of bog containing peat with a suitable nitrogen content, and sufficiently large to provide power for a period long enough to justify the capital expenditure involved. This may be difficult in some cases owing to vested interests and the existing turbary rights of small holders.
- (b) The development of a suitable method of "winning" peat on a large scale from the bog.
- (c) A commercial process for the removal of surplus water from the required quantity of peat.

Granted the provision of a continuous supply at a sufficiently low cost of peat with a water content not much exceeding, say, 50 per cent., it may at once be said that there are no unsurmountable engineering difficulties to prevent peat being used on a large scale as a substitute for coal for the production of power, in gas engines for small and medium powers, and preferably in steam engines for large powers.

Oil may form a substitute for coal to a certain extent, provided the supply can be made more reliable, and the price per ton brought down to a sufficiently low figure, and kept out of the realm of speculation.

It may be interesting to note in passing that the largest oil engine so far built is a two-cycle single-acting Diesel engine, completed during the present war to the order of Messrs. Harland and Wolff, of Belfast. This engine was built in Switzerland for an output of 3,750 H.P., and gave 4,500 H.P. on the test bed.

The only source of power other than peat that we need seriously consider in this country as a substitute for coal is water. The Coal Commissioners (1905), in dealing with this matter, suggest that it is desirable to examine into the capabilities of the water powers in Ireland, as small sources of power might be used economically where there is little or no competition with coal. There is no doubt that it is eminently desirable that the investigation suggested by the Commissioners should be carried out. Matters for consideration in connection with the development of water power in this country are existing and future navigation and fishery rights, and the peculiar geological formation of the country, which raises important questions with regard to drainage. It should not be overlooked that the capital cost of a scheme for developing power from water is almost always much higher than the cost of a corresponding steam plant.

Altogether I think it may be said that for the United Kingdom, as a whole, no new facts have arisen since the Royal Commissioners' Report, to which reference has been made, to alter the conclusion they arrived at—viz., that "coal is our only reliable source of power, and there is no real substitute." With regard to Ireland, however, the bulk of the coal consumed is sea-borne; its cost is consequently higher than in Great Britain, and a very strong case can be made for a careful and systematic investigation of Irish resources in coal, peat, and water power, and of the best methods of utilising these for the development and distribution of power.

The production of power from large power units in central power stations is incomparably more economical in coal consumption per horse-power than the present method of production in small scattered plants, and the decrease in coal consumption with size of generating unit continues far beyond the largest size unit so far built. Further, the cost of power produced falls off even more rapidly with the size of generating unit than does the consumption of fuel. It may be of interest to note, in passing, that the Germans claim to be building just now the world's largest single electrical unit, of an output of 60,000 K.V.A., or at a power factor of 0.8, approximately 65,000 electrical H.P. I mention this advisedly, as it shows that the Germans are working on the same lines as we are with regard to the economical generation of power.

The production and distribution throughout suitably chosen areas of economic size of power in bulk from large suitably situated central power stations would, at a conservative figure, save us 50 per cent. of our present coal bill for power purposes, and effect a still greater percentage saving in the cost of the power generated.

Power engineers generally are agreed that the steam turbine is the most suitable prime mover to produce power on a large scale, and electricity the most suitable agent to distribute it. The steam required can be raised from coal, fired in the ordinary way, coal-

dust, producer gas made from coal, waste gases of any kind as coke oven, blast furnace gas, &c., natural gas, water gas, peat fired directly under boilers, peat powder alone, or mixed with coal, producer gas made from peat, &c. or from oil. There are many points in favour of factory owners taking bulk electrical supply from central generating stations, and many well-known advantages in driving the machinery electrically.

Any advantages claimed for electric driving generally can be claimed for individual electric driving also; while, in addition, special advantages can be obtained with this drive in certain cases, such as: (1) Saving in the power consumed; (2) increased production due to (a) peculiar advantages in the case of certain machines, resulting, in some cases, in an increase in production varying from 10 to 25 per cent.; (b) better supervision, &c.

General opinions such as have to be expressed in a paper such as this are naturally subject to revision based on developments in engineering or increases in the cost of power; Belfast may, one day, for instance, receive its power electrically from the coal-fields of Scotland, but I do not see any reason to anticipate any substantial revision in the immediate future.

I have endeavoured in the short time at my disposal to show that coal is our main source of power, that there is reason to fear that supply will not always keep pace with demand, that the price will steadily advance, and that in our endeavour to economise in its use and at the same time provide cheap power for our industries we would do well to consider the use of peat and of water as alternative sources of power. Further, considerable economies can be effected by producing power in bulk in central stations, transmitting it electrically to the industrial centres of the country and distributing it to consumers, both large and small.

STEEL TROLLEY WIRE.

In an article in the *Electric Railway Journal*, S. H. Anderson describes the successful use of steel trolley wire on the Pacific Electric Railway.

The company put up its first steel trolley wire in February, 1910, with a view to testing its value against copper costing 15 cents a lb.; now copper is valued at 40 cents and steel costs 12 cents a lb., and since 1910 the company has gradually extended its use until about 100 miles of No. 0000 double-grooved Roebling steel wire has been erected. The first steel trolley wire was for 600-volt direct suspension, and was butt-welded and ungalvanised. Galvanised wire was then adopted to prevent corrosion, and a lap-welded braze superseded the butt joint on account of the wire parting at the factory splices. This eliminated most of the trouble, but it was necessary to provide an oxy-acetylene welding outfit to weld the wire on site when breaks occurred. Seven years' service on a line with a 3 or 4-minute service during rush hours, shows the wire to be in first-class condition as a whole. It has a smooth under surface, and no signs of wear at clips, switch points, or splices, contrary to the condition of copper trolley wire.

Since the copper and splice at the ends of the steel wire has been renewed twice since 1910, and as the steel is good for four or five years more, the life of the steel on tangents should be three or four times that of copper. At accelerating or feeding points, however, steel is not expected to last longer than copper, if as long. In 1912, some 1,800 ft. of steel wire was installed on a high-speed catenary line with a 3 or 4-car train service. Inspection shows 13 per cent. wear on tangents, and 22 per cent. at clips of hangers; future life estimated at 3 years. On curves the wear is 22 per cent. on the run and 29 per cent. at clips; future life estimate, 2 years. About 500 ft. of tangent was renewed this year, owing to wear due to heavy arcing at accelerating points, the wear being as great, or greater, than with copper.

The most important installation is on a stretch of line operated at 60 to 70 M.P.H. on 1,200 volts, where the smaller current induces less burning than on the 600-volt lines.

It is not found that trolley wheels wear out faster under steel, but it is surmised that the pneumatic trolley bases, which keep a constant upward pressure, may be the reason.

A larger number of feed-in points are required; on the San Bernardino line, with a copper circuit and steel messenger in parallel with the trolley, the feed-ins are 450 ft. apart. For direct suspension, a feed-in at every other pole—that is, 220 ft. apart—is being gradually adopted.

Generally speaking, the maintenance on steel trolley wire is far below that on copper; the steel is harder, the clips hold better, and the wire does not break if the trolley pole hits a span. No breaks have been due to crystallisation at ears, &c., and where wire has broken and shorted to the rail, it can usually be restrung, whereas copper would become annealed. The steel is easier to pull up, and its wear is almost all due to burning and arcing.

For welding, rods of $\frac{1}{8}$ in. or $\frac{3}{16}$ in. nickel steel are used, the time taken to weld the wire in the air being 10–15 minutes.

Bending tests showed that the wire would stand six right-angle bends in a vice before breaking, and heating tests, by passing current through the wire until red hot, showed that though the galvanising burnt off, the wire was otherwise uninjured. Tests showed the resistance to be 0.00342 ohm. per ft. at 100° F., or 6.53 times that of No. 0000 copper under similar conditions; being 10.6 per cent. lighter, its resistance per unit of weight is 5.83 times that of copper.

INDUSTRIAL RECONSTRUCTION.

THE following recommendations on the Whitley Report on Industrial Councils have been put forward by the FEDERATION OF BRITISH INDUSTRIES, and are referred to in our leading columns to-day:—

1. The Federation cordially endorses the view of the Reconstruction Committee as to the vital importance of securing co-operation between employers and workpeople after the war; it is needless to recapitulate the many difficult problems which are likely to arise, some of which are touched upon in the Report of the Committee, but few can fail to realise the serious consequences to our commercial and national position which may result from failure to secure harmony between employers and employed. Efficiency of production is a prime consideration. For this it is necessary to have co-operation and agreement with labour, who in return will, and are entitled to, demand improved conditions of employment, a higher standard of comfort generally, and opportunity of appreciating the true interests of the trade in which they are engaged.

The complement of efficiency of production is efficiency of management, whether in the organisation of works and of business, in inventiveness, or in the study and capture of world-wide markets. Such management is at the base of an intensive demand for labour, and must be guided and controlled by the best individual brains of the country. Care must therefore be taken not to interfere with their work, but to afford them the fullest scope, for without an intensive demand for labour it is hard to see how the best conditions can obtain. Any scheme for reconstruction must therefore have regard to the importance of efficiency, both in business and productive methods and in commercial management, and nothing in the suggested Councils should tend to impair or interfere with development in this direction.

2. The Federation cordially welcomes the views expressed by the Committee as to the important part which must be played by Associations in the settlement of these difficult questions, and expresses the opinion that it is indeed only by the establishment in each trade of organisations representative of employers and workpeople respectively that the object can be achieved.

The Federation, therefore, would lay particular emphasis upon the views expressed in Paragraph 23 of the Report:—

"It may be desirable to state here our considered opinion that an essential condition of securing a permanent improvement in the relations between employers and employed is that there should be adequate organisation on the part of both employers and workpeople. The proposals outlined for joint co-operation throughout the several industries depend for their ultimate success upon there being such organisation on both sides: and such organisation is necessary also to provide means whereby the arrangements and agreements made for the industry may be effectively carried out."

While agreements in the fullest sense can only be made between organisations representing each side, it is almost impossible to provide security for such agreements if any appreciable portion of workpeople on the one side, or manufacturers on the other, are not members of their respective organisations, and are consequently not bound by the agreements.

In the opinion of the Federation this point is so important that they suggest that the Government ought to go far to recognise, and give an official standing to, organisations representative of employers and workpeople respectively, and to encourage the development of such organisations.

3. The recommendations of the Committee are far-reaching and important, but it will be readily admitted that the construction of an organisation on the lines suggested is a delicate matter, and the Federation notes with satisfaction that in the creation of the proposed organisation it is not contemplated that the Government shall actively interfere. The Federation desires to emphasise this point, and to urge that while sympathetic Government assistance may be, and doubtless will be, of great value, it is most important that there should be no suggestion whatever of Government pressure or coercion, and that each trade shall be free to build up its own organisation voluntarily and on lines best suited to its peculiar needs.

4. It may be pointed out that the descriptions in the Report of the various Councils are somewhat vague and uncertain. The Federation, however, understands that the National Industrial Councils referred to are Councils of individual trades, and not national in the literal sense.

The Federation is of opinion that the basis of the scheme should be Trade Councils of masters and men—that is to say, that each trade or section of an industry should form a Council representative of the employers' organisation or organisations and of the Trade Union or Trade Unions concerned with such particular trade or section of an industry. This Council should have the sole power of dealing with agreements of all kinds and any other matters appropriate to the particular trade or section of industry.

Some difficulty arises in this connection owing to the existence of Unions in certain cases overlapping various different sections of trade. This, however, is a matter of detail which could no doubt be easily overcome.

5. In the opinion of the Federation, devolution of constructive work to District or Works Committees would be very dangerous. It should only be permitted to develop in the light of experience.

6. It is suggested that the main value of District Councils would be to constitute a court of arbitration in the case of any difference between employers and employed in the trade in the district, having regard to the general and any peculiar conditions obtaining in that district.

7. In the opinion of the Federation the Works Committees

should be entirely voluntary in the case of each individual firm, and not in any way officially constituted. They should consist entirely of representatives of the employes, and they should, if possible, be elected by secret ballot. Where instituted their duties should be confined to reporting to, or receiving from, the management complaints regarding breaches of any agreements which may have been made between employers and employed.

8. It appears to the Federation that the general principle underlying these suggested Councils should be the centralisation of policy and the decentralisation of administration.

9. The Federation suggests that while the proposed Trade, or as they are designated in the Report National, Councils, may be well suited for discussing questions peculiar to the trade, and may provide a suitable Court of First Instance for the settlement of disputes, it would be highly desirable that superior bodies should exist, consisting (1) of representatives of employers and employed in each group of trades forming an industry, which might possibly be styled "Councils of Industry," and (2) of representatives of the employers and employed in all industries, which might possibly be styled "The National Industrial Council."

The Councils of Industry and the National Industrial Council would provide suitable Courts of Appeal from the Trade Councils in cases of differences between employers and employed in any trade which cannot be settled by the Trade Council. It is not necessary to suggest exact details of procedure, nor is it intended to interfere in any way with existing Conciliation Boards or other arrangements for settling disputes, but rather to build up similar organisations in industries where they do not at present exist, and only to supplement existing organisations.

The Federation is of opinion that provision of methods for preventing or settling differences is almost as important as provision of facilities for co-operative action, and the Federation is of opinion that if no strike or lock-out could take place until the question had been submitted to final arbitration by a truly National Council of employers and employed, there would be good grounds for hoping that the time for reflection afforded, and the pressure of popular opinion, would ensure the loyal adoption of the award.

10. With regard to the consideration of general questions, amongst which many of the most important are mentioned in paragraph 16 of the Report, the Federation are of opinion that these should be dealt with primarily by the National Industrial Council, which should delegate to the Councils of Industry, and possibly to the Trade Councils, the consideration of matters of peculiar trade interest in such cases as the National Industrial Council may think desirable. The final decision in all matters of general policy should be taken by the National Industrial Council after providing reasonable opportunities of criticism on the part of the Councils of Industry and Trade Councils. Nothing in this suggestion, however, is intended to prevent the Trade Councils or Councils of Industry from initiating the consideration of any matter of general interest.

SYSTEM OF INDUSTRIAL COUNCILS RECOMMENDED BY THE FEDERATION OF BRITISH INDUSTRIES.

National Industrial Council.—Composition.—Representatives of employers and workpeople from all industries.

Duties.—Final Court of Appeal in disputes. Primary body for consideration of questions in Clause 16 of Whitley Report, with powers to allocate specific questions to other Councils. Should take final decision in all matters of general policy after giving ample opportunity for discussion and criticism by Councils of Industry and Trade Councils.

Councils of Industry.—Composition.—Representatives of employers and employed in each group of trades forming an industry (such as the textile trades, &c.).

Duties.—To act as a Court of Appeal from the Trade Councils in disputes. To deal with all special matters which may be allocated to them by the National Industrial Council, to initiate consideration of matters of general interest to the particular industry with which they are concerned, and to forward such matters to the National Industrial Council if of general interest, and to consider, and, if necessary, forward to the National Industrial Council any such matter initiated by a Trade Council.

Trade Councils.—Composition.—Representatives of the Employers' Organisation or Organisations, and of the Trade Union, or Trade Unions, concerned with a particular trade or section of an industry.

Duties.—First Court of Appeal in case of disputes. Sole power of dealing with agreements and all other matters pertaining to the particular trade or section, and with any special matters delegated to them by the Council of Industry or by the National Industrial Council.

Works Committees.—Composition.—An elected body of workpeople in each works, to be set up only by the joint consent of the individual employers and employed concerned, their institution to be entirely voluntary.

Duties.—Reporting to, or receiving from, the management complaints regarding any breaches of agreements which may have been made between employers and workpeople.

TRADE STATISTICS OF SPAIN.

The figures given below show the imports of electrical and similar goods into Spain during the year 1915, according to the official statistics recently issued. The figures for 1914 are given for purposes of comparison, and notes of increases and decreases (which are very considerable) have been added:—

	1914.	1915.	Inc. or dec.
	Pesetas.	Pesetas.	Pesetas.
<i>Arc lamps.—</i>			
From Germany ...	66,000	9,000	— 57,000
" France ...	10,000	2,000	— 8,000
" Great Britain ...	29,000	2,000	— 27,000
" Other countries ...	10,000	1,000*	— 9,000
Total ...	115,000	14,000	— 101,000

* United States.

<i>Carbons for arc lamps.—</i>			
From Germany ...	63,000	21,000	— 42,000
" France ...	13,000	1,000	— 12,000
" Great Britain ...	15,000	9,000	— 6,000
" Other countries ...	2,000	2,000	—
Total ...	93,000	33,000	— 60,000

<i>Incandescent electric lamps, mounted.—</i>			
From Germany ...	2,105,000	1,624,000	— 481,000
" France ...	48,000	37,000	— 11,000
" Great Britain ...	47,000	33,000	— 14,000
" Austria ...	215,000	—	— 215,000
" United States ...	—	179,000	+ 179,000
" Italy ...	—	122,000	+ 122,000
" Switzerland ...	—	246,000	+ 246,000
" Other countries ...	742,000	179,000	— 563,000
Total ...	3,157,000	2,420,000	— 737,000

Dynamos, electric motors, induction coils, resistances, transformers, &c., up to 100 kg. weight.—

From Germany ...	1,946,000	—	— 1,946,000
" France ...	427,000	297,000	— 130,000
" Great Britain ...	302,000	196,000	— 106,000
" Holland ...	5,000	88,000	+ 83,000
" Italy ...	160,000	234,000	+ 74,000
" Norway ...	—	20,000	+ 20,000
" Sweden ...	110,000	61,000	— 49,000
" Switzerland ...	46,000	136,000	+ 90,000
" Other countries ...	472,000	815,000	+ 343,000
Total ...	3,468,000	1,847,000	— 1,621,000

Ditto, weighing from 101 to 400 kg.—

From Germany ...	860,000	266,000	— 594,000
" United States ...	265,000	27,000	— 238,000
" France ...	148,000	96,000	— 52,000
" Great Britain ...	249,000	163,000	— 86,000
" Italy ...	24,000	71,000	+ 47,000
" Norway ...	—	52,000	+ 52,000
" Sweden ...	244,000	94,000	— 150,000
" Switzerland ...	85,000	156,000	+ 71,000
" Other countries ...	37,000	12,000	— 25,000
Total ...	1,912,000	937,000	— 1,075,000

Ditto, weighing from 401 to 2,500 kg.—

From Germany ...	1,597,000	251,000	— 1,346,000
" France ...	333,000	159,000	— 174,000
" Great Britain ...	399,000	277,000	— 122,000
" Switzerland ...	82,000	169,000	+ 87,000
" United States ...	532,000	46,000	— 486,000
" Other countries ...	412,000	174,000*	— 238,000
Total ...	3,355,000	1,076,000	— 2,279,000

* Sweden, 109,000.

Ditto, weighing from 2,501 to 5,000 kg.—

From Germany ...	387,000	234,000	— 153,000
" Switzerland ...	89,000	139,000	+ 50,000
" Great Britain ...	63,000	21,000	— 39,000
" United States ...	694,000	98,000	— 596,000
" Other countries ...	336,000	65,000*	— 271,000
Total ...	1,569,000	560,000	— 1,009,000

* France, 24,000; Sweden, 28,000.

Ditto, weighing more than 5,000 kg.—

From Germany ...	2,564,000	229,000	— 2,335,000
" France ...	489,000	177,000	— 312,000
" Great Britain ...	571,000	178,000	— 393,000
" Switzerland ...	189,000	434,000	+ 245,000
" United States ...	2,025,000	440,000	— 1,585,000
" Other countries ...	66,000	346,000*	+ 280,000
Total ...	5,904,000	1,804,000	— 4,100,000

* Norway, 178,000; Sweden, 132,000.

Electrical Trades Union.—An organising meeting of power and sub-station engineers was to be held by the London District Committee on Wednesday last. All central station and sub-station men were invited to attend and to hear what was being done for the station men. "Join us, and so hasten the day when your Trade Union shall control the electrical industry. Over 600 station men already in our ranks in London branches."

	1914. Pesetas.	1915. Pesetas.	Inc. or dec. Pesetas.
<i>Accumulators and electric batteries.—</i>			
From Germany ...	47,000	10,000	— 37,000
„ France ...	68,000	24,000	— 44,000
„ Great Britain ...	17,000	10,000	— 7,000
„ United States ...	23,000	28,000	+ 5,000
„ Other countries ...	37,000	26,000*	— 11,000
Total ...	192,000	98,000	— 94,000

* Sweden, 10,000.

Cables and wires for electricity, with or without insulating material, of 1 cm. dia. or more.—

	1914. Pesetas.	1915. Pesetas.	Inc. or dec. Pesetas.
From Germany ...	895,000	6,000	— 889,000
„ Great Britain ...	149,000	46,000	— 103,000
„ United States ...	137,000	53,000	— 84,000
„ Other countries ...	532,000	50,000*	— 482,000
Total ...	1,713,000	155,000	— 1,558,000

* France, 46,000.

Ditto, less than 1 cm. in dia.—

	1914. Pesetas.	1915. Pesetas.	Inc. or dec. Pesetas.
From Germany ...	207,000	8,000	— 199,000
„ France ...	33,000	26,000	— 7,000
„ Great Britain ...	22,000	36,000	+ 14,000
„ United States ...	23,000	54,000	+ 31,000
„ Other countries ...	8,000	3,000	— 5,000
Total ...	293,000	127,000	— 166,000

Telegraph and telephone apparatus, electric meters and parts.—

	1914. Pesetas.	1915. Pesetas.	Inc. or dec. Pesetas.
From Germany ...	1,641,000	565,000	— 1,076,000
„ Belgium ...	45,000	5,000	— 40,000
„ France ...	174,000	425,000	+ 251,000
„ Great Britain ...	448,000	304,000	— 144,000
„ Sweden ...	261,000	596,000	+ 335,000
„ United States ...	11,000	295,000	+ 284,000
„ Italy ...	3,000	6,000	+ 3,000
„ Other countries ...	34,000	248,000*	+ 214,000
Total ...	2,617,000	2,444,000	— 173,000

* Norway, 15,000.

Electrodes.—

	1914. Pesetas.	1915. Pesetas.	Inc. or dec. Pesetas.
From United States ...	—	23,000	+ 23,000
„ France ...	—	32,000	+ 32,000
„ Germany ...	15,000	3,000	— 12,000
„ Italy ...	13,000	4,000	— 9,000
„ Other countries ...	6,000	1,000	— 5,000
Total ...	34,000	63,000	+ 29,000

Hydraulic motors.—

	1914. Pesetas.	1915. Pesetas.	Inc. or dec. Pesetas.
From Germany ...	611,000	194,000	— 417,000
„ France ...	193,000	131,000	— 62,000
„ Great Britain ...	29,000	32,000	+ 3,000
„ Switzerland ...	387,000	1,241,000	+ 854,000
„ Other countries ...	50,000	29,000*	— 21,000
Total ...	1,270,000	1,627,000	+ 357,000

* Sweden, 28,000.

Steam and gas engines (stationary) up to 10,000 kg. weight.—

	1914. Pesetas.	1915. Pesetas.	Inc. or dec. Pesetas.
From Germany ...	298,000	31,000	— 267,000
„ Great Britain ...	490,000	332,000	— 158,000
„ France ...	88,000	20,000	— 68,000
„ Belgium ...	247,000	—	— 247,000
„ Italy ...	39,000	3,000	— 36,000
„ Other countries ...	21,000	159,000*	+ 138,000
Total ...	1,183,000	545,000	— 638,000

* Switzerland, 121,000.

Ditto, from 10,000 to 25,000 kg. weight.—

	1914. Pesetas.	1915. Pesetas.	Inc. or dec. Pesetas.
From France ...	—	49,000	+ 49,000
„ Germany ...	39,000	—	— 39,000
„ Great Britain ...	112,000	—	— 112,000
„ Belgium ...	59,000	—	— 59,000
„ Other countries ...	35,000	—	— 35,000
Total ...	245,000	49,000	— 196,000

Ditto, over 25,000 kg. weight.—

	1914. Pesetas.	1915. Pesetas.	Inc. or dec. Pesetas.
From Switzerland ...	—	117,000	+ 117,000
„ Germany ...	579,000	—	— 579,000
„ Belgium ...	88,000	—	— 88,000
„ Great Britain ...	404,000	56,000	— 348,000
„ France ...	163,000	46,000	— 117,000
„ Other countries ...	—	1,000	+ 1,000
Total ...	1,234,000	250,000	— 984,000

Cylindrical steam boilers.—

	1914. Pesetas.	1915. Pesetas.	Inc. or dec. Pesetas.
From Switzerland ...	—	25,000	+ 25,000
„ Germany ...	55,000	—	— 55,000
„ Great Britain ...	151,000	124,000	— 27,000
„ France ...	37,000	7,000	— 30,000
„ Belgium ...	92,000	—	— 92,000
Total ...	335,000	156,000	— 179,000

Multitubular boilers.—

	1914. Pesetas.	1915. Pesetas.	Inc. or dec. Pesetas.
From Great Britain ...	1,540,000	1,444,000	— 96,000
„ Germany ...	476,000	94,000	— 382,000
„ Belgium ...	196,000	—	— 196,000
„ France ...	346,000	251,000	— 95,000
„ Other countries ...	24,000	12,000	— 12,000
Total ...	2,582,000	1,801,000	— 781,000

NOTE.—25 Pesetas = £1.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Temperature Indicators for Electrical Apparatus.

The rating of electrical machinery depends in most cases purely upon the temperature of the insulated windings; as a rule the efficiency is high on "overload" and even if this is not the case the fixed charges per KW. are so much reduced on overload that the loss in efficiency will often be comparatively negligible. Hence it is important to distinguish between the nominal overload which a machine is rated to carry and the actual overload which it can safely deal with in actual practice, bearing in mind that the duration of the overload is an essential factor in this question. Yet very little has been done hitherto with a view to enabling the operating staff to run machines at their full practical output, regardless of the figures on the name plate, though really important economies in capital cost might be effected by this means.

The *Electrical World* states that the GENERAL ELECTRIC CO., of Schenectady, has developed temperature indicators which, when used in conjunction with temperature coils in electrical apparatus, afford a convenient means of indicating continuously at the switch-board the temperatures of various portions of the windings of electrical apparatus under various conditions. The indicator is a direct-current differential indicator with three terminals. Its

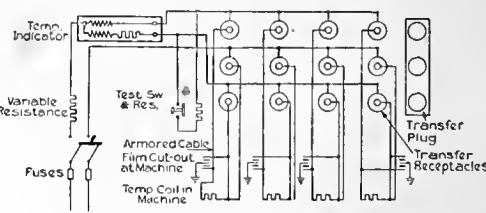


FIG. 1.—CONNECTIONS OF TEMPERATURE INDICATORS.

operation depends on the variation of resistance of a copper resistor placed in a slot of the machine stator in contact with the insulation of the winding, or in any location, external or internal, where the resistor may be protected from the conductors by suitable insulation. Four temperature coils are used on machines rated at 500 KVA. to 3,125 KVA., two of the coils being considered as spares. Above 3,125 KVA. six coils are used, three of which are spares.

One of the windings of the temperature indicator is in series with a coil of manganin, having a resistance equal to that of the temperature coils (usually at 80° C.). The other winding is in series with the temperature coil itself. When the temperature in the copper coil rises, the current in the branch of the circuit including the temperature coil decreases, causing a corresponding deflection toward the higher temperature end on the indicator scale. The reverse action occurs when the temperature of the temperature coil falls. The scale of the standard instrument has a range of 20-120° F. or 0-90° C., marked in 1° divisions. The temperature coils are made of copper wire wound in a thin form and pressed flat so as to be non-inductive. Current is derived from the supply circuit. The connections of the apparatus are shown in fig. 1.

Cable-pulling Eye.

In pulling cable it is considered good practice among some cable men to make an attachment to the cable conductors as well as the sheath in all duct runs over 375 ft. (114 m.) in length. To facilitate such a connection, one of the foremen of the General Electric Co.'s cable-pulling crew, working on large cables at Cincinnati, developed an attachment eye shown herewith, fig. 2.

This device is made in two styles. One of them is a solid forging about 9 in. (22.8 cm.) long, having an eye at one end. The shank is made of 1-in. (2.54 cm.) round stock, one end being upset or spread out in the form of a truncated cone. In this cone are

three grooves which extend from the base toward the shank of the device.

In using this device the sheath of the cable to be pulled is cut saw-tooth fashion for several inches back from the cable end; the lead is then turned back and the conductors are peeled. After this operation the conductors are laid in the grooves in the cone-shaped end of the pulling device, and the strands are served around the

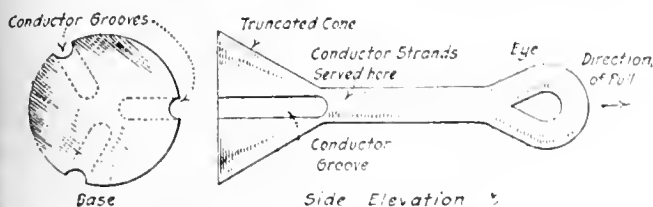


FIG. 2.—ATTACHMENT EYE.

shank of the tool. The saw-toothed lead-sheath ends are then bent down closely around the conductors and solder is sweated into the joint, making a smooth wiped joint. With these joints properly made it has been possible to break ropes designed to stand a 6'8-ton load without parting the joint between the cable and the eye. The second style of attachment eye is like the first, except that a swivel is used in the shank.—*Electrical World*.

Armature-winding Machine.

This machine has been invented with the idea of expediting the output, thereby cheapening cost, and to obviate the use of skilled labour, male or female. This applies especially to places where labour is of so migratory a character that it is always a problem to those who have to get this work done. The machine here illustrated is the experimental one, and will wind armatures up to 3 in. in diameter, but the machine as intended for commercial purposes will wind up to 5 in., after which it is usual to wind with formed coils. The inventor, Mr. L. E. WOOD, A.M.I.E.E., states that the machine follows the hand method as nearly as it is possible to do so, fills the slots and piles up the ends in less space and more neatly than is possible by hand, and will wind 3 to 1 with the best female winder he has yet seen—that is with the experimental machine; better results are claimed for the commercial machine. No previous experience, skill, or training is necessary; any boy or girl can operate a number of machines according to the size of the armature and number of turns per coil. All that is necessary on the part of the operator is to put in the loop and

adjustments being made by turning hand-wheels while the machine is running.

The armature runs at the same speed and in the same direction as a dummy shaft. This shaft carries two weights, which may be shifted toward or from each other. The armature and the dummy shaft are supported together on a bed which is hinged at one end and free to vibrate vertically at the other end under the influence of any unbalanced couple in the armature or in the weights. When the weights are brought close together they exert no couple, but any running unbalance in the armature will cause the bed to vibrate. The weights are then moved to such positions that the couple they exert is opposite and equal to that exerted by the armature; the vibration then stops. Since the weights and their radius from the centre of the shaft are predetermined, it only remains to measure their distance apart to calculate the couple they exert. With this known, it is easy to calculate what weights should be added to or subtracted from points of known radius at known distances apart in the armature to produce a similar couple in the opposite direction. In order that the plane of unbalance may be determined, the dummy shaft is arranged so that it may be rotated with respect to the armature. The weights may be shifted on their shaft without stopping the machine.

To apply the readings of the machine to the object tested, a set of charts is used from which the readings in ounce-inches are converted directly into diameter and depth of holes to be drilled at the specified radii and specified distances apart. This is usually more convenient than adding weights.

The makers, the CARLSON-WENSTROM Co., of Philadelphia, state that the machine will easily handle 100 armatures in an eight-hour day.—*Electrical World*.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Employment of Disabled Soldiers.

It was with great pleasure that I perused your valuable journal of July 27th, and on page 87 you called attention to the recent advertisement which had the audacity to call for invalid young officers, at a salary, including war bonus, of 37s. per week, to act as switchboard attendants. It goes to prove that the undertaking concerned values the "invalided young officer," who has had to bear the "burden and heat of the day," at a low rate; and it is also unfortunate that the letters appearing on page 128 of your issue of August 10th have apparently been inspired by authors who have not yet had any experience of active service during the past three years.

I would point out to the authors of the letters that such an advertisement as referred to does not materially help their position, as it obviously follows that probably an advertisement might appear calling for shift engineers, worded similarly.

Before the war, the condition of pay to central-station men was deplorable, and it looks as if the advertisement in question tends to make the position worse. Therefore, it behoves those who are at present spared the trials and hardships of active service not to kick against the Editors of the ELECTRICAL

REVIEW, but to protest, and protest strongly, against the advertisement and the undertaking which inspired it. It is to be remembered that in these days hundreds of commissions are given from the ranks, irrespective of a man's station in life; therefore I cannot understand the attitude of the writers of the letters. If anything is to be done to raise the status and increase the salaries of central-station men as a whole, it must be by a concerted action, and not as a divided party. It would therefore appear that the steps taken by the Institution of Electrical Engineers, with their new scheme, are absolutely on the right lines; and I do most sincerely hope that the Institution of Mechanical Engineers and other kindred institutions will do likewise in organising some scheme to provide employment for those unfortunate invalided men who, in the prime of their vigour and manhood, have given their best to keep the invader at bay. The people at home, however much good work they may be doing, have no conception of a modern battle and the terrible conditions under which the men out here have to exist.

As one who has been on active service for over two years in France, an advertisement like the one quoted above caused me to wonder who was the author and what the central-station men think of it who are on active service on the different fronts.

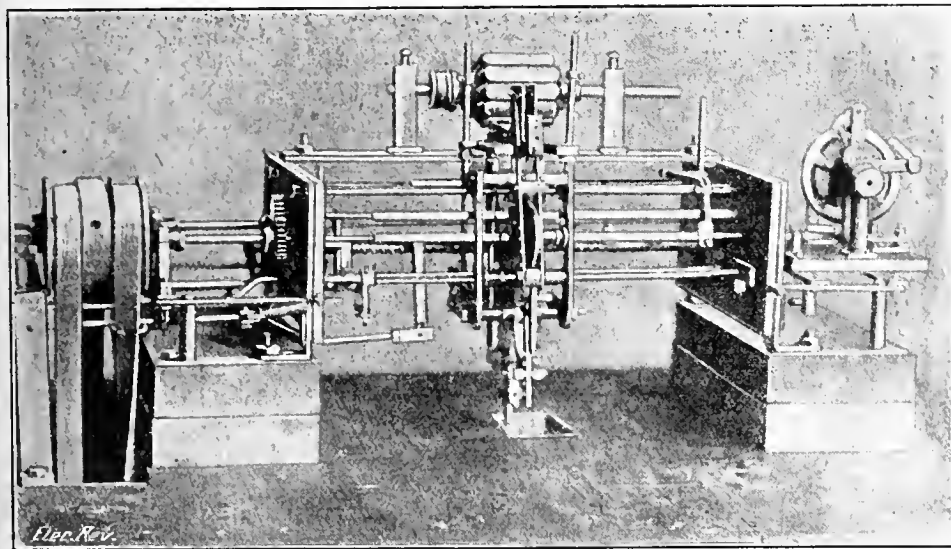


FIG. 3.—ARMATURE-WINDING MACHINE.

revolve the armature to the next slot, which is done by a graduated disk, restart the machine, pass on to another, and repeat the process; an electrical device stops the machine when the predetermined number of turns is reached. The machine has been developed so as to be entirely automatic, if required—that is, to form the loop and move the armature to the next slot.

The power required to run one machine is approximately $\frac{1}{2}$ H.P.; where a number of machines were used they would be grouped on shafting, driven by a suitable motor.

It is proposed to make the machine in two sizes—one for the smallest armatures up to, say, 2½ in., the other from 2½ in. to 5 in. The machine is in process of being patented in the U.S.A. and other countries, and the inventor would be pleased to hear from any one interested with a view to its being exploited in the United Kingdom. His address is P.O. Box 427, Valleyfield, P.Q., Canada.

Dynamic Balancing Machine.

True running balance may be quickly secured in an armature, motor crank shaft, turbine rotor, fan, or other high-speed rotating part by the use of a dynamic balancing machine built under the

It is to be hoped that after the above trespass on space in your valuable journal, the authors of the various letters will take a different view of the situation.

A.M.I.Mech.E., A.M.I.E.E.

B.E.F., France.

The Psychology of Shift Work.

In reference to my letter in your issue of August 17th, it should read: "Secretary, Birmingham Station Engineers' Branch, Electrical Trades Union."

Thos. N. Morris.

WAR ITEMS.

Trading with the Enemy.—In the "London Gazette" of August 17th is given an amended list of persons and firms in neutral and allied countries with whom trading is prohibited.

Employment of Women.—Returns made by employers to the Board of Trade show that since July, 1914, the number of women employed mainly in industries and commerce and Government establishments has increased by one and a quarter millions, and about the same number of men have been directly replaced by women. Between January and April, 1917, there was an increase of 51,000 women in industrial occupations.

Bribery in War Time.—The valuable "News-sheet" of the Bribery and Secret Commissions Prevention League, Inc., states that in the three war years ended August 4th there have been directly connected with the war 22 convictions on indictment under the Prevention of Corruption Act, and 27 summary convictions. During the same period there were 26 convictions, eight on indictment, purely civil. Together there were 90 cases, including five untried and 75 convictions, 56 of which belong to the present year, irrespective of convictions for bribery under other Acts and the common law.

A Dublin Wiring Contract.—The contract for the electric lighting of Coleraine House, Dublin—a Government Department—has been the subject of some comment. It is now officially announced that five contractors were invited by the Board of Works to tender for the work; that three responded, but that the tenders were in excess of the Board's estimate; and that, as no substantial modifications could be obtained, and as the work was urgent, it was decided to ask the General Post Office Telegraph Department, Dublin, to undertake the work. In the opinion of the Government, no further action is required, though, needless to add, local opinion differs.

Munitions Levy.—With the passing of the Finance Act the duty of assessing munitions levy up to December 31st, 1916, when the levy ceases, passes to the Board of Inland Revenue, and the staff engaged on this work is transferred to that department. In dealing with the question of the values of plant, buildings, and machinery erected or installed in controlled establishments for munitions work, the Board of Inland Revenue has made arrangements to retain the honorary services of the Valuation Advisory Committee of eminent experts, formed by the late Mr. Howard Chatefield Clarke, and consisting of Mr. Basil Mott, Captain H. Riall Sankey, C.B., R.E., Lieut.-Col. C. L. Morgan, Mr. Leslie R. Vigers, Mr. H. M. Jones, and Mr. J. George Head, who have for the past 18 months been almost daily occupied in visiting controlled establishments in various munitions areas and advising the Ministry of Munitions on the extensions therein.—*Financial Times*.

A Munitions Council.—The Minister of Munitions has formed a body, to be known as the Munitions Council, including the Minister as President, two Parliamentary Secretaries as Vice-Presidents, and 10 members, each representing a group of departments of the Ministry, together with a secretary. The staff of the Ministry at headquarters has increased from 5,000 a year ago to 13,500 at present; the Department employs in all about 2,000,000 persons, and is responsible for the expenditure of over 600 millions sterling per annum. The possibilities of further expansion to meet the needs of the situation are approaching exhaustion, and it is necessary to seek the means of increasing production by improving the efficiency of the organisation. The new Council will be the intermediary between the Minister and the component departments, which number over 50; it will aid and advise the Minister, and will fill a rôle similar to that of the Board of Admiralty or the War Council, relieving the Minister of much administrative work, and dealing with important questions affecting more than one group of departments. The scheme was brought into effect on Monday last, the following being the members of the Council and the groups of departments under them:—Finance: Sir H. Hambling. Design: Major-General the Hon. F. R. Bingham. Steel and Iron: Mr. John Hunter. Materials, &c.: Sir E. Moir. Explosives: Sir K. Price. Projectiles, &c.: Sir J. Stevenson. Guns: Sir G. West. Engines: Sir A. Duckham. Allies: Sir F. Black (*pro tem.* Sir C. Ellis). Labour: Sir S. Kent.

China and the German-Asiatic Bank.—As a result of China's entrance into the war, the German concessions at Tientsin and Hankow revert to China, the large financial obligations to Germany are cancelled, and her extra-territorial privileges are abolished. All the offices of the Deutsch-Asiatische Bank have been sealed up, and foreign bankers, in conjunction with a Chinese official, have been instructed to liquidate its affairs.

German Methods in South Africa.—The August issue of "Production," the monthly report of the British Empire Producers' Organisation, contains an abstract of an address in which Mr. E. Saunders, of the S.A. Federated Chamber of Industries, explained the German "Circle System" which enabled the German engineering firm of Koppels to secure a grip of the mining and engineering trade of the Transvaal, and to continue trading freely even after the outbreak of war. Large groups of mines were worked on the "circle" system, almost all the orders for machinery going to Germany, and large portions of the surplus funds being invested in German, Hungarian, and Turkish securities before the war.

War Poetry.—We have received a copy of "Stand Down," a small book of poems written by Mr. Donald H. Lea, of the New Zealand Expeditionary Force; the author is the younger son of the late Mr. Henry Lea, the well-known consulting engineer, and we regret to add that owing to the ill-effects of being gassed in France, where he was serving in a Machine-Gun Section, he had to be invalided out of the N.Z. Force. In a brief "Foreword," Sir Thos. Mackenzie expresses the pleasure that the poems have given him, and we can cordially endorse the judgment of the High Commissioner for New Zealand. The poems all relate to incidents or aspects of the great war; a few are humorous, but most are pathetic, and some sublime. We defy any lover of children to read "First Aid" unmoved. The author is to be congratulated on his excellent work, and we trust that it will be continued.

Trade Cards and Exemptions.—At Southwark, Coun. Weaver drew attention to the decision of Mr. F. Mead, the magistrate at the South-West London Police Court, in dealing with a charge against an engineer of being a deserter, but who held a card under the protected trades schedule. Mr. Mead held that the card was *ultra vires*, as it was issued by a munitions area recruiting officer, to whom powers under the Military Service Acts could not legally be delegated. He maintained that the card was not an exemption, and was null and void, although the Military had given a promise to the holders of these cards that they should not be called up for military service. Coun. Weaver pointed out that it placed the men who held these trade cards in a very serious position, for by Mr. Mead's decision they held no legal exemption, and were liable to be called up for military service. If they did not join up they might be arrested and charged as being deserters. The Military Representative replied that Mr. Mead, who was the chairman of the Lewisham Tribunal, had always held that these cards were not exemptions under the Military Service Acts. In the case before the magistrate an error had been made by the military authorities, for when the man was arrested they were not aware that he held a card; but when they found that he did hold one, they did rightly in at once offering to withdraw the charge. Mr. Mead would not consent, and, ignoring the honourable undertaking the military authorities had given the holders of the cards, said, in effect: "I want to call public attention to the fact that these cards are not exemptions under the Acts." Everybody knew that; but the reason why this Tribunal, and many other Tribunals as well, withdrew their exemptions to holders of these cards was that it was undesirable for men to hold two exemption cards, one from a Tribunal and the other under the Protected Trades Schedule, for one might get lost, and be found and kept by another man not entitled to it. He thought the Tribunal had adopted the best course in withdrawing their exemptions to the holders of the cards, but granting them the right to apply to the Tribunal again for exemption should the cards be withdrawn. The Tribunal decided to continue to adopt this course.

Exemption Applications.—A singular application came before the Manchester Appeals Tribunal, when a man named Macintosh, aged 37, carrying on a dairyman's business in the day-time and acting as electric crane-driver and attendant-in-charge of a private electric light and power works in Salford at night time, appealed for exemption. Mr. E. C. Pearson, solicitor, who represented the man, said it was not claimed that he was a skilled electrician, but owing to the dearth of labour the firm had been obliged to put up with his services. If he were taken, however, they would have to replace him by a skilled electrician, as he was in possession of a red protected trade card for his last employment. His present wages were 43s. 6d., for 53½ hours a week. The appeal was dismissed, and the man was told he would have to rely on his trade protection card.

On the recommendation of the Advisory Committee, Rochdale Tribunal has granted conditional exemption to five motor-men appealed for by the Corporation Tramways Committee; and until December 31st to J. B. Chadwick (41, B2), coach-builder, also appealed for by the Tramway Committee. Other appeals by the department were for J. Crossley (36, Class A), electric wireman, and for four motor-men, three in Class A and the other in B1. Mr. Webster stated that he had lost

43 drivers out of 88, and was still 14 short. He was trying to obtain substitutes wherever he could. Crossley was given conditional exemption, and the others were put back to November 15th.

Oswestry Tribunal has given exemption until January 1st to E. Jobson (37, Class A), electrical engineer.

At Weymouth, the borough electrical engineer appealed for the retention of W. O. Sargeant (26, Class A), stoker at the refuse destructor works. He stated that the Committee had not appealed for any of the 32 men employed at the works, and 24 had gone into the Army. The Military Representative contended that the occupation was not a certified one. The Town Clerk said that they had approached the Military, but they could not give a substitute. In reply to a question, Mr. Bolam said that with war bonus the man's wages were £2 2s. per week. The appeal was refused as from September 30th.

The County Appeal Court has dismissed a Military appeal against exemption until September 13th granted to an electrical engineer (39, B 2), in business at Hove.

Chester-le-Street Tribunal has given conditional exemption, on his undertaking some additional work, to J. Paruley (40), electrician at the Empire Picture Hall.

At a sitting of the East Kent Appeal Court, on August 13th, the Isle of Thanet Traction & Lighting Co. appealed against the variation of certificates granted to three drivers, aged respectively 37, 40, and 39, whose conditional exemption had been altered to exemption until September 1st. It was stated that as a result of an interview with the War Office, the latter had undertaken to find substitutes for the men, but none had arrived. The appeal was allowed, and exemption granted on each of the men remaining in their present certified occupations, unless suitable substitutes are found for them in the meantime.

At Oxford, the Tramway Co. asked for exemption for F. L. Chatwin (34, general service), fitter, and M. F. Sadler (33, C 1), unit adjuster, and each was temporarily exempted for three months.

At Wigan, an electrician who appealed claimed that he was indispensable to a firm of munition workers and Government contractors, and that he came within the list of certified occupations, and he was exempted until November 1st.

An appeal was made to the Herts. County Tribunal by Mr. M. J. Connari (37), electrical engineer, of Watford; appeal dismissed.

At Maidstone, three months' extended exemption has been granted to C. Butler (33, passed for general service), coal carman at the Corporation electricity works; and six months to J. E. Watkin (25, B 2), electrician at the Palace Theatre.

The Surrey Appeal Court has respite until called up an appeal filed by T. Hill (37, B 1), electrical engineer, of Farnham, he having been relegated to the reserve.

Frome Tribunal has granted a month exemption to two employees, single and passed for general service, of the electricity works, pending an appeal to the Munition Area Recruiting Officer for temporary exemptions.

The West Lancashire Rural Tribunal has refused an application for exemption for an electrical engineer and tractor driver by Major Fermor-Hesketh, of Rufford Hall. It was admitted that four tenant farmers on the estate had received notice to quit.

BUSINESS NOTES.

Ferranti Transformers.—MESSRS. FERRANTI, LTD., have recently secured the following orders:—

Rotherham Corporation.—Four single-phase transformers, 2,085 K.V.A. each.
Manchester Corporation.—Annual contract for transformers, 250, 500 and 1,000 K.V.A. sizes.
Salford Corporation.—One three-phase 250 K.V.A. transformer.

Circulars and Catalogues.—Tradesmen's catalogues and price lists, and all classes of advertising circulars, with certain exceptions, may be issued and dispatched from now up to January 31st, 1918, to the extent of one-third of the weight of paper used for the catalogues and price lists and advertising circulars issued by tradesmen between August 1st, 1916, and January 31st, 1917. For the purpose of this licence the expression "advertising circulars" includes any advertising sheet or periodical in the form of a newspaper or magazine, whether registered as a newspaper or not, which is distributed gratuitously, and of which advertising is the main, and not merely an ancillary purpose; diaries, almanacs, and calendars issued gratuitously, and containing advertising matter; but does not include circulars requesting the verification of information for books of reference. The expression "paper" includes cardboard or other similar material, or any substitute for paper.

Bankruptcy Proceedings.—C. B. OGILVIE, Whalley Range, Manchester, electrical engineer.—First and final dividend of 2s. 2½d. in the £, payable August 27th, by the Official Receiver.

Trade Announcement.—BRITISH ELECTRICAL FEDERATION.—The temporary address of the Federation and its constituent companies as from the 20th inst. is Manchester Hotel, Aldersgate Street, E.C. 1.

Sale.—Oldham Corporation has for sale two 740-KW. sets. See our advertisement pages.

Fire.—Early reports of the fire which took place at the works of the India-Rubber Co., Silvertown, on the 11th inst. appear to have been greatly exaggerated. Comparatively little damage was caused, and there was practically no disturbance to the manufacturing operations in the building involved.

Catalogues and Lists.—THE LONDON TELEPHONE (NEW SYSTEM) CO., LTD., Donington House, Norfolk Street, W.C. 2. Folder relating to the "New System" intercommunication telephone service.

MESSRS. JOHN MACLENNAN & CO., 90, Newgate Street, E.C. 1. Card drawing attention to electrical insulating tapes and tubular sleeving, cotton, linen, and silk tapes, &c. Scales of centimetres and inches are printed on the edges of the card.

MR. GEORGE ELLISON, Wellhead Lane, Perry Barr, Birmingham. Lists Nos. 151 and 304, the former describing the "Industrial Unit Type" switchgear, which is of the totally enclosed ironclad pattern for workshops and mines, each panel being a self-contained unit adapted for assembly with similar units to form a switch-board, and the latter relating to quick make-and-break switches operated by a tappet on a crane, hoist, or similar machinery, or by hand, with positive mechanism.

Book Notices.—British Westinghouse Motors and Generators in Industrial Service. This brochure (Instruction Book No. 5,010/1) deals with the installation, operation, care, and repair of the B.W. motors and generators; but it will be of interest and value to erectors and users of all such machines. It contains concise and simple directions relating to the subject-matter, including allied considerations, such as lubrication, belts, starters, the causes of sparking, &c., and if carefully studied by attendants should be largely instrumental in prolonging the life and maintaining the efficiency of the machines concerned. It is issued by the British Westinghouse Electric and Manufacturing Co., Ltd., Trafford Park, Manchester.

Messrs. Fawcett & Co., of 125, Strand, London, W.C. 2, announce the preparation of a history of British commercial houses which have been established over 100 years, under the title "Historic Firms of Great Britain and Ireland." They will be greatly obliged if firms coming under the scope of the publication will communicate with them.

Liquidation.—ANGLO-COLONIAL ENGINEERING CO., LTD. —General meeting to be held on September 29th to hear an account of the winding-up from the liquidator, Mr. G. E. Corfield.

LIGHTING AND POWER NOTES.

Australia.—The newly-incorporated Borough of Sandringham (Vic.) has already decided to install electricity for lighting and power purposes. At the last meeting of the Council the Mayor reported that he had interviewed the Melbourne Electric Supply Co. and suggested that it should extend its mains or supply the Council with electricity in bulk. The company stated that it was prepared to extend the mains to the Black Rock railway terminus, where a transformer station would have to be erected to permit of the neighbourhood being served, but at present the company was faced with a shortage of cable, &c. With regard to the extension to Beaumaris, it would not be possible to undertake that work until after the war; in addition, it would be necessary to obtain permission to supply that district, for which it was about to apply. It was decided that the matter should be deferred for further consideration. *Tenders.*

The Melbourne Harbour Trust proposes installing mechanical coal-handling plant capable of dealing with 400 tons of coal per hour; the present rate per hour of handling by man power is 60 tons. Tenders are to be invited for both steam and electrically-operated appliances (those electrically-operated being preferred), of which not less than two, or more than four, are to be employed to obtain the total output.

Mr. T. Murray, the engineer to the Victorian State Rivers and Water Supply Commission, is to furnish a report on the proposal of the Yea and Mansfield Dairy Co. to supply electric power for pumping water to the township of Yea. *Tenders.*

Canada.—The report of the Toronto hydro-electric system for the year ended December 31st shows a gross income of \$1,706,177, and after deducting working expenses, a gross surplus of \$634,042; interest, depreciation, and sinking fund charges absorbed \$615,646, leaving a net surplus of \$18,396. The report states that the gross income is 53 per cent. in advance of that for 1915. Mr. H. H. Cousins, the general manager, states that the total kw.-hours sold in 1916 were greater than in 1915 by approximately 27 per cent.; the total revenue shows an increase of 6 per cent., in spite of rate reductions; the total number of private consumers is 43,160, with a connected load of 70,500 KW.; the capital expenditure amounts to \$6,300,000; the sustained 20-minute peak load on December 4th, 1916, was 47,165 H.P.; the average revenue per kw.-hour for the whole system was 1.2 cents in 1916, as compared with 1.41 in 1915; the total number of kw.-hours sold was 139,000,000 in 1916, as compared with 109,000,000 in 1915 and 83,000,000 in 1914. Notwithstanding these heavy increases, the total cost of operation and maintenance has decreased from \$550,000 in 1914 to \$548,000 in 1915 and to \$543,000 last year. An item of interest, as indicating the extent to which the customers of the Toronto hydro-electric system are utilising electrical

appliances of various kinds, is that, excluding lamps, 18,500 articles were sold from the hydro-electric showrooms, an increase of more than 30 per cent. over the previous year. The balance-sheet now shows total assets for the Toronto hydro-electric system of \$8,882,171, made up roughly as follows:—Fixed assets, \$7,501,186; stores in hand, \$125,259; accounts recoverable, \$241,461; capital funds in hands of city treasurer and cash in bank, \$710,141. The report states that the necessary amounts have been set aside for interest, depreciation, and sinking funds, in accordance with the regular policy of the Commissioners.—*Canadian Electrical News*.

Continental.—SPAIN.—A concession has lately been granted for the establishment of a plant to utilise the water power of the River Mijares near Montargis (Province of Castellon) in the generation of electrical energy for power purposes.

Dundee.—The Electricity Committee has refused a request for compensation by the Yorkshire Henebique Co. in respect of a contract entered into in May, 1915, in regard to which it was contended that a serious loss was incurred through the increased cost of labour and materials.

Finchley.—PROPOSED EXTENSION.—At the last meeting of the U.D.C. it was announced that an increase of plant was necessary to the electricity undertaking, at a cost of £14,000. Permission to proceed with the proposed scheme had been refused, and a new one was being prepared.

Great Harwood.—PROVISIONAL ORDER.—The B. of T. has agreed to the request of the U.D.C. for an extension of the Electric Lighting Order, the date now fixed being August 7th, 1918.

Halifax.—WAGES.—The Committee on Production has made an award of a 9s. per week advance on pre-war rates of pay for the semi-skilled employees of the Corporation—to the number of about 500. The men demanded 12s.; the Corporation offered 8s.

London.—MARYLEBONE.—The annual statement of accounts of the B.C.'s electricity undertaking for the year ended March 31st last, shows a gross revenue from sales of electricity amounting to £185,465, as compared with £174,753 in the previous year, being an increase of 6.13 per cent. The average price decreased by .09d. per cent. from 2.74d. to 2.65d. per unit. The total revenue amounted to £214,170, while working, management and establishment expenses accounted for £105,790, leaving £121,444 to be carried to net revenue account, which, with bank interest, totalled £121,716. Interest charges and loan instalments absorbed £114,753, and the net profit on the year's working was £6,963. During the year the final instalment of one of the short period loans was paid off, relieving this year's account of £4,740, and the ensuing and subsequent years of £5,358 per annum; another loan will be fully liquidated during the present year, which will further reduce the loan service charges by £850. The revenue, surplus and appropriation account at March, 1916, showed a balance of £13,917, which, with this year's net profit added, made a total credit of £20,880; of this £2,936 has been expended on new meters, mains, services, &c., other improvements accounted for £1,761, and after providing for depreciation of fittings on hire, there is a surplus carried forward of £14,582. During the year 17,617,146 units were sold, as compared with 16,069,870 in the previous year; the total works cost per unit sold being 1.216d., and the total all-in costs 2.773d.; the total average price obtained was 3.009d. The maximum load was 9,737 K.W., and the load factor 20.7 per cent.

London Electricity Supply Conference.—At a conference recently held between the L.C.C. Special Committee on London Electric Supply and representatives of the City Corporation, Metropolitan Borough Councils, and the London Electric Supply Companies, upon the question of the electricity supply in London, the following resolutions were passed:—1. That, in the opinion of this Conference it is desirable that, before formulating a scheme for the electricity supply of London, the L.C.C. should consult the Metropolitan Borough Councils owning electric undertakings, the Metropolitan Borough Councils not owning electric undertakings, the City Corporation, and the London Electric Supply Companies. 2. That, in the opinion of the Conference, it is desirable that Metropolitan Borough Councils owning electricity undertakings, Metropolitan Borough Councils not owning electricity undertakings, and the various companies should appoint a Committee, or Committees, to confer with the Electricity Committee of the County Council.

Llandudno.—The Urban Council has decided to engage Mr. W. H. Patchell to report on the Council's electricity undertaking in relation to the supply of energy to the Light Railway Co. and on the economical working and the undertaking generally.

Mytholmroyd (Yorkshire).—Some time ago the D.C. declined to agree to an intended application by the Electrical Distribution of Yorkshire, Ltd., for a prov. order, and has since arranged with the Halifax Corporation to provide electricity. The Council, at its recent meeting, received a letter from the Power Co., stating that the Halifax Corporation had applied to it for a supply of electricity for Mytholmroyd consumers, and that the company had agreed to provide it; but for the war, it was added, the main would by now have been extended to Mytholmroyd.

Radcliffe.—YEAR'S WORKING.—The engineer's report shows that for the year ended March last the electricity undertaking had a total income of £12,793, an increase of £2,516 on the previous year, while the gross profit was £1,292, after providing £373 for meters and war allowances; deducting interest and sinking fund charges, the net surplus was £251, as against a deficit

of £176 in the previous year. Some 2,150,000 units were sold, as against 1,764,000 in the previous year; the department generated 1,056,000 units, and purchased 1,533,000 units in bulk from the Bury Corporation, the joint coal and bulk supply costs being .467d. per unit sold. During the year a three-phase supply for textile driving has been inaugurated.

South Africa.—The Cape Town T.C. has made arrangements with the Cape Town Tramways Co. for a temporary supply of 200 to 300 K.W., to be taken at the Council's convenience, so long as it does not interfere with the tramway service, the Council to carry out all necessary work at the power station, and to provide suitable meters.

The Paarl (Cape Province) hydro-electric lighting installation was recently opened; the lights were switched on by the Mayoress, this being the signal for the firing of a seven-gun salute.

Warrington.—YEAR'S WORKING.—The accounts of the electricity undertaking show that the income during the past year amounted to £41,203 and the expenditure to £28,577, leaving a gross profit of £12,626. Loan charges and bank interest, less interest received, absorb £8,455, leaving a net profit of £4,171, as against £2,395 in the previous year.

TRAMWAY AND RAILWAY NOTES.

Belfast.—With reference to the views expressed by our correspondent in this column in our issue of the 10th inst., we gather from Mr. J. S. D. Moffet, general manager of the Corporation Tramways, that these are not in agreement with the facts, as regards fare revisions and extensions of the system. He states that the new fare scheme put into operation in May last has given an additional revenue of £8,000—a much bigger increase than was expected—and that its success is admitted. As regards the extensions, no new ones have been opened since 1912, so that they cannot be called recent. It is also untrue to say that certain routes are being run at a dead loss to the ratepayers, the difficulty being how to increase the services and so remove the grievance of overcrowding. Mr. Moffet further urges that, in any case, tramway facilities cannot be confined within artificial boundaries, in which we fully agree with him.

According to the *Belfast News-Letter*, Mr. Moffet recently reported on the working of the tramways during the four months ended July 1st, from which it appeared that the total revenue was £108,204, as compared with £100,287 for the corresponding months last year. Due to additional expenditure, and after allowing for fixed charges, there was, however, a deficit of £1,981 for the period mentioned.

Bolton.—WAGES.—The Tramways Committee has received an application from the Lancashire District Council of Tramway Workers for an advance of 7s. 6d. per week for all the members 18 years of age and over, including motormen, conductors, inspectors, and general staff. The Committee resolved that the application be not acceded to, but that the matter be referred to the Committee on Production for decision, and also that various other matters raised by the Association at an interview with representatives of tramway authorities on August 2nd, relative to the method of paying war bonus and payment of bonus for overtime should be embodied in such reference, with a view to the decision of the Committee on Production being obtained thereon.

Brighton and Hove.—The B. of T. has granted an extension of time for the completion of the overhead equipment of the Brighton, Hove and District railless traction system, for one year from August 7th, 1917.

Dover.—ACCIDENT.—A crowded Corporation car descending Crabble Hill, on Sunday, got out of control, and finally collided with a wall and overturned, 10 people being killed and 35 injured. The driver jumped clear as the collision occurred, and escaped with minor injuries; the conductress was killed.

Dunfermline.—Following upon the appointment of Sir Eric Geddes as First Lord of the Admiralty, the construction of the tramway line between Dunfermline and Rosyth will be begun in the immediate future.

Edinburgh.—INCREASED FARES.—The Edinburgh and District Tramway Co. has decided to raise the fares. The company, it is stated, has been compelled to take this step in view of the refusal of the Corporation to reduce the rent. In a statement regarding the increased expenditure, Mr. J. R. D. Cox, general manager of the company, says it is highly probable that the cost of materials will further increase. In fact, the cable makers have already advised a further increase of £12 a ton, making a total increase in price since 1914 in this important item of 73 per cent.

Halifax.—HOLIDAY TRAFFIC.—The Corporation tramways experienced a time of great prosperity during the local "Wakes" week, which is the week following Bank Holiday week. The receipts during the four days, Saturday to Tuesday, were £2,341, as compared with £1,910 during the same period last year.

Huddersfield.—FREE RIDES.—The T.C., last week, agreed that members of the local Volunteer Force be permitted to travel on the cars at half fares when in uniform. An amendment that the recommendation be referred back was defeated. It was mentioned that 11,000 wounded and other soldiers travel free weekly on the local tramways.

Rochdale.—The Tramways Committee has decided to renew the overhead equipment between Heybrook and Little-borough.

Swinton.—At a meeting of the D.C., last week, it was announced that the South Lancashire Tramways Co. had refused to reopen the question of tramway service in the Swinton district. It was understood that it was going to revise the whole of the stages, but would not consider the question of transfer tickets at Swinton.

U.S.A.—The New York, New Haven, and Hartford Railway intends to reduce its schedule by 199 passenger trains a week, in compliance with national defence plans, and with a view to movements of troops and supplies. The Boston Elevated Railway has inaugurated a tank-car haulage system for transporting molasses during off-peak hours. A maximum of 12 tank cars have been filled, hauled, and emptied in one night, the distance being two miles, and the charge being equivalent to 18 cent per gallon as against 3 cent for team haulage when 13 trucks were employed.—*Electric Railway Journal*.

The four Chicago traction Bills, which would have enabled an extensive reorganisation of the city's transportation system to take place, have been shelved by the State Legislature until its next meeting, which may not be for two years.

West Riding Holidays.—A Yorkshire correspondent states that the high railway fares and the spread of tramways all over the West Riding of Yorkshire and Lancashire have resulted in large numbers of people from the West Riding cities and towns adopting, this summer, the comparatively new method of reaching Blackpool and other Lancashire holiday resorts by tramway. There are various routes from different industrial centres, but they mostly converge when over the border, and utilise the Preston tramway system as the final "jumping off" place in getting clear of industrial environment. Practically all the routes involve an occasional walk between the termini of different towns' systems, but, despite the repeated changing and transference of luggage by hand and the length of the journey, an increasing proportion of workers are realising the huge saving which can be effected in travelling costs. Many people from Bradford and Halifax, during the general holiday period last week, were grievously inconvenienced in utilising the Keighley way over the county border, by finding that the Keighley railless service from the tramway terminus did not commence until nearly mid-day.

TELEGRAPH AND TELEPHONE NOTES.

Federated Malay States.—During the past year 410,641 telegrams were dispatched and 451,417 received for delivery, an increase of 138,014. There are 2,210 miles of telegraph and telephone line in the country and 10,461 miles of overhead wire, of which 7,914 miles are telephone wires. In addition, there are 26½ miles of underground telephone cables, containing 2,413 miles of wire, single line.

Mexico.—After a lapse of several years, telegraphic communication has been re-established between Mexico City, Mexico, and the State of Yucatan.—*T. and T. Age*.

Secret Wireless Station.—Men of the Argentine Navy have discovered, on the coast of Chubut, Patagonia, a secret wireless installation. The authorities have seized the plant. It is thought that the station was used to communicate with suspect vessels in the South Atlantic.—*Birmingham Daily Post*.

United States.—The Government is making such heavy demands for telegraphists all over the country that the situation is assuming a serious aspect. The telegraph and telephone companies are experiencing very large increases of business, and it is with difficulty that they can keep up their own supply of working forces, let alone meeting the requirements of the Government. Approximately 6,000 telegraphists will be taken to secure the required strength of the Signal Corps department of the first military unit of 500,000 men: each succeeding unit of the same size will require 4,000 more.—*T. and T. Age*.

U.S. Telephones.—During the year 1916 the daily average of telephone calls in New York City was about 29,420,000. The Bell Telephone system in the United States on May 31st owned 20,870,194 miles of wire, compared with 18,905,218 at the same time in the year 1916, and 10,256,068 connected stations, compared with 9,463,800.—*T. and T. Age*.

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—MELBOURNE.—October 10th. Department of the Navy. Pumping plant and equipment for the Commonwealth Naval Dockyard, Cockatoo Island, Sydney. Specifications from the Director of Navy Contracts, Melbourne.

Kettering.—August 28th. Electricity Department. Supplying and laying 751 yards of lead-covered cable, with three-core pilot; feeder pillar, dividing boxes, switchboard instruments and stoneware troughing. See "Official Notices" August 17th.

London.—BERMONDSEY.—Sept. 7th. B.C. 500-KW. rotary converter. See "Official Notices" August 3rd.

New Zealand.—The Public Service Stores Tender Board, Wellington, N.Z., invites tenders up to 4 p.m. on September 5th, for the supply and delivery of (1) 30,000 dry cells for telephones; (2) 3,000 cords, 4 conductor; and 2,000 diaphragms for watch receivers; (3) 15,000 swan-neck insulator bolts and 20,000 cups to fit these bolts; and (4) 3,135,000 envelopes of various kinds. The conditions of tender, &c., may be consulted by British manufacturers at the Department of Commercial Intelligence, 73, Basinghall Street, London, E.C. 2.—*Board of Trade Journal*.

Portsmouth.—August 28th. Tramways Committee. Six months' supply of engine-room stores, insulating material, &c. See "Official Notices" August 10th.

Rathmines.—August 29th. U.D.C. 500 tons of coal for the electricity works. Particulars from the Electricity Department.

Spain.—The municipal authorities of Cáceres have just invited tenders for the concession for the electric lighting of the town. Tenders have also lately been invited for the concession for the electric lighting of the town of Ferrol (Province of Coruna) during a period of 15 years.

The Spanish Post and Telegraph authorities in Madrid have just invited tenders for the supply of about 12 km. of telephone cable.

CLOSED.

Glasgow.—The Tramways Committee recommends acceptance of the following offers:—

Special trackwork.—Haddfields, Ltd.
Traction lamps.—Edison Swan Electric Co.; General Electric Co.
Steel pinions.—A. Wiseman, Ltd.
Gear-cases.—Equipment & Engineering Co.

The following tenders for plant at Dalmarnock generating station were recommended for acceptance by the Electricity Committee:—

Fraser & Chalmers.—One 500-kw. turbo-alternator, £6,180.
British Westinghouse Co.—One 500-kw. turbo-alternator, £6,300.

For static transformers for sub-stations:—
British Electric Transformer Co.—16 transformers, £1,932 each.
Ferranti, Ltd.—16 transformers, £1,924 each.

Government Contracts.—List of new contracts placed during July, 1917:—

WAR OFFICE.

Electric bells.—W. Maxwell & Co., Ltd.; J. Sax & Co., Ltd.
Practice buzzers.—Edison Swan Electric Co., Ltd.
Generating sets.—Aster Engineering Co. (1913), Ltd.; O. Stott, Ltd.
Terminals.—Ingram & Kempe, Ltd.
Copper wire.—B.I. & Helsby Cables, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co., Ltd.
Works services.—Installation of electric power: Edmundson's Electricity Corporation.

POST OFFICE.

Protective apparatus.—L. M. Ericsson Manufacturing Co., Ltd.
Telegraph apparatus.—I.R., G.P. & Telegraph Works Co., Ltd.
Telephone apparatus.—British L. M. Ericsson Mfg. Co., Ltd.; Gent & Co., Ltd.; Peel-Conner Telephone Works, Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
Telegraph cable.—Craigpark Electric Cable Co., Ltd.; Fuller's Wire and Cable Co., Ltd.; General Electric Co., Ltd.; Johnson & Phillips, Ltd.; New Gutta-Percha Co., Ltd.; Union Cable Co., Ltd.; Western Electric Co., Ltd.
Telephone cords.—B.I. & Helsby Cables, Ltd.
Insulators.—Bullers, Ltd.
Jointing sleeves.—C. M. Powell Bros.
Solder.—B.I. & Helsby Cables, Ltd.
Insulator spindles.—Bullers, Ltd.; Guest, Keen & Nettlefolds, Ltd.; C. Richards & Sons.
Bronze insulated wire.—B.I. & Helsby Cables, Ltd.

Leigh (Lancs.).—Tramways and Electricity Committee. Accepted tenders:—

Wigan Coal & Iron Co., Ltd.—2,500 tons fine slack (Priestner's), at 11s. 6d. per ton; 1,200 tons rough slack, at 15s. 6d. per ton; and coke dust, at 6s. per ton, delivered.
Astley & Tyldesley Collieries, Ltd.—Engine fuel, at 15s. 9d. per ton, delivered.

NOTES.

The Channel Tunnel.—In the House of Commons, last week, Mr. Fell asked the Prime Minister if he could now say if the Government was in favour of the construction of the Channel Tunnel, and would support the Bill when introduced to give the necessary powers. Mr. Bonar Law replied:—The Cabinet have again carefully considered the question in consultation with their naval and military advisers, and they are still of the opinion that it is not practicable to proceed further with the matter during the continuance of the war. In these circumstances, it would not be possible for the Government to support a Bill of the nature indicated in my hon. friend's question.

Educational.—SOUTH-WESTERN POLYTECHNIC, CHELSEA, S.W. 3.—The college will re-open on September 24th, for day and evening classes. Students are prepared for the London University B.Sc. degree in engineering, for the examinations of the engineering institutions, and those of the City and Guilds of London Institute. The evening courses also include classes in aeronautics and electrical installation work. In the electrical installation department, an advanced course has been arranged for the preparation of candidates for the final examination of the City and Guilds of London Institute. Arrangements have been made for placing students who have passed satisfactorily through the three years' day course in positions with large engineering firms, and hitherto such firms have offered more vacancies than the Institute has been able to fill with its students. Further particulars can be obtained on application to the secretary.

ROYAL TECHNICAL COLLEGE, GLASGOW.—Particulars of the diploma and degree courses in Engineering, &c., for the new session (which begins on September 25th) are advertised in this issue.

UNIVERSITY OF LONDON.—At a recent meeting, the Senate approved a memorandum, which has been forwarded to the Treasury, the Board of Education, the Civil Service Commission, the Government Committee on Science, and the Royal Society. It sets forth, in the first place, that education till the age of 16 should be general and not specialised, and should embrace not only literary, but also scientific studies. In the second place, it is laid down that natural science—including physics and chemistry—should be compulsory in all secondary schools.

In addition to the ordinary secondary schools, the Senate also desires that special technical day schools in accordance with local needs should be established in all industrial centres for boys and girls between 13 and 16 years of age who wish to enter technical industries at the age of 16. These schools would apparently form an exception to the general principle laid down, that education under the age of 16 should not be specialised.

The Senate in its memorandum next states that, in order to secure for science teaching the position to which it is entitled and which for the benefit of the nation it ought to occupy, the schemes under which the great public schools are administered should in each case contain provisions to the effect that:—(a) The governing body shall include a substantial number of representatives of the learned and scientific societies; and (b) that members of the governing body shall not hold office for life.

Without such provisions it is probable that men distinguished by mathematical and scientific attainments will continue to be at a disadvantage in applying for appointment to headmasterships of public schools. Greek should not be a compulsory subject for entrance scholarships to these schools, and adequate facilities, including equipment, for learning science should be available for, and accessible to, all their pupils.

Almost all the headmasterships of the great public schools are held by those who have taken classical degrees, and consequently in the schools in question science is relegated to an inferior position. In the few cases where a mathematician or scientist is headmaster, and science is well taught, the schools are so full that it is almost impossible for boys at the present time to gain admission.

Specialised first degrees in science at a university are deprecated in the memorandum. It is held that a student should first obtain a general degree in science, and then specialise in some branch of science or in the application of science to industry. This is probably the ideal training, but the question of time is of importance, and it may be found in practice that few, without valuable scholarships, can undertake such a lengthened course of study.

The Civil Service examinations are next considered, and the Senate suggests that the present arrangement for the selection of first division clerks in the Civil Service should be modified so that on every occasion an adequate proportion of those appointed must have had mathematical or scientific training. In all selections for the higher administrative posts for the Government Departments, the work of which is of a scientific or technical character, the official selected ought to have received such a scientific training as will fit him to understand the character of the work for the organisation of which he will be responsible.—*Daily Telegraph*.

Books for British Prisoners of War.—Excellent work is being done in the way of enabling British prisoners of war usefully to employ their time during internment by Mr. A. T. Davies, C.B., of the Board of Education, chairman of the British Prisoners of War Book Scheme, the war charity which provides British prisoners interned in enemy or neutral countries with books for study purposes. Through the instrumentality of the organisers of the book scheme arrangements have been made, and in some cases have been in operation for a considerable time, whereby examinations have been held at a foreign camp, of those students who have been desirous of taking their examinations notwithstanding their internment. Increasing use, too, is being made by the prisoners of the "Form of Record" prepared by the Committee of the Book Scheme, which enables the regular studies in any subject of a "Student Captive" to be duly recorded and certified with a view to the record assisting him on his return from captivity at the close of the war. Contributions in aid of the scheme are urgently needed. In the technical and scientific sections the prisoners' demand for books is very large, but the works asked for are rarely obtainable as gifts, as the owners generally need them for their own use, while second-hand copies, sufficiently up to date, are proving increasingly difficult to procure. In these circumstances, the Committee is compelled to make large purchases of

new copies of up-to-date books of the above character, and, for this, ample funds are essential. Offers of books (which should always be accompanied by a detailed list) are also invited, and should be addressed to Mr. A. T. Davies, C.B., "Prisoners of War," Board of Education, Victoria and Albert Museum, South Kensington, S.W. 7.

Volunteer Notes.—COUNTY OF LONDON VOLUNTEER ENGINEERS (FIELD COMPANIES).—Headquarters, Balderton Street, Oxford Street, W. 1.

Orders for the week, by Lieut.-Colonel C. B. Clay, V.D., commanding:—
Office for the Week.—Platoon Commander C. Campbell.

Monday, August 27th.—Technical instruction (searchlight) for No. 3 Company, Right Half Company, at Regency Street, Drill, No. 3 Company, Left Half Company. Signalling Class. Recruits' Drill, 6.30.

Tuesday, August 28th.—Lecture, 6.30. Physical drill and bayonet fighting, 7.30.

Wednesday, August 29th.—Drill and elementary bridge construction for No. 1 Company, Right Half Company.

Thursday, August 30th.—Drill and elementary bridge construction for No. 2 Company, Right Half Company. Ambulance Class.

Friday, August 31st.—Technical instruction (searchlight) for No. 3 Company, Left Half Company, at Regency Street. Drill, No. 3 Company, Right Half Company. Signalling Class. Recruits' Drill, 6.30.

Musketry.—All N.C.O.'s and men who have signed the "A" and "B" agreements are required to attend during this month to reclassify in order to enable the corps to obtain the capitation grant. Preference will be given to those men in firing.

(By order) MACLEON YEARSLY.

TYNESIDE VOLUNTEERS.—A joint meeting of the electrical section of the Newcastle-upon-Tyne and Gateshead Chamber of Commerce and the Local Section of the Institution of Electrical Engineers was held on the 14th inst., at Newcastle, Mr. H. W. Clothier presiding. It was in relation to the raising of certain specialist units for the Durham and Northumberland County Volunteer Regiments. The units required were signal companies and electric light companies for what will become the County Engineer Corps. The suggestion was to raise two electric light companies south of the Tyne, one north of the Tyne, and one in the Hartlepool area of Durham; and one similar company at Newcastle, one at Tynemouth, one at Blyth, in Northumberland. It was proposed to form one signal company for Durham, with six sections centred at, respectively, Gateshead, South Shields, Sunderland, Hartlepool, Stockton, and Darlington. The sections of the Northumberland Company would be located two at Newcastle, one at North Shields, one at Blyth, and one at Morpeth. The establishment of an electric company was put at £7, and of a signal company headquarters section 38, and of other sections at 24.

The Chairman said the whole industry was alive to the necessity of moving with the times, and it was most essential for the individual members themselves to take an active part in such movements. He said they were being approached in various matters, and instanced the action of the Electrical Section of the Chamber of Commerce with respect to the giving of evidence before the Board of Trade Electrical Committee on the development of power stations. The matter before them that night was one which concerned them individually.

Col. W. C. Blackett, County Commandant, Durham Volunteer Regiment, said there was real need for the appeal they were making to raise those units for the Volunteer Regiments, to have them ready for any emergency that might arise. They had twelve battalions of infantry, and engineering corps (in which the signalling and electric light corps would be included), artillery, transport and medical corps were being raised. They had hopes of raising two companies of the electric light corps at Hartlepool, and wanted two at Tyneside. As to the signalling companies they had three movements under way which they hoped would bear fruit.

Captain Barnes laid stress upon the urgency of the matter, and gave details as to the formations, emphasising the importance of the signalling companies, upon which matter Capt. Worsley also spoke. The latter stated that a very important part of the work of the signalling company was to deal with field telephones, and there would be also motor cycle sections.

The Chairman moved: That this meeting representing the electrical industry of Tyneside give the appeal their heartiest support. Mr. Lunn seconded and the motion was carried.

As the outcome of the above meeting, the following preliminary arrangements have been made for the Durham area:—Mr. H. W. Clothier, of Messrs. A. Reyrolle & Co., Hebburn-on-Tyne, will confer with Mr. Pyne, of Palmer's, Hebburn, with a view to raising an electric light company for that district. From Hartlepool Engine Works, under the direction of Mr. D. B. Morison, two electric light companies will be formed, and the names of 150 men have been sent to the County Territorial Association. There are also 21 men for the signalling section awaiting word from headquarters to commence training. In connection with the Horden Coal Co., South Shields, a signalling section is proposed, Mr. H. S. Ellis, borough electrician, acting as organiser. At Sunderland, Mr. Windle proposes to co-operate with local firms with a view to raising a signalling section. At Stockton-on-Tees, Lieut. J. Riley is to co-operate with Messrs. Riley Bros. in raising a signalling section. In regard to the county of Northumberland, it is stated that the Newcastle Electric Supply Co. are raising a special unit amongst their men in connection with their own plant. This unit would engage principally those in the operating department, and other members of the staff may be available to co-operate with consulting engineers with a view to raising a signal section in Newcastle. Members have already signed on for different units.

Any gentleman or firm, who was not able to be present at the meeting and who is interested in the movement, is asked to communicate with Mr. Herbert Shaw, Secretary, Newcastle Chamber of Commerce.

National Insurance (Unemployment) Acts, Unemployment Insurance.

The Umpire has decided that contributions are payable in respect of:—

2,372 X. A steam-hammer forger engaged in making copper refining ladle plates and rabble heads and light forgings for use in copper, spelter, and steel works.

2,375 X. Workmen engaged in screwing tubes.

2,377 X. Workmen engaged wholly or mainly in making metal laths.

2,378 X. Workmen engaged in corrugating and curving galvanised metal sheets.

2,380 X. Workmen engaged wholly or mainly in the manufacture of accumulator cell boxes or of lead linings for such boxes.

2,381 X. Workmen engaged in making wrought or welded iron pipes for use as telegraph poles.

2,383 X. Workmen engaged wholly or mainly in making and fitting together wrought-iron parts of small forges for heating rivets.

The Umpire has decided that contributions are not payable in respect of:—

2,369. Switchboard attendants and workmen engaged wholly or mainly in minding, tending, or driving electrical machinery in connection with uninsured trades.

2,373. Joiners engaged wholly or mainly in making by hand wooden drums for electric cables.

2,384. Workmen engaged wholly or mainly in making vulcanised fibre parts of electric light fittings which are not intended for use in war.

Tribute to Samuel Insull.—Officers and directors of the Commonwealth Edison Co. celebrated the twenty-fifth anniversary of Samuel Insull's presidency of the company and its predecessors by giving an "Edison Family Birthday Party," on June 25th.

In an address acknowledging the tributes, Mr. Insull reviewed the gigantic growth of the company and its predecessors, as well as of the other corporations composing what is commonly called "the Insull group." These companies have an aggregate capital of \$445,000,000, and the gross annual turnover is \$75,000,000. On the average, this shows that the companies turn over their capital about once in six years. The companies pay a little less than \$5,000,000 in taxes, and serve 1,500,000 customers living within an area of between 58,000 and 60,000 square miles. They have between 20,000 and 25,000 employes.—*Electrical World*.

Commercial Intelligence Service.—Lord Robert Cecil and Sir Albert Stanley are submitting to the Commercial Committee of the House of Commons a new scheme for a Commercial Intelligence Service. The suggested arrangements have been approved by the Cabinet. An emergency meeting of the Committee has been convened to consider the scheme.—*The Times*.

Inland Water Traffic.—The Canal Control Committee has issued a letter directing the attention of manufacturers, merchants, and others to the desirability of using the inland waterways of the country for the conveyance of goods of all kinds. The letter points out that the principal object for which the Canal Control Committee has been appointed is to relieve the traffic on the railways by increasing the amount carried on canals.

Since the beginning of the war, both the canal companies and the carriers on the canals have lost a considerable number of their employes, but the Committee is taking steps to provide crews for as large a number of boats as possible, and it is hoped that a greater number of boats capable of carrying traffic will be available at an early date.

The A.E.S.E. and Central Station Staffs.—As we go to press we have received the following letter:—

"Staff," that magic word, I notice has occurred with remarkable frequency of late in various articles and correspondence anent electrical station engineers appearing in the REVIEW.

The "staffs" of electrical stations are apparently realising that they have had no say in the scheme of things, where those employed in stations not on the staff have had a great deal to say through their organisations, and have influenced to some extent Acts of Parliament, war bonuses, &c.

The liberty of action of the staffs has been curtailed by Acts of Parliament and Regulations agreed to by organisations of employes not on the staff.

Staff engineers of this country must rouse themselves: they must strengthen existing staff organisations, and must be prepared to subscribe to these organisations an amount yearly at least equal to that subscribed by a member of a skilled Trade Union. They can then, at least, be on an equal footing with employes not on the staff with regard to influencing regulations concerning their employment.

The Government does not deal with individuals: it now invites representatives from various organisations when some new regulation with regard to any industry is proposed.

It is certain that the time will shortly arrive when vast new regulations will be made to regulate the transition from munitions of war manufacture to reconstruction and ordinary peace industries.

Only those men who are organised will have any say in the matter. Fitters, wiremen, and labourers are organised, and have been consulted on various matters appertaining to their employment. The staff engineers must organise, if only to preserve their position.

Will they take the opportunity before it is too late?

W. J. EBBEN, Hon. Secretary A.E.S.E.

26, Little Park Gardens, Enfield.

August 20th, 1917.

Fatalities.—A collision between a taxicab and a motor-wagon at Aspley, Huddersfield, on Thursday last, resulted in injuries to Lance-Corporal Edward William Chinn, of the Royal Engineers—formerly a driver on the Huddersfield tramways—from which he died later in the day at the infirmary. Verdict, "Accidental death."

Arthur Suthers, aged 28, an electrician employed by the Cleveland Bridge and Engineering Co., at Darlington, was working on a platform of a travelling crane, on Saturday, when he was knocked off accidentally and fell 30 ft. to the ground, receiving fatal injuries.

Leaving Certificate Case.—At Oldham Munitions Court, an electrician employed at a local electrical engineering establishment applied for a leaving certificate. He said he was asked to do "navy's work" to get through a 2-ft. wall, in order to wire a private office, and he was not going to do it. He received 17s. 5d. for a 49½-hour week, which, he said, was not the standard rate. He was not on war work, though he had been previously, and he had been offered a post at Sheffield. The representative of the firm said they were not on munitions, and so could not grant a leaving certificate. The President said the Court had no sympathy with the plaintiff, and, in granting the certificate, they wished to remind him to be careful, or he might have to prefer the trenches.

Textile Research.—In their annual report, the Tootal Broadhurst Lee Co. announced that "assured of the importance of research and education in the struggle for the world's trade, the directors have decided to set aside £10,000 for five years for this purpose." The Provisional Committee on Research and Education for the cotton industry will, at the close of the current holiday season, issue a prospectus of the new Government-incepted and aided organisation. This definite industrial research federation of the cotton trade will be followed by the establishment of institutes and laboratories.

The Anchor Hospital and Distress Fund.—The sixth annual general meeting of members of the Hospital and Distress Fund, in operation at the Anchor Cable Works, Leigh, was held on August 16th. There are three separate funds in existence, and the balances standing to the credit of these funds at June 30th, 1917, were as follows:—

The Hospital and Distress Fund	...	£210	2	1
The Belgian Refugee Fund	...	108	13	6
Special War Fund	...	339	14	0
		£688	9	10

The parent Hospital and Distress Fund has for its objects:—

(a) The granting of annual sums to hospitals and convalescent homes, &c., thereby ensuring to members hospital treatment in case of accident or other sickness.

(b) The granting of temporary relief to members in exceptionally distressed circumstances, so that shop collections may be discontinued.

All the employes in the works and offices at Leigh, aged 17 years and over, are members, and contribute according to their means sums varying from 1d. to 8d per week.

The Committee of the Fund is responsible for the administration and distribution of the allowances made by the firm to dependents of members who have joined His Majesty's Forces, and is also responsible for the maintenance of a Belgian refugee family. From the special war contributions of members parcels of comforts and cigarettes and tobacco are regularly sent out to the firm's employes on active service, and during the 12 months ended June 30th last a total sum of £210 was distributed amongst the various local and national war funds. At the general meeting it was decided to make grants amounting to more than £200.

It should be added that the good work of the Fund could not be continued were it not for the generous assistance rendered by the directors and management of the company—Messrs. Callender's Cable and Construction Co., Ltd., of London and Leigh.

Competition for Electric Cookers.—According to the *Génie Civil*, the Société Générale Italienne d'Electricité Edison has opened a prize competition for the construction of an electric cooking outfit of the thermal storage type, designed to consume as little energy as possible, and to spread the daily demand over the longest possible period, the criterion being the ratio between the consumption in kw.-hours and the maximum demand in kw. The conditions are that before March 31st, 1918, at least three samples shall be submitted, suitable for a family of five or six persons, as well as particulars of smaller and larger sets. The Société Edison has placed 10,000 lire (£400) at the disposal of a commission for distribution in the form of one or more prizes.

Munitions and Labour.—The Minister of Munitions, accompanied by officials of the Ministry of Munitions, Admiralty, and Ministry of Labour, met representatives of the Engineering and Shipbuilding Trades Federation in the Central Hall, Westminster, on August 22nd. He explained to them that the principal object of the meeting was to set up an advisory committee of trade unionists, the appointment of which had been discussed at previous conferences. The delegates indicated that they had every intention of helping him in his work. Their proposals as to the membership of the advisory committee were handed to the Minister in the course of the afternoon.—*Daily Telegraph*.

Patents and Alien Enemies.—Licences have been granted by the Board of Trade to the Chesham Supply Co., Ltd., in respect of 10 patents granted to Simms and Robert Bosch.

A Large American Loan Issue.—The *Electrical World* states that the General Electric Co., of Schenectady, has arranged a loan of \$15,000,000 for three years, to provide for the demands of a largely increased business. The company expended nearly \$9,000,000 on additional plant facilities in 1916, and will spend much more this year. The live assets of the company, as shown by its last annual report, excluding securities, amounted to \$97,000,000, and the indebtedness, excluding current liabilities, to \$12,000,000. The new issue was made at 6 per cent. to Messrs. J. P. Morgan & Co. and Lee, Higginson & Co. The subscriptions are said to have aggregated \$80,000,000.

Removing Rust by Electrolysis.—An electrolytic process of deoxidisation has been patented in the United States. The object to be treated is made the cathode in an electrolyte containing phosphoric acid. In addition to its normal function of carrying the current, this acid acts as a solvent upon rust without attacking the steel or iron body beneath. It is in this last detail that its chief availability lies, since nitric, sulphuric, or hydrochloric acid would not display such moderation. Finally, the phosphoric acid is beneficial in preventing subsequent further rusting. The electrolyte is made by adding 10 parts of phosphoric acid to 90 parts of water, or by adding 10 per cent. of the acid to a 10 per cent. solution of sodium phosphate. A temperature between 50° and 70° C. is recommended.—*Scientific American*.

South African Institution of Engineers.—The report of the Council for the session 1916-17 states that, as a result of the work of a Joint Committee formed in 1915-16, a conference of the Councils of the Mining, Electrical, and Engineers' Societies was held in May, which agreed that the time was ripe for the closer working and joint housing of all scientific and technical societies, and a Committee is to be appointed to prepare a scheme. Mr. C. T. Elliott, the secretary, having resigned, Mr. W. R. Jago was appointed in his place. The membership of the Institution numbers 488, a net increase of 25; 72 members are on Active Service or war work. The income was £1,345 and the expenditure £1,585; the capital fund stands at £2,330. At the annual general meeting the president presented the Institution Gold Medal to Lieut.-Colonel J. H. Dobson, D.S.O., for his paper on the Johannesburg electricity works, and referred to his splendid work in German East Africa. Owing to the death of Mr. D. Cullen, the only nominee for the presidency, the election of president had to be deferred to the next general meeting. Mr. Bernard Price, the retiring president, then delivered his valedictory address, dealing mainly with the past year's work, and especially the proposed federation of technical societies on the Rand, which, he believed, was a matter of national importance.

Importation Prohibited.—A Royal Proclamation prohibits the importation, save under licence from the Board of Trade, of all machinery driven by power and suitable for use in operating on wood, including electrical motors up to $\frac{1}{2}$ H.P.

Electrically Equipped Seminary.—A recent issue of our American namesake, the *Electrical Review* of Chicago, contained a description of the electrical equipment of the St. Stanislaus Seminary, near St. Louis. This institution consists of several large buildings, as well as outbuildings, including a bakery, shoe shop, laundry, cannery, cold storage, dairy, pumping station, smith and carpenter's shops, winery, garage and stables, a 900-acre farm being part of the property. To supply it a 13,200-volt line, built with galvanised iron wire, was run 6 miles from the 60-cycle transmission line of the Electric Co., of Missouri, the seminary guaranteeing a connected load of 60 kW.

At the seminary end the line is led into a distribution house, whence 110-volt lighting circuits radiate to the various buildings, underground cable being used. In all 600 lamps of 22,000 watts capacity are installed. For the farm supply two 220-volt underground lines run from the distribution station; one of these supplies a 10-H.P. laundry motor, a 10-H.P. ammonia compressor motor, and a 5-H.P. well-pump motor. A 10-H.P. corn grinder, a 10-H.P. circular saw, and a cream separator motor are also operated. The lighting for the farm buildings is taken off the power supply, up to 20 per cent. of the connected power load.

In the kitchen of the infirmary, a General Electric range is installed, also two 18-in. exhaust fans for use in vacuum cleaning. Heaters are being placed in the rooms and tests are being made for space heating.

The community kitchen is to have an electric bake-oven to bake 100 24-oz. loaves per hour, and an electric range to cook meals for 350 persons. This range will have four large ovens and two broilers to deal with 140 lb. of steak an hour. All vegetables, soups, &c., will be prepared in six electric steamers, and all roasting is to be carried out in a special oven. A plate-warmer, potato peeler, meat and coffee grinders are also included in the equipment.

All water heating for cooking, dish washing and bathing will be done electrically by two 300-gallon heaters which will furnish some 1,000 gallons of water at 180° every 24 hours.

Electrically heated coffee and tea-urns will be supplied with initially heated water from this source. The bakery has been equipped with an electric dough-mixer driven by a 2-H.P. motor, also with three electric baking ovens each with a capacity of 100 24-oz. loaves an hour. The output of two of these ovens has easily equalled the combined rated capacity of all three. In each oven three heats are employed. Previously the brick ovens in use required 24 hours' heating to obtain the proper temperature; with the electric ovens 14 hours suffices. Already well-defined monetary savings are being made over the previous costs.

Appointments Vacant.—Car-shed mechanic (36s.—42s.), for Exeter; shift engineer, Birmingham Corporation; switchboard attendant for the Leek U.D.C. Electricity Works. See our advertisement pages to-day.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station and Tramway Officials.—A request has been received by the Dublin Corporation from the Coal Mines Department of the Board of Trade for the part-time services of Mr. LAURENCE J. KETTLE, deputy city electrical engineer. The Corporation has acceded to the request.

The Rochdale Electricity Committee has decided to recommend the appointment of Mr. F. H. RUDD as permanent electrical engineer to the Corporation, at a salary of £400 per year, with a further increment of £50 within 12 months. Mr. Rudd has been the acting engineer since the resignation of Mr. C. C. Atchison.

The Greenock Electricity Committee recommends that the salary of Mr. FRANK H. WHYSALL, the burgh electrical engineer, be increased by £100, which will bring it up to £700.

Mr. W. E. THORP has been appointed inspector on the Doncaster Corporation tramways. He was engaged in the service prior to the war, has been to the Front, and has been discharged as unfit for further military service.

General.—The marriage took place last week, at Erith Parish Church, of Mr. E. J. DAVIS, and Miss Mabel May Vaux, second daughter of Mr. J. H. Vaux, of Callender's Cable & Construction Co., Ltd.

The marriage took place, at Crewe Green Church, last week of Sapper HUBERT SIMPSON, London Electrical Engineers, late of the staff of the Crewe Corporation electricity works, and Miss Melville Alcock, only daughter of Coun. C. Alcock, of Crewe.

At St. Paul's Church, Helsby, the marriage has taken place of Mr. N. GREENING, only son of Mr. N. Greening, of Newlands, Frodsham, and Miss Elsie Brotherton, younger daughter of Mr. J. Brotherton, J.P., manager of the Helsby Cable Works.

Roll of Honour.—Captain ESMOND WILLIAM MILNES, R.G.A., who has succumbed to wounds, was manager of the electric power station at Tres Arroyos, Argentina, and returned home in 1915 to take up a commission.

Lieut.-Col. MACRORY, D.S.O., wounded, is a brother of Mr. R. V. Macrory, city electrical engineer, Londonderry.

Lieutenant DOUGLAS KENNETH BEST, son of Mr. Walter Best, of the electric light department, India-Rubber, Gutta-Percha & Telegraph Co., Silvertown, was killed in action on August 16th. He joined the London Rifle Brigade in 1913, and went with the 1st Battalion to France in October, 1914. He was given a commission in the 6th Essex in 1915, and went through the Dardanelles; afterwards he went to Egypt, where he saw some further active service. He was then attached to the Royal Flying Corps, and sent home to complete his training. He obtained his wings this year, and was sent to France a short time ago. He was employed for some time in the test room of the electric light department at Silvertown, and afterwards with Messrs. Wallace Bros., Ltd., of Crosby Square, and was within one month of his 21st birthday.

Private A. E. WERRELL, of the Royal Fusiliers, who was wounded in France on August 2nd, was outside representative of the A.E.G. Electric Co. up to the outbreak of war.

Gunner MAURICE LIGHTOLLER JONES, South African Heavy Artillery, who died on April 22nd, 1917, was for 10 years accountant to the British General Electric Co., Ltd., Cape Town.

Company-Sergeant-Major R. EDWARDS and Sergeant S. DAVY, York and Lancaster Regiment, who were before the war on the Rotherham Corporation tramway staff, have been promoted to the respective ranks of Regimental-Sergeant-Major and Company-Sergeant-Major.

Private J. COOPER, Royal Dublin Fusiliers, who enlisted whilst with Messrs. Siemens, of Stafford, has fallen in action.

Private J. A. MITCHELL, Seaforth Highlanders, who has fallen in action, was a driver on the Corporation tramways at Croydon.

Sergeant BERNARD CHAPMAN, Northants Regiment, who has died of wounds, was engaged with the Premier Accumulator Co.

Private A. PHILLIPS, Royal West Surrey Regiment, who joined up whilst a motorman with the Swansea Tramways Co., is reported missing since May 12th last.

Lance-Corporal E. RICHARDSON, East Kent Regiment, who was prior to the war engaged at the Maidstone Corporation electricity works, is reported dead after being missing since October 7th, 1916.

Lance-Corporal C. BISHOP, Sussex Regiment, killed in action, was formerly with the Brush Electrical Engineering Co., Ltd.

Sergeant A. B. CLIFFORD, Royal Engineers, formerly in the electrical department at Wharfedale Silkstone Colliery, has been awarded the Meritorious Service Medal for special work at the front in connection with mining.

Private W. CLARE, West Yorks Regiment, who was on the Halifax Corporation tramway staff, has fallen in action.

Sergeant J. BERRYMAN, Royal Fusiliers, son of Inspector Berryman, of the Torquay Tramway Co.'s staff, and who enlisted whilst a motorman on the system, has been promoted to the rank of Company-Sergeant-Major.

The Military Cross has been awarded to Sec.-Lieut. EDWARD HARLEY, York and Lancaster Regiment, formerly assistant electrical engineer to Hastings Corporation.

Formerly employed on the Blackpool and Fleetwood tramways, Private J. SIMPSON, A.O.C., has died from heat-stroke in Mesopotamia. He was 38 years of age.

Signaller-Sergeant F. HILL, in hospital in France, suffering from shrapnel wounds, was employed in the Lytham & St. Annes tramway offices.

Private R. A. STEWART, of Wallasey, who has been killed in action, was an electrical engineer in Liverpool.

Private FRANK SMITH, who has been killed in action, was on the tramway staff of the Doncaster Corporation.

Corporal W. HOLT, Machine Gun Corps, of Crawshawbooth, has been awarded the Military Medal, and also recommended for the Distinguished Conduct Medal. Prior to enlisting he was employed in the British Westinghouse Co.'s works.

Private J. CODDICK, King's (Liverpool) Regiment, has died from wounds received in action; he was employed by the Automatic Telephone Manufacturing Co., Ltd.

Private N. TAYLOR, West Riding Regiment, who is reported missing, was employed by the Halifax Corporation tramway department.

Private H. BROOKE, of the Grenadier Guards, who has been killed in action, was a driver on the Bradford Corporation tramways prior to the war.

Company-Sergeant-Major HUGH HOUSTON, York and Lancaster Regiment, formerly with the Glasgow Corporation tramways, has been awarded the Military Medal for conspicuous gallantry.

Lance-Corporal J. LESLIE, King's Own Scottish Borderers, a former employé of the Glasgow Corporation tramways, has been posted as missing.

Private H. BURNS, Manchester Regiment, previously reported missing, and now officially posted killed, was employed by Messrs. W. T. Glover & Co., Ltd., cable makers, Trafford Park.

Private B. REILLY, Lancashire Fusiliers, killed in action, was formerly employed by Messrs. Charles Macintosh & Co., Ltd., cable makers, Manchester.

Obituary.—THEODORE TURRETTINI.—In *La Revue Générale de l'Electricité* the death of M. Théodore Turrettini is recorded; he was a Swiss engineer of the first rank, and took part in 1868 in the first test of Siemens & Halske's electric generators at Berlin. He was one of the experts advising on the utilisation of Niagara Falls in 1891, for 20 years a member of the Administrative Council of Geneva, and for long periods a member of the municipal and national councils, a colonel of artillery, and consulting engineer to many important undertakings.

Will.—An estate of the gross value of £405,965, with net personality £390,056, has been left by Alderman ISIDOR FRANKENBURG, J.P., of I. Frankenburg & Sons, Ltd., Manchester and Salford.

NEW COMPANIES REGISTERED.

Grimsby Electric Vehicle Co., Ltd. (148,210).—Private company. Registered August 14th. Capital, £5,000 in 1,800 7 per cent. cumulative pref. and 3,200 ord. shares of £1 each. To take over four electric vehicles and the business of an automobile proprietor and carrier carried on by J. Morris, at 67, Wellowgate, Grimsby, also to carry on the business of bakers, wholesale and retail confectioners, &c. The subscribers (each with one share) are: J. Morris, 67, Wellowgate, Grimsby, wholesale confectioner and vehicle owner; Mrs. E. R. Morris, 67, Wellowgate, Grimsby. The first directors are: J. Morris (managing director) and Mrs. E. R. Morris. Registered office: 67, Wellowgate, Grimsby.

A. Chase & Co., Ltd. (148,214).—Private company. Registered August 14th. Capital, £3,000 in £1 shares. Electrical and general engineers, &c. Agreement with A. M. Cole and A. R. Cole. The subscribers (each with one share) are: A. M. Cole, 97, High Street, Teddington, engineer; A. R. Cole, 97, High Street, Teddington, engineer; T. B. Hill, Hillside, Tonning, accountant. The first directors are: A. M. Cole, A. R. Cole, and T. B. Hill. Registered office: 97, High Street, Teddington.

Portable Electric Motors, Ltd. (148,223).—Private company. Registered August 14th. Capital, £2,500 in £1 shares. To acquire certain inventions and rights relating to portable electric cutters, &c. Agreement with G. Fryer. The subscribers (each with one share) are: Lord Clifford of Chudleigh, 18, Haven Green, Ealing, landowner; G. Fryer, 121, Victoria Street, S.W.1, engineer. The first directors are: Lord Clifford of Chudleigh and G. Fryer. Registered office: 121, Victoria Street, S.W.1.

Argilla Aluminium Co., Ltd. (148,228).—Private company. Registered August 15th. Capital, £7,500 in 5s. shares. Manufacturers of aluminium and other metals, &c. Agreement with R. D. Mackintosh, M.B. The subscribers (each with one share) are: R. D. Mackintosh, The Bungalow, Mortlake, medical practitioner; P. Evans, 92, Victoria Street, S.W., organiser. Permanent directors: R. D. Mackintosh and P. Evans. Registered office: 92, Victoria Street, S.W.

Chemical Engineering and Wilton's Patent Furnace Co., Ltd. (148,912).—Private company. Registered August 15th. Capital, £20,000 in £1 shares. To take over the business formerly carried on at Hendon by F. Wilton and G. Wilton as the Chemical Engineering Co. and Wilton's Patent Furnace Co., also to carry on the business of electrical engineers, &c. Agreement with N. Wilton and T. O. Wilton. The subscribers (each with one share) are: N. Wilton, 100, Station Road, Hendon, N.W.4, engineer; T. O. Wilton, 6, Emerson Road, Ilford, E., engineer. The first directors are: N. Wilton and T. O. Wilton, each of whom may retain office while holding 9,000 ord. shares. Registered office: Hendon, N.W.4.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

David Anderson & Co., Ltd.—Charge on general assets (subject to debentures authorised in 1915), dated July 19th, 1917, to secure £1,000 in favour of Mrs. A. M. Anderson, Putney.

Stuart Turner, Ltd.—Mortgage on freehold premises at Henley, dated July 31st, 1917, to secure £1,250. Holders: L. H. Hanbury, A. T. Hawes, and W. Simonds.

William Taylor Electric Lamp Co., Ltd.—Particulars of £400 debentures created January 29th, 1917, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Ackroyd & Best, Ltd.—Issue on July 31st, 1917, of £1,300 debentures, part of a series of which particulars have already been filed.

Thomas Pritchard, Ltd.—Trust deed dated July 19th, 1917, securing £6,000 debentures. Property charged: South Staffordshire Tube Works, the business of tube manufacturers carried on there, the company's plant and stock-in-trade, &c. Trustees: A. E. Pritchard, Wednesbury, and Rev. L. A. Pritchard, Sutton Coldfield.

Glantawe Electric Supply Co., Ltd. (112,615).—Capital, £15,000 in £10 shares. Return dated June 20th, 1917. All shares taken up; £15,000 paid. Mortgages and charges: Nil.

Brush Electrical Engineering Co., Ltd. (29,533).—Capital, £253,780 in ordinary stock. Return dated May 21st, 1917. £105,244 issued; £49,312 10s. paid; £55,931 4s. considered as paid. Mortgages and charges: £358,447 4s.

Anglo-Portuguese Telephone Co., Ltd. (24,545).—Capital, £200,000 in £1 shares. Return dated June 26th, 1917. All shares taken up. £51,046 paid; £98,954 considered as paid. Mortgages and charges: £33,940.

Altrincham Electric Supply, Ltd. (40,795).—Capital, £50,000 in 49,650 pref. shares of £1 each and 7,000 shares of 1s. each. Return dated June 4th, 1917. 45,000 pref. and 7,000 ord. shares taken up. £1 per share called up on 40,000 pref., 1s. per share on 5,000 pref., and 1s. per share on 7,000 def.; £40,600 paid. Mortgages and charges: £40,000.

Walter's Electrical Manufacturing Co., Ltd. (94,300).—Capital, £13,000 in £1 shares. Return dated July 18th, 1917. 11,250 shares taken up. £1,250 paid; £10,000 considered as paid. Mortgages and charges: Nil.

CITY NOTES.

Tyneside Tramways Co. The report of the directors of the Tyneside Tramways & Tramroads Co. states that the surplus of receipts over expenses was £7,490, which, with the balance brought forward from last half-year of £664, makes a total to the credit of profit and loss account of £8,154, and after deducting interest on debentures, loans, &c., amounting to £1,012, there remains an available balance of £7,142. This profit the directors propose to appropriate as follows: In the payment of a dividend on the preference shares at the rate of 5 per cent. per annum (less income-tax), £601; in the payment of a dividend on the ordinary shares at the rate of 4 per cent. per annum (less income-tax), £2,678; in placing to the credit of reserve for renewals, depreciation, and other contingencies, £1,000 (this, with £576 interest on investments, will increase the fund to £27,413); in placing to the credit of special reserve account, to meet contingencies, £1,000; in setting aside for the reduction of registration and formation expenses, &c., £389; leaving to be carried forward to next half-year £1,474. The traffic receipts show an increase of £5,539, compared with the corresponding period of last year.

Electro Bleach & By-Products, Ltd.—Interim dividend of 3½ per cent. (less income-tax) on the preference shares, payable on September 1st next.

France.—The capital of the Société Française des Fonderies et Acieries Electriques, of Paris, is being increased from £40,000 to £100,000.

A new company has been formed in Lyons, with a capital of £20,000, and the title of La Société pour la Création et l'Utilisation des Forces Motrices, to establish hydro-electric plants.

Crossley Bros., Ltd.—Interim dividends of 5 per cent. per annum on both the preference and the ordinary shares for the half-year ended June—the same as last year.

Guildford Electricity Supply Co., Ltd.—The report of the directors, to be presented at the meeting on Monday next, states that the gross receipts for the past year were £12,792, as compared with £12,098 for the year 1915, thus showing an increased revenue of £694. There is a balance on the revenue account of £2,657 (after crediting depreciation fund account with £572), as compared with a balance of £1,380 on the revenue account for 1915, when no provision was made for depreciation. After making due provision for debenture interest, interest on temporary loans, and the placing of £514 to the credit of reserve fund account, the net revenue account shows a balance of £289, and the directors recommend that this balance be carried forward to the credit of the net revenue account for the present year. The company during the past year has again suffered owing to the increased cost of production of electricity, and also to some extent by the decrease in the sale of current for lighting purposes. To meet these difficulties the directors were compelled again to increase the company's charges for current for all purposes as from the end of June quarter, 1916.

Reduction of Capital.—*Creed & Co., Ltd., and Reduced.*—The order confirming the reduction of the capital of this company from £130,000 to £90,000 was registered by the Registrar of Joint Stock Companies on August 9th.

Stewarts & Lloyd.—Interim dividend for the half-year ended June 30th at the rate of 10 per cent. per annum on the preferred ordinary shares, to be paid on August 31st, the same as a year ago.

Blackpool & Fleetwood Tramroad Co.—An interim dividend of 4 per cent. per annum, free of income-tax, on the ordinary shares has been declared. The same rate was paid a year ago.

Calcutta Electric Supply Corporation, Ltd.—The number of units sold to consumers during the four weeks ended June 29th, 1917, amounted to 2,230,711, compared with 1,866,546 units in the corresponding four weeks of 1916.

STOCKS AND SHARES.

TUESDAY EVENING.

VARIOUS of the electric lighting shares are quoted ex dividend, but this has not checked further advances in their prices. That is to say, the amount of the deduction has been more than recovered; and the prices of the shares are decidedly good. Rises have occurred in Charing Cross ordinary and preference, County, St. James's, City of London, Metropolitan, and Westminster. The market is good all round, and has received a little attention in consequence of an article in one of the evening papers suggesting that investors will find in this section excellent opportunities for cheap purchases.

The advice would be very sound, were it not for the fact that there are scarcely any shares to be had; and the little demand which arose as a result of the article found no amount of stock worth mentioning ready to supply it. This, of course, has been pointed out in these notes from time to time. The best way of securing shares is to leave an order with a stockbroker that he shall pick them up at a fixed price whenever any happen to come to market; otherwise, the would-be purchaser is likely to be disappointed, and, after waiting some time, will probably elect to put his money into something else.

The threatening aspect of affairs in the railway world caused a natural dullness amongst the various issues of the steam companies, and most prices are lower on the week, despite the calmer complexion that the trouble assumed on Tuesday. The depression coloured to some extent the stocks of the electrically-driven concerns. Districts, for instance, are down to 15. Metropolitan keep steady at 22½. The income bonds of the Underground Electric Railways are maintained by the consideration that the price carries £2 net dividend in it at the present time, and, accordingly, it shows another rise of ½ at 82½.

From the speculative point of view, the most interesting features in the Stock Exchange at the moment are those connected with Mexico. Carranza is declared, by those who profess to know what they are talking about, to entertain a new-born friendliness for the railway systems and the utility companies. Whether this be so or not, the prices of all the stocks have advanced hand over fist, and come, of course, upon the top of substantial improvements a week ago.

Mexican Tramway 5 per cent. bonds at 11½ are 1 point up, following their previous rise of ½. Mexican Light & Power preferred at 29½ is also 1 point to the good, after its rise of ½ last week. Pachuca Fives at 35½ are up 7, and Monterey Fives at 23½ have also gained several points. The same tendency is noticeable in everything else pertaining to Mexico, but, as those who follow the course of these markets are

fully aware, it requires very little demand to push up prices; and a rise of a few points can easily be secured in some particular security without any stock at all changing hands.

Foreign descriptions are very firm throughout, although British Columbia deferred has lost part of its rise of last week, and at 29 is 1 to the bad. A little buying of Anglo-Argentine Tramway issues is reported. Brazilian Traction remain at 49. Bombay Electric preference at 9½ are ex dividend.

Cable stocks and shares show no diminution of strength. Indo-Europeans have risen £1. Eastern Extensions are ½ higher. Westerns are up ¼. The Telephone list is equally good. Chiles and United River Plates are both 1/16 higher. The rise in Marconis is well maintained; the shares now are quoted 3 1/16, ex the dividend of 2s. There is a fair amount of business doing in this department, but there would be more were there a sufficiency of shares to satisfy the would-be buyers.

British Aluminium ordinary are 1/32 better at 31s. 3d. British Insulated put on 7s. 6d. to 13½, and Castner-Kellners are good at 3 7/16. Nearly all the sections given up to industrials exhibit prominent strength. For August, there is quite a lot of business doing.

This applies also to rubber shares, where a large volume of business has been accompanied by very little alteration in quotations, arguing that the buying is fairly well balanced by the selling. The iron and steel market would be better were it not for the labour difficulties, which it is feared may radiate from those engendered by the minority Union of the railwaymen. The armament group is quiet; and amongst base-metal shares, notwithstanding the prices now current for the metals themselves, there is but little doing.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.					
	Dividend		Price	Rise or fall this week.	Yield p.o.
	1915.	1916.	Aug. 21, 1917.		
Brompton Ordinary	10	9	61½xd	—	£7 4 0
Charing Cross Ordinary ..	5	5	82½xd	+4/-	6 9 0
do. do. do. 4½ Pref. ..	4½	4½	82½xd	+2/-	6 13 4
Chelsea	4	3	24	—	5 4 4
City of London	8	8	13	+ ¼	6 3 3
do. do. 6 per cent. Pref. ..	6	6	10	—	6 0 0
County of London	7	7	11½	+ ¼	6 8 1
do. do. 5 per cent. Pref. ..	8	6	10½	—	5 17 1
Kensington Ordinary	7	6	61½xd	+2/8	5 14 8
London Electric	8	8	1	—	Nil
do. do. 6 per cent. Pref. ..	6	4	32	—	5 6 8
Metropolitan	8	8	23½xd	+1/-	5 9 1
do. do. 4½ per cent. Pref. ..	4½	4½	32	—	7 4 0
St. James' and Pall Mall ..	8	8	7	+ ¼	5 14 6
South London	5	5	23	—	7 5 6
South Metropolitan Pref. ..	7	7	21½	—	6 10 3
Westminster Ordinary	7	7	61½xd	+8/-	5 12 0
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	98	—	6 2 5
do. Def.	88/6	1½	22½	—	6 16 4
Cable Telephone	8	8	7½	+ ½	5 18 4
Cuba Sub. Ord.	5	5	8½	—	5 17 8
Eastern Extension	8	8	14½	+ ¼	5 9 4
Eastern Tel. Ord.	8	8	14½	+1	5 10 8
Globe Tel. and T. Ord. ..	7	7	12½	—	5 9 10
do. Pref.	6	6	10½	—	5 15 8
Great Northern Tel.	22	24	86	—	6 13 4
Indo-European	13	13	54½	+1	5 19 8
Marconi	10	15	8½xd	—	4 16 10
Oriental Telephone Ord. ..	10	10	22	—	8 12 9
United R. Plate Tel.	8	8	61½	+ ½	5 19 8
West India and Pan.	6d.	6d.	1½	—	1 12 0
Western Telegraph	8	8	14½	—	5 10 4
HOME RAILS.					
Central London, Ord. Assented	4	4	61½	—	6 10 1
Metropolitan	1	1	22½	—	4 8 6
do. District	Nil	Nil	15	—	Nil
Underground Electric Ordinary	Nil	Nil	18	—	Nil
do. do. "A"	Nil	Nil	5½	—	Nil
do. do. Income	6	4	82½	+ ¼	4 17 0
FOREIGN TRAMS, &c.					
	Dividend				
	1915.	1916.			
Adelaide Sup. 6 per cent. Pref.	6	5	5	—	6 0 0
Anglo-Arg. Trams, First Pref.	5½	5½	2½	—	9 11 4
do. 2nd Pref.	5½	—	2½	—	—
do. 5 Deb.	5	5	67	—	7 9 8
Brazil Traction	4	4	49	—	—
Bombay Electric Pref.	6	6	93½xd	—	6 4 8
British Columbia Elec. Rly. Pfee.	5	5	47½	—	10 10 6
do. do. Preferred	Nil	Nil	81	—	Nil
do. do. Deferred	Nil	Nil	29	—	Nil
do. do. Deb.	4½	4½	55	—	7 14 7
Mexico Trams 5 per cent. Bonds	Nil	Nil	44½	+4	Nil
do. 6 per cent. Bonds	Nil	Nil	83½	—	Nil
Mexican Light Common	Nil	Nil	18	+2½	Nil
do. Pref.	Nil	Nil	29½	+4	Nil
do. 1st Bonds	Nil	Nil	45½	+4½	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	3½	—	4 15 10
British Aluminium Ord. ..	7	10	1½	+7½d	6 8 0
British Insulated Ord. ..	17½	20	13½	+ 8	7 11 3
British Westinghouse Pref. ..	7½	7½	2½	—	5 11 6
Callenders	20	20	14½	—	7 0 6
do. 5 Pref.	5	5	1½	—	6 1 8
Castner-Kellner	22	22	8½	+ ½	6 8 0
Edison Swan, fully paid ..	—	—	1½	—	Nil
do. do. 4 per cent. Deb. ..	4	4	7½	—	5 12 0
Electric Construction	7½	7½	4½	—	8 0 0
Gen. Elec. Pref.	5	6	10½	—	5 17 1
do. Ord.	10	10	16	—	6 5 0
Henley	25	25	16	—	7 16 8
do. 4½ Pref.	4½	4½	4	—	5 12 8
India-Rubber	10	10	12½	+ ¼	7 6 10
Telegraph Con.	20	20	38½	—	5 6 2

* Dividends paid free of income-tax.

SECOND REPORT OF THE COMMITTEE FOR THE INTERCONNECTION OF THE LANCASHIRE AND CHESHIRE ELECTRICITY SUPPLY SYSTEMS.

(Continued from page 153.)

Basis for Determining the Charges for Electricity Supplies.

—15. The Committee consider it of importance that some basis for arriving at the costs for the different classes of supply should be put forward in this report.

They fully recognise the complexity of this problem, and consider it impossible to formulate any uniform rate or rates.

16. **BULK SUPPLIES.**—By a bulk supply is implied a supply afforded by one undertaking to another under an agreement for a defined period, and which is available at all times from the undertaking giving the said supply, and the undertaking receiving the same agrees to use regularly for supplying the usual requirements of consumers in his district.

The Committee recommend that—as a general rule—only those stations now employing or about to employ individual generating sets of not less than 5,000 kw. capacity should in the future be used for bulk supply purposes.

The items which should be included in the cost per unit at the bus-bars of the supply station are:—(a) Capital charges on generating plant, (b) working expenses of generating plant, (c) coal.

(a) **CAPITAL CHARGES ON GENERATING PLANT.**—The pre-war cost of installing a complete plant using modern sets of not less than 5,000 kw. will not be found to vary greatly as between one locality and another. The Committee propose that the figure should be taken out in each case and the total annual charges thereon, calculated at 10 per cent., should be expressed in £ per kilowatt of maximum demand (kw.d.).

(b) **WORKING EXPENSES (GENERATION ONLY).**—Under this heading are included:—

Coal (Stand-by) ... ..	...	Expressed in £
Oil, Waste, Water, and Stores ... ..	...	per kilowatt
Wages and Salaries ... ..	...	of maximum
Repairs and Maintenance ... ..	...	demand per
Management ... ..	...	annum.

Although not strictly accurate, the method of treating the above working expenses as an annual charge per kw.d. greatly simplifies the calculation, and is sufficiently near theoretical accuracy for all practical purposes.

No allowance has been made in any of the above estimates for rates and taxes, as the Committee are of opinion that all plant at power stations used for electrical supplies delivered outside the area in which the power station giving the supplies is situated should be exempted from local taxation.

(c) **COAL (RUNNING).**—The Committee recommend that the item of total fuel costs should be based on a consumption of 28,000 B.T.H.U. per unit delivered to feeders at stations, with a 30 per cent. load factor, provision being made for a variation in the price of fuel. The allocation of the total fuel costs between "running" and "fixed" expenses being determined according to load factor.

A numerical example is given in a schedule, from which it is seen that for a 30 per cent. load factor the costs delivered to feeders at the station bus-bars equal £2 6s. per kw.d. per annum, plus .168d. per unit.

A table is also included in the schedule showing a suggested variation in the price per unit for load factors above and below 30 per cent.

Alternatively, this variation may take the form of a reduction in the running charge of .168d. per unit of from 1 per cent. to 7½ per cent. for load factors between 30 per cent. and over 50 per cent., and an increase in the said running charge of .168d. per unit of from 1 per cent. to 200 per cent. for load factors between 30 per cent. and 10 per cent.

The undertaking receiving the bulk supply shall declare its maximum demand in kilowatts, which may be exceeded to the extent of 15 per cent. only.

In arriving at the fixed charges to be paid per annum to the supplying authority, the actual recorded kw.d. at the station supplying shall in every case be taken. There shall be a minimum fixed charge per annum payable in respect of all bulk supplies by the purchasing authorities, which minimum shall be based on 85 per cent. of the said declared maximum demand.

All bulk supply agreements shall be entered into for a minimum period of 12 months.

The bulk supply rates ascertainable in the manner put forward by the Committee shall only be applicable to authorities purchasing supplies involving a kw.d. of not less than 500.

17. **STAND-BY SUPPLIES.**—By a stand-by supply is implied a supply given under an agreement for a definite period which one undertaking is under a distinct obligation to give to any other undertaking—if called upon to do so—at any hour of the day.

Stand-by supplies are capable of being divided into two classes:—

A.—Those in which energy is actually supplied by one undertaking to another at certain periods (including peak-

load hours) for varying reasons, e.g., breakdowns of plant, new plant under construction not completed by contract date, &c.

B.—Those in which no energy may pass although the supply authority is standing by the whole time. This class of stand-by supply may be termed an insurance against accidents.

The rates for Class A supplies shall be determined on the actual kw.d. recorded at the supply station, and, as far as possible, shall be based on the rates put forward for bulk supplies, with due regard to all local circumstances or special conditions.

The prices for Class B supplies at the bus-bars of the supplying station shall be determined at the rate per annum per kilowatt of maximum demand of the guaranteed stand-by corresponding to 33½ per cent. of "the capital charges" per annum set forth under "bulk supplies."

For all energy that may pass under the Class B supplies the rate per unit shall be in accordance with the overall costs according to load factor set forth in the table for bulk supply.

18. **EMERGENCY SUPPLIES.**—The Committee consider that it is difficult, if not impossible, to formulate charges for a supply of this character. Under certain conditions the rates set out under either bulk supplies, stand-by supplies, or reciprocal supplies might be applicable, depending to a large extent on the capability of adjacent undertakings to afford such supply at the time it is required. Moreover, in an extreme emergency, and in order to avoid a partial shut-down, it may be necessary for certain undertakings to incur heavy additional costs through having to temporarily use small or obsolete plant. In all cases, therefore, the charges under this heading would be determined by the district boards after investigating the circumstances.

19. **RECIPROCAL SUPPLIES.**—These supplies may be given during periods of light load, or heavy load, or both.

A.—**Light Load Periods.**—Light load periods may be taken to mean 6 p.m. to 6 a.m. daily, and 12 noon Saturday to 6 a.m. Monday; holiday times, and such other hours, if any, between 6 a.m. and 6 p.m., as may be mutually agreed between undertakings.

The Committee propose that the rates for this class of supply, at the bus-bars of the supplying station, shall be determined as follows:—

(a) 33½ per cent. of the capital charges per kw.d. per annum.
(b) 25 per cent. of the working expenses per kw.d. per annum.

(c) A running charge per unit to cover the cost of fuel.

A numerical example of the application of the above proposed basis for this class of supply is given in a schedule, assuming a load factor of 30 per cent.

In every case the kw.d. shall be the actual maximum demand at the supply station bus-bars.

One week shall be taken as the minimum period in arriving at the kw.d. charge.

B.—**Heavy Load Periods.**—These are defined as being all other periods than those specified for the light load periods.

The rates applicable to this class of supply are the same as for bulk supplies.

Basis for Allocating the Capital Charges on Interconnecting Mains, Transformers, and Switchgear against the Revenue Accounts of the Participating Authorities.—20. As previously provided, each participating authority shall—where necessary—apply to the proper Government authority for borrowing powers for the interconnecting mains to be laid within its own statutory area. Each authority shall in like manner apply for the borrowing powers in respect of transforming plant and switchgear required for interconnecting purposes. If interconnecting mains have to be constructed in any area intervening between the statutory areas of two participating authorities, each of the participating authorities shall apply for borrowing powers for one-half of the cost of such mains.

21. The capital and maintenance costs for interconnecting mains and plant shall be allocated by the board against the respective participating authorities on the basis that each authority shall pay the proportion of such costs corresponding to his user of the said mains and plant. In making the allocation the board will give due regard to the potential and actual demand of each authority, the amount of energy transmitted, and the purpose for which such energy is required, i.e., for bulk, stand-by, or reciprocal supplies.

22. When new or existing mains and plant are used partly for interconnecting and partly for supplies to industrial or other consumers, the board shall allocate a proportion of the total capital and maintenance costs incurred in affording such supplies, and shall charge this proportion against the authority or authorities supplying such industrial or other consumers, the balance of the costs to be allocated as set out in Clause 21.

23. The maintenance of all interconnecting mains and plant shall (unless otherwise directed by the board) be carried out by the authority in whose area such mains and plant are situated. In the event of a portion of the interconnecting main being situated in any area intervening between the statutory areas of two participating authorities, the maintenance of such portion shall be carried out (unless otherwise directed by the board) by the authorities at whose cost the mains have been provided.

24. The rates of charge set forth previously for bulk sup-

plies, stand-by supplies, and reciprocal supplies are given in terms of units delivered to feeders from the bus-bars of the supplying generating stations. As supplies given by interconnecting mains between various authorities may sometimes be metered at the boundaries of the respective areas of supply, and sometimes at the bus-bars of the receiving station, it is proposed to add a percentage to the overall costs (per kW. demanded) and per unit supplied as previously laid down to cover transmission and transformation losses. These losses are estimated to fall within the following limits:—

Transmission losses 1 per cent. to 2 per cent. per mile.

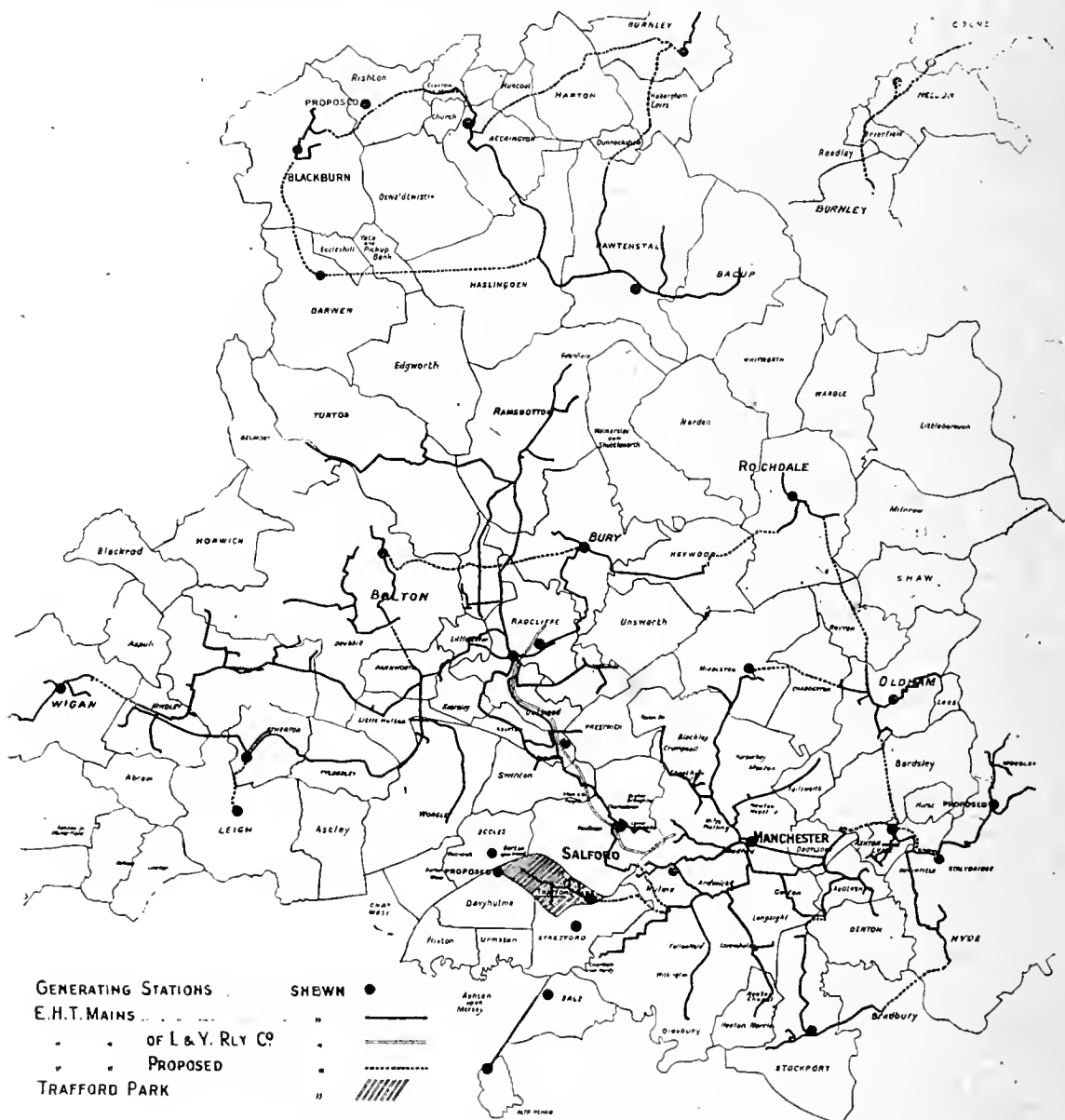
Transformation losses ... 2½ per cent. to 5 per cent.

25. As the interconnecting mains between the various undertakings will in most cases pass through the areas of several rating authorities, and would therefore become liable under existing methods of rating to repeated taxation, and as the mains are to be used for mutual and national benefit,

statutory authorities owning the interconnecting mains should—subject to the terms of Section 6 of the 1909 Electric Lighting Act—be allowed to furnish a supply to the said premises.

27. The Committee, in setting forth above the basis of charges for supplies, have not made provision for any "direct" profit on sales thereon for the purpose of rate-aid, which must therefore—in the absence of any legislation—be left to be decided by each undertaking as at present, in accordance with the accepted local policy.

The Committee cannot refrain, however, from giving expression to the opinion that the practice of making profits for the purpose of handing over substantial grants in aid of local rates is detrimental to the interests of an adequate and economical supply of electricity, particularly for industrial purposes. On the other hand, they would lay stress on the necessity of making adequate provision for depreciation and obsolescence of plant.



LANCASHIRE AND CHESHIRE SCHEME: MAP OF AREA DEALT WITH IN THE REPORT.

the Committee is of opinion that all interconnecting mains and plant should be entirely exempted from assessment for rating purposes unless used for distributing supplies to consumers. The Committee would point out that the methods of assessing electrical mains and plant differ in the various localities, and unless special protective provisions are introduced with regard to rating interconnecting mains, rates will be charged on supplies in one district for which corresponding rates have already been paid in other districts. It would be obviously unfair to rate mains used for exchanging supplies between stations on the same basis as mains used for distributing supplies within the areas of the participating authorities.

Miscellaneous Provisions.—26. The Committee have considered the possibility of interconnecting mains being laid in the area of a statutory authority who is unable or unwilling to afford a supply of electrical energy to the premises in his area of industrial or other consumers requiring a supply.

They therefore recommend that one or both of the adjacent

28. Whilst the Committee are of opinion that, broadly speaking, no direct profits should be made on the supplies enumerated in this report, a possible exception may arise in the case of electricity supplies which are given to new industries established in an area other than that of the authority containing the source of the supply.

In this instance the establishment of the new works brings increased rateable value to the district in which they are established, and if, as may very well prove to be the case, the inducement to establish such new industries in the selected area was a supply of cheap electricity (purchased from another authority) it appears only reasonable for the supplying authority to expect some direct return on the sale of current.

Summary of Recommendations on Interconnection.—29. As a preliminary step it is essential that a scheme of interconnecting the power stations of certain of the existing electrical undertakings in Lancashire and Cheshire should be at once proceeded with.

30. That the proper authority to control this movement

would be a local joint board, on which local authority and company interests are represented in the manner set forth in the foregoing report.

31. That the existing rights of all electrical undertakings as distributors should be observed within their statutory areas.

32. Any undertaking adversely affected financially by reason of the co-ordination of the interconnected power stations should be reimbursed by the participating authorities.

33. That the basis for costs of supply between authorities and all charges in relation to expenditure on interconnecting mains and plant should be determined by the joint board in the manner described in the report.

The Conferment of Additional Powers upon the Joint Board in regard to the Establishment and Control of all Future and Existing Power Stations and High-Pressure Transmission Lines.—34. The Committee recognise that the matters dealt with under this section of the report are somewhat outside the strict terms of their reference, but the future economical development of electricity generation and supply on a large scale is so bound up with the question of interconnection of existing undertakings that this report would not be complete without a reference to the larger question.

35. The Committee would again reaffirm their opinion that it is not desirable or necessary to interfere with the existing rights of undertakings with regard to the distribution of electricity within their statutory areas.

36. During the course of its deliberations on "interconnection" the Committee had under consideration the necessity in the near future of making provision for a much larger output than is at present called for, thus necessitating the erection of new power stations or additions to existing stations which would be used (in conjunction with the new and existing systems of high-pressure interconnecting mains) to furnish supplies to areas now served by a number of existing undertakings.

37. The units generated by the undertakings included within Groups A, B, C, and D amounted to 421,000,000 units for the year ending March 31st, 1916. Under normal conditions the rate of increase is about 20 per cent. per annum, so that during the next five years the output may be expected to increase to at least 1,000,000,000 units, and the maximum load, which for the year ended March 31st, 1916, amounted to 138,429 kw., will have correspondingly increased to 300,000 kw. The average increase in load is, therefore, equal to 32,000 kw. per annum for the whole of the groups.

38. The Committee have carefully considered how this increase in production can be met so as to achieve the most economical results, both in the employment of capital and in reduced operating expenses.

39. In some districts it may be desirable to increase the capacity of existing stations, while in others it will be necessary to erect new power stations. In both cases the new plant will consist of large units which will be used in conjunction with the new and existing systems of high-pressure interconnecting mains to furnish the total supply to certain statutory areas and to augment the existing supply to others.

40. In the preceding report dealing with interconnection the Committee, in order to ensure the most economical results, recommend, *inter alia*, that powers should be conferred on the joint board to co-ordinate and prescribe the running hours of existing stations and to act in an advisory capacity in regard to all proposals for future extensions of generating plant. The joint board, as one central body, will therefore exercise some of the powers at present administered by each existing statutory authority.

41. The Committee have considered whether the new power stations required to supply more than one authority should be erected and operated by a combination of the authorities more immediately interested in the use of such power stations as contemplated in Section 8 of the Electric Lighting Act, 1909 (subject to the powers of the joint board as previously set out), or whether the erection and operation of such new power stations should be provided at the cost of, and be operated by, the joint board, thus necessitating the conferment of financial and administrative powers upon the joint board.

42. In the ordinary course of development, as indicated in Clause 37, a considerable improvement would no doubt result over present methods if, in certain localities, new power stations were erected at the cost of those authorities who, for the present or immediate future, will obtain their supplies from such a source, but as such power stations increase in size, and the area over which their supply is given also increases, a larger number of authorities become interested in the operation of the stations, and will naturally require representation in their administration.

43. As the new stations will be interconnected with each other, it appears inevitable that there must be a general co-ordination of effort, first in localities, then in districts, and finally in the larger area covered by this report. In view of this inter-relationship between existing statutory authorities in the different localities and districts, the Committee are of opinion that ultimate developments may lead to a complete federation of the interests of the whole of the different authorities in the area.

44. Many advantages would be derived if the financial and controlling powers now exercised by the various company

and municipal undertakings in the areas under consideration were centred under one owning and operating authority. The time involved and expense at present incurred by individual undertakings and Government departments in connection with the procedure for raising and repaying capital would be greatly reduced. The apportioning of the capital and maintenance charges on plant and mains used for interconnected supplies between the various participating authorities would be avoided. All questions of profit, direct or indirect, between one authority and another would be eliminated, and by reason of centralised and collective ownership there would be more effective control than would be possible under any scheme of individual ownership.

45. The initiation of such a scheme at the present time presents certain difficulties which cannot be overlooked. The capital expenditure per kilowatt of plant installed, the cost per unit generated, and the selling price to industrial consumers vary so considerably as between one authority and another that the owning and operating of the whole of the existing power stations by a central authority might, unless adequate safeguards are provided, adversely affect those authorities who at present have the benefit of low capital expenditure, low generating costs, or favourable local conditions, to the immediate benefit of other authorities who do not possess these advantages.

46. Under the interconnection scheme, it seems inevitable that some of the less efficient power stations must be superseded in favour of more economical supplies from the new power stations, or from new plants installed in the more favourably situated existing stations, and it appears to the Committee that in such cases the undertakings so affected must necessarily be relieved of the financial obligations resting upon them in respect of superseded plant.

47. The difficulties referred to in Clause 45 will be largely overcome as the less efficient power stations are superseded, because the capital expenditure per kilowatt and the generating costs of the remaining stations in the various localities will tend to become approximately the same. The Committee feel, therefore, that while the rights of the statutory authorities should be maintained as regards the distribution and sale of energy, it may be desirable in order to secure a closer co-ordination of effort to invest the joint board with further powers to erect new power stations, and to acquire when and where necessary the ownership and control of existing power stations. The Committee recommend that powers to acquire existing stations should only be exercised after the joint board has approved thereof by a two-thirds majority, and would be subject to the sanction of the proper central Government tribunal. Any authority whose undertaking is being acquired would have the right of appeal to the tribunal on all questions, financial and otherwise, relating to the action of the joint board.

In the case of companies, these proposals would probably involve the purchase of their entire undertakings.

48. In the event of a power station being purchased under Clause 47, the joint board shall supply energy to the authority owning such power station at a price not exceeding the cost at which energy was produced at the said power station during the preceding 12 months, but all such prices shall be subject to revision at the close of each financial year, due regard being had in each case to all the factors entering into the costs of production.

(To be concluded.)

Testing for Troubles with a Telephone Receiver.—

One of the most useful devices for locating wiring troubles is a headband receiver of from 250 to 500 ohms resistance—the same type of receiver as is used by telephone operators. This type has the advantage of allowing the free use of both hands for testing.

In testing for door bell trouble, for instance, remove the cover from the push button, touch one cord end to each terminal, and listen. If no sound is heard in the receiver it is an indication that the circuit is clear and the wiring is all right. If a frying noise is heard it indicates a loose joint or poor connection on the circuit—on the bell, probably. If the terminals are pushed together to ring the bell while the receiver cords are still connected and a sharp back kick is heard in the receiver, it indicates that the bell is either short-circuited or the tension on the clapper is too great. If there is a rattling sound, the bell has been ringing. If every operation produces but a very faint response in the receiver, it means that the battery is weak.

After a little practice the trouble man can soon find very many uses for a receiver of this kind. By this push-button test method, trouble can be readily located and remedied. A double receiver headband should never be used, but a single one, so as to have one ear free for listening to outside noises.—*T. and T. Age.*

Municipal Tramways Conference, 1917.—This year's annual meeting of the Municipal Tramways Association will be held at Blackpool on September 20th and 21st (headquarters, Savoy Hotel). Amongst the subjects for discussion are "Principles to Adopt to Ensure the Highest Net Earning Capacity," by Messrs. Holford, Barnard and Priestley; "Rules of the Footpath," by Mr. J. Dalrymple; "Differentiation in Tramway Fares," by Mr. W. Murray; and the "Development of Tramways." The annual general meeting will be held on September 21st.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

SALVADOR.—In reporting the issue of a Decree making certain modifications in the Customs Tariff of the Republic, H.M. Consul at San Salvador states that Customs duties on imported goods are now payable as follows:—5 per cent. in U.S. currency, 10 per cent. by a draft on the United States, and 85 per cent. in local currency, at the exchange of the day. Electrical goods do not appear to be affected by the Decree itself.

CHILE.—A Presidential Decree has been issued providing that, as from January 29th, import and export duties, warehouse, lighthouse and buoy dues, and consular fines shall be collected as follows:—All with the exception of export duties are to be paid in currency, with a surcharge which is to be fixed weekly according to the average price of gold. Export duties are to be paid as to 50 per cent. in notes with the corresponding surcharge, as indicated above, and 50 per cent. in drafts on London at 90 days' sight, the amount in drafts to be paid for each gold peso to be determined according to the average exchange value of drafts, which is also to be ascertained weekly. From March 1st only 30 per cent. of the export duties is to be paid in drafts, the remaining 20 per cent. (to make up the 50 per cent.) being paid in national gold coin.

By a Decree dated January 26th a new form of consular invoice has been brought into use for merchandise shipped to Chile, which requires, *inter alia*, that each class of merchandise shall be designated in the invoice itself, and should there be various kinds of any class of goods each particular kind must be stated. Invoices are to be in Spanish throughout, and if the Chilean Consul who legalises the invoice considers that the value declared in it is not the current market price of the goods, he may note at the foot what he considers to be the true value. The Decree took effect in Chilean Consulates on May 1st, and in Chilean Customs Houses on July 1st.

ITALY-BRAZIL.—The Italian Government have denounced the provisional Commercial Agreement between Italy and Brazil of July 5th, 1900, and the Agreement will accordingly cease to have effect at the end of 1917.

BRAZIL.—An official intimation has been made that the new consular invoice regulations contained in the Budget Law for 1917, and in the subsequent Decree—see the REVIEW of April 20th—have been modified in view of the objections raised.

It is now required that invoices shall be presented for consular "legalisation" before the arrival of the vessel conveying the merchandise at the port of destination in Brazil (this supersedes the requirement that the invoice must be taken out before the departure of the vessel).

A fine will be levied on the consignee in Brazil only in cases where any discrepancy that may be discovered between the declaration contained in the consular invoice and the actual contents of packages is such that a greater amount of duty is leviable on the goods than would have been levied had the consular invoice declaration been accepted by the Customs without question.

All packages must be numbered, if possible in consecutive order; in no case may the same number be used more than once in numbering packages included in one and the same consignment (the Budget Law required consecutive numbering of packages).

NORWAY.—The exportation of carbon electrodes and electrodes for industrial use, electrode scrap, and retort graphite has recently been prohibited.

SWEDEN.—As from May 26th the exportation of the undermentioned goods has been prohibited:—

Insulating compositions, also manufactures of the compositions; mercury and mercury alloys (amalgams); vulcanised fibre and other chemically prepared fibre board in plates or sheets; vulcanised fibres in tubes or rods. (*Extensions of existing prohibitions.)

NETHERLANDS.—The Board of Trade are informed by H.M. Consul-General at Rotterdam that a statistical tax at the rate of one per mille (one-tenth per cent.) *ad valorem* is now leviable on all goods imported into, or exported from, the Netherlands, in order to defray the expenses of a Bureau which has been established to compile Customs, &c., statistics.

TERRITORY KNOWN AS "GERMAN EAST AFRICA."—Regulations have been issued by the Senior Military Customs Officer at Dar-es-Salaam setting out the conditions under which goods in transit through the occupied territory in "German East Africa" may be conveyed through the ports of Bukoba and Muanza. The text of these regulations was given in the official *Board of Trade Journal* for May 24th.

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford

- 11,350. "Printing-telegraphy." F. RITCHIE. August 7th.
- 11,357. "Magnetic blocks for holding iron and steel during grinding, planing, &c." G. KHISANACHVILI. August 7th.
- 11,358. "Means for controlling electric circuits." W. O. KENNINGTON. August 7th.
- 11,360. "Alternating-current generator and group converter." SOC. FRANCAISE RADIO-ELECTRIQUE. August 7th. (France, August 4th, 1916.)
- 11,380. "Thermo-electric generators." M. SANTANGELO. August 8th.
- 11,389. "Lamps or lanterns for aircraft." H. C. BROWN. August 8th.
- 11,390. "Lampholders for electric lamps." H. C. BROWN & FULLER ACCUMULATOR CO. August 8th.
- 11,392. "Electric transforming and converting apparatus." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). August 8th.
- 11,410. "Spark arresters." F. A. LAGRANGE, J. P. O'DONNELL & P. C. SACCAGGIO. August 8th.
- 11,420. "Ignition devices for internal-combustion engines." W. O. KENNINGTON. August 8th.
- 11,440. "Igniting spark for internal-combustion engines, shot-firing magnets, &c." L. C. GRANT. August 9th.
- 11,457. "Ignition apparatus for aviation engines." SOC. LORRAINE DES ANCIENS ETABLISSEMENTS DE DIETRICH ET CIE DE LUNEVILLE. August 9th. (France, August 16th, 1916.)
- 11,465. "Interrupter for electric circuits." R. BOSCH. August 9th.
- 11,486. "Apparatus for rectifying high-tension discharge from transformers, &c." B. H. MORPHY. August 10th.
- 11,489. "Dynamo-electric machines." J. FRASER. August 10th.
- 11,490. "Control of electric motors, applicable to cranes, hoists, &c." J. HENERY. August 10th.
- 11,497. "Electrical distilling apparatus." D. B. JONES. August 10th. (U.S.A., December 7th, 1916.)
- 11,505. "Electrical induction apparatus." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). August 10th.
- 11,506. "Alternating-current circuits." R. H. LONG. August 10th.
- 11,511. "Art of electric welding." S. C. CARY. August 10th.
- 11,528. "Electric cables or conductors." T. S. SEYMOUR. August 10th.
- 11,531. "Compasses and instruments for detecting changes of magnetic declination." R. L. GLAZEBROOK & F. E. SMITH. August 10th.
- 11,534. "Magnetic compasses and electric lamps for use therewith." R. S. MASON. August 10th.
- 11,544. "Sparkling control of aviation engines." M. G. SMILES, W. D. SMILES & W. T. WARREN. August 10th.
- 11,579. "Sparkling-plug tester." J. HANMAN. August 11th.

PUBLISHED SPECIFICATIONS.

1916.

The numbers in parentheses are those under which the Specifications will be printed and abridged, and all subsequent proceedings will be taken.

- 5,842. DYNAMO-ELECTRIC MACHINES. British Thomson-Houston Co. & F. P. Whitaker. April 20th, 1916. (107,993.)
- 5,858. ELECTRIC FUSES. A. F. BERRY. April 20th, 1916. (107,994.)
- 5,859. ELECTRIC HEAT RADIATORS. A. F. BERRY. April 20th, 1916. (107,995.)
- 10,023. ELECTRIC JOINT-MAKING WASHER. C. J. BEAVER & E. A. CLAREMONT. July 17th, 1916. (108,015.)
- 10,178. CONTROLLERS FOR ELECTRIC MOTORS. W. B. BENNITT. July 19th, 1916. (108,030.)
- 11,360. ELECTRIC HEATERS FOR WATER AND OTHER LIQUIDS. Benham & Sons, and C. R. Allensby. August 11th, 1916. (108,045.)
- 12,396. ELECTRIC FURNACE. J. RENNERFELT. September 8th, 1915. (101,412.)
- 12,561. DYNAMO-ELECTRIC MACHINES FOR COMBINED ELECTRIC LIGHTING AND IGNITION IN CONNECTION WITH MOTOR-DRIVEN VEHICLES AND THE LIKE. W. HOLT & B. BROOKS. September 5th, 1916. (108,062.)
- 17,752. ELECTRIC FIRE OR RADIATOR. H. H. BERRY. December 9th, 1916. (108,097.)
- 18,160. ARRANGEMENT FOR AUTOMATICALLY ADVANCING THE IGNITION IN EXPLOSION ENGINES. SOC. ANON. POUR L'ECLAIRAGE ELECTRIQUE DES VEHICULES. December 29th, 1915. (102,958.)
- 18,504. ELECTRIC STARTERS FOR INTERNAL-COMBUSTION ENGINES. A. H. MIDGLEY and C. A. VANDERYVELL & CO. December 27th, 1916. (108,114.)

1917.

- 438. HIGH-FREQUENCY ALTERNATORS. J. BETHENOD & E. GIRARDEAU. August 10th, 1915. (Divided application on 10,576/16.) (103,657.)
- 2,022. IGNITION DEVICES FOR INTERNAL-COMBUSTION ENGINES. J. J. MURRAY. April 13th, 1916. (Divided application on 5,460/16.) (108,124.)
- 2,332. SEALING AND BONDING GLANDS FOR ELECTRICAL JUNCTION BOXES. G. S. BOOTHROYD and Callender's Cable & Construction Co. February 16th, 1917. (108,125.)
- 3,091. CARRIER OR MEANS FOR SUPPORTING ELECTRIC-LAMP OR OTHER SHADES, REFLECTORS AND THE LIKE. A. P. KUTHERFORD. March 2nd, 1917. (108,129.)
- 6,196. ELECTRIC IRONS AND THE LIKE. Cable Accessories Co., F. H. REEVES and P. W. DAVIS. May 2nd, 1917. (108,141.)

Decimal Coinage.—The Decimal Association has issued a pamphlet on the subject of British Decimal Coinage, dealing with the choice of unit: the Association considers that the question is narrowed down to the choice of the sovereign or the dollar, the former involving no change in the values of our gold and silver coinage, but a change of 1 per cent. in value of the bronze coinage, while the latter would retain the bronze coins at their existing values, but would change all the rest, including the pound sterling. The Association is clearly in favour of the retention of the pound, divided into 1,000 mils, but invites the expression of opinions from all who are interested in the subject. The view which we have always advocated, and to which we adhere, is that the pound should be retained unchanged in value.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

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OFFICE :—4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: "A0EEKAY, LONDON." Code, A B C.

Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 8d.; Canada, £1 3s. 10d. (\$5.80). To all other countries, £1 10s.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson, & Co., Gresham Street.	MELBOURNE: The Mining & Engineering Review, 90, William Street; Gordon & Gotch, Queen Street.
AUCKLAND N.Z.: Gordon & Gotch, Albert Street; The Mining and Engineering Review, 31a, Strand Arcade, Queen Street.	MILAN: Fratelli Treves.
BRISBANE: Gordon & Gotch, Queen St.	NEW YORK: D. Van Nostrand, 25, Park Place.
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DUNEDIN, N.Z.: Gordon & Gotch, Princes Street.	PERTH, W.A.: Gordon & Gotch, William Street.
JOHANNESBURG, CAPE TOWN, BLOEM-FONTEIN, DURBAN, PORT ELIZABETH, &c.: Central News Agency, Ltd.	ROME: Loescher & Co., Corso Umberto I° 307.
LAUNCESTON: Gordon & Gotch, Cimitiere Street.	SYDNEY: The Mining & Engineering Review, 273, George Street; Gordon and Gotch, Pitt Street.
	TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.
	WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

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RAILWAY ELECTRIFICATION RESULTS.

It is fortunate for us that the American railway authorities have a habit of scattering their electric railway statistics broadcast, for were the British "railway public"—amongst whom we include existing shareholders and that large section of the public which may be regarded as potential investors in railway undertakings—to depend for its information as to working results on the tender mercies of the British railways which have adopted electric traction, we fear that it would fare rather badly. The fact that British railways have in recent years equipped many miles of electrically worked routes is, of course, a general indication that a change was necessary and that electrical working has been found to offer the most satisfactory method of effecting the change. So much is clear to those who think the matter over; but how many do this?

Some valuable data was recently given at a meeting of the New York Railroad Club in regard to the electrical operation of the Chicago, Milwaukee & St. Paul and the Norfolk and Western Railroad's electrified routes. The former is the most extensive project of the kind yet carried out, being the conversion of 440 miles of main line, crossing three mountain ranges, and involving a naturally difficult route with many tunnels. This company, as stated in our issue of March 2nd last, is preparing to electrify another 220-mile stretch of main line, to Seattle, crossing the Cascade Mountains, and situated further west than the existing electrified route, from which it will for the present be separated by an intermediate steam-operated section 200 miles in length. Ultimately, however, it is proposed to electrify the whole western end of the system to the Pacific, some 900 miles in length.

The data concerns the working during the last three months of the years 1915 and 1916 under steam and electric traction respectively, of the 226-mile Rocky Mountain division, between Harlowton and Deer Lodge, which handles both passenger and freight service. Under steam conditions we find 119,330 train engine-miles plus 24,752 helper engine-miles, normally requiring 13 engines; under electrical operation 119,237 train engine-miles were run, no helper engines being required, and seven locomotives only were employed. The figures do not disclose the true position, however, as freight engines often assisted passenger trains, and it is considered that less than half the number of locomotives will suffice under electrical operation. Per engine, the train miles with steam averaged, roughly, 9,000, as against 17,000 with electricity, and the latter required 29 kw.-hours per train mile, as against 188 lb. of coal under steam conditions.

Turning to the freight service, the electrical results show to even greater advantage. Measured in 1,000 ton-mile units, 282,862 were moved under steam, and 364,087 under electric operation, requiring 176,937 steam train-miles, plus 56,363 helper engine-miles, as compared with 186,010 electric train miles and 20,157 electric helper miles. For this work 43 steam and 15 electric locomotives were used, which, allowing for the additional electric ton-miles, shows that three and three-quarter times as many steam locomotives were required to handle

the same ton-mileage, though this does no represent the whole of the difference, as more electric locomotives were available than would be normally used.

In 1,000 ton-miles per engine, steam averaged 6,745, as against 24,260 under electric traction. The total time under steam conditions was 17,825 hours, as against only 14,535 hours for electrical working, representing 3.78 mins. for steam, and 2.39 mins. for electrical working per 1,000 ton-miles, the latter requiring 39.4 kw.-hours and the former 276 lb. of coal. The steam data includes no mileage for light-engine working, while the electric working presumably allows for energy returned to the system during regenerative working, which is a feature of this line, and during one month amounted to 11½ per cent. of the total power consumed at the motors, as measured at the locomotives.

The Norfolk & Western electrification was designed for a special purpose, *i.e.*, to reduce the time taken and to obtain greater efficiency in handling the heavy eastbound mineral traffic up the Elkhorn grade and through the Elkhorn tunnel, which is single tracked. Electrical working has increased the average speed from seven to 14 miles an hour, and the average engine-miles per day from 60 to 100.

The maximum east-bound tonnage of 51,226 under steam conditions has increased to 59,543 under electrical working, but only nine electric locomotives were required to deal with the maximum day's traffic, as compared with 43 steam locomotives. In 1914, 132,618 loaded eastbound cars required 93,625 engine-hours, but in 1916, 165,680 cars were dealt with electrically in 44,112 engine-hours. The through freight and passenger trains are still worked by steam, but are helped by electric locomotives; the latter have, with reduced operating costs, doubled the capacity of the line.

Both these instances of electrical working may be classed, by those who feel so disposed, as special applications, in which the conditions were favourable to electric traction and unfavourable to steam operation, though it seems probable that the results will bear a wider application, in view of the tendency for railway conditions to become more and more difficult for steam operation, and ever more favourable to electrical working. The paying limits of railway electrification are not easily defined in practice, if battery traction is taken into consideration as an adjunct. In this country the limits of suburban electrification schemes have shown greater expansion in recent times—the South-Western being an example, while the London-Brighton, and London-Southend electrification proposals—unfortunately in abeyance at the moment—the Manchester suburban schemes, and the North-Eastern mineral railway electrification, all indicate that even our conservative railway directorates are showing a widening interest in the extended application of electric traction, under conditions which a few years ago would have been regarded in railway circles as impracticable.

An important point is that nearly all the fore-going projects originated before the war, when the cost of fuel and labour were relatively much more favourable than they are now, or will be after the war, *i.e.*, the conditions are becoming such that the paying limits of electrification will be greatly extended, and this will be even more the case when cheap electric power becomes available in large quantities in industrial areas—which are also heavy railway traffic centres—as an outcome of the proposed reorganisation of our electric supply industry. Under the probable conditions of the near future British main-line operation by electric traction may become an economic necessity—though we are well aware that the cherished tradition of the past will not be overcome without a struggle.

SOME time ago it was announced that the Government intended to appoint 12 additional Trade Commissioners. We have so often expressed our opinion concerning the usefulness of the services rendered by the four Commissioners who have acted in this capacity for some years past that we need not repeat it now. What we, as plain men, cannot understand is why, when a decision has been made it cannot be acted upon without a prolonged period of waiting. These additional Trade Commissioners have been asked for by the business world for many years past, and its recommendation has been authoritatively endorsed by committees that have reported upon the after-the-war situation. Since the Government made up its mind to act, a great deal of time and attention have been devoted to the schemes for a reorganisation of our Commercial Intelligence Services (Board of Trade and Foreign Office), and, according to the daily Press, such reorganisation scheme, bringing trade intelligence matters under unified control, has been approved by the Cabinet. It may be that it is because headway has been made at last in that connection that the Civil Service Commission has been authorised to invite applicants for the positions of Trade Commissioners to lodge particulars of their qualifications. They have to be, according to the announcement, men possessing a good knowledge of import and export trade, who have had commercial experience at home and abroad, and who should be under 50 years of age. In our own opinion, the more they know of engineering and electrical affairs the better, for we look for far-reaching and beneficial effects to ensue for our particular industries from the efforts of the 16 Trade Commissioners of the British Empire during the years following the war. The selection of the most likely men will be made by the Selection Committee of the Civil Service Commissioners, and that Committee's recommendation will be passed on to the President of the Board of Trade after the chosen applicants have been interviewed. We sincerely hope that in every case the choice will be wisely made, and on essential merit, and that there will not be another long period of waiting. The Commissioners should be ready to take up their work straightaway.

The Ignition Magneto Industry in France.

JUST as was the case in Great Britain, so also in France, prior to the war, the automobile industry was mainly dependent on the German Bosch Co. for its supply of ignition magnetos. The situation was so dealt with that quite a large number of magneto manufacturing concerns have sprung into existence there, with the object of not only freeing the business from the German monopoly, but also of rendering the country self-supplying as regards magnetos for ignition purposes. One of the principal makers is the S.E.V. Co., in which about 75 per cent. of French motor-car manufacturers are financially interested. This concern took over the Bosch establishment in Paris early in the war, and ran it until its own magneto factory, which is now ten times as large as the French Bosch plant, had got into working condition. Other French concerns now making magnetos are Messrs. Grouvelle and Arquembourg, the Salmson Aviation Motor Co., the Compagnie Générale des Magnetos, the Lavallette-Eisemann Co., the Gibaud Co., the Nilmelior Co., and about half-a-dozen other small concerns. It is understood, too, that the De Dion Bouton Co., makers of the motor-cars of that name, are establishing a plant for the production of magnetos.

BALANCER USED FOR TESTING PURPOSES.

FOR some years the balancer, of which the diagram of connections is shown, has been in use for the testing of motors and dynamos. With the use of this machine on a supply of 500 volts pressure, any direct-current motor from 50 volts to 500 volts may be tested up to a limited horse power. One of the chief features about it is that the pressure can be regulated with ease to suit any motor. This balancer is comprised of three six-pole shunt-wound machines, with lap-wound armatures, which are all direct-coupled.

The three armatures shown are connected in series with each other across the 500-volt supply. The shunt windings of all three machines are connected in parallel across 500 volts, and, as will be observed from the diagram, they have

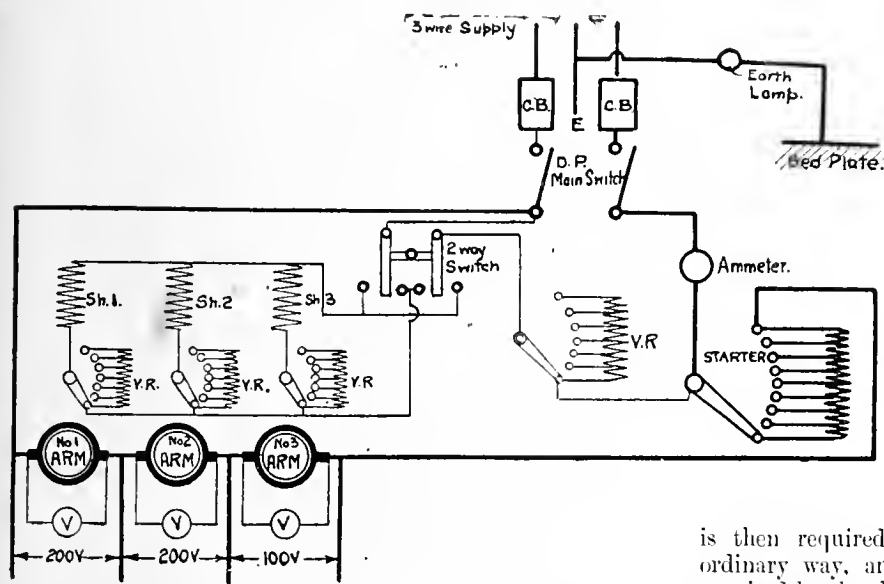


FIG. 1.

a variable resistance in circuit with each one. The pressure of 500 volts is divided up as shown in fig. 1, so that as the armatures are in series with each other, any alteration of shunt resistance alters the voltage on all three armatures: and when the volts are reduced on one armature, the volts subtracted are added to the volts on the other two armatures. If the two armatures normally at 200 volts each were reduced to 180 volts each, the armature normally at 100 volts would then be increased to 140 volts.

It is convenient to have a voltmeter connected with each armature, as shown, when the effect of using the variable shunt resistances can be seen.

The balancer itself is belted up to the larger sized machines, and so it is necessary to reverse it; the two-way switch is employed for this purpose. This switch is only operated when the double-pole switch is out, and it is possible to arrange a device to prevent breaking the shunt circuit when the current is on.

The other variable resistance shown in the diagram is for the purpose of increasing or decreasing the speed of the balancer, and so increasing or decreasing the load of any motor which may be tested by being belted to the balancer. The four cables from the armatures are connected to switchboards in parallel with each other, which are fixed in convenient positions near the test plate.

In testing the smaller sizes of machines, the load is supplied by other permanent shunt-wound machines connected as motors from the switchboard as shown in fig. 2, and when any motor is running with full load, the current generated is fed back to the balancer. This permanent shunt machine is fitted with a shunt-reversing switch for changing the direction of rotation, and also a variable

shunt resistance for adjusting the load of the motor which is being tested.

It is also convenient to have a four-way switch and voltmeter on one branch switchboard to observe the voltage between different main terminals. The outside voltage would be 500 volts, and armatures 200, 200, and 100 when normal. In an actual test of three motors, the largest being belted to the balancer, and the two others on to the permanent machines, the writer took the readings of the watts supplied and the watts used on the motors. The motor readings were:—

No. 1, 220 volts, 180 amperes	=	39,600 watts.
No. 2, 220 " 55 "	=	12,100 "
No. 3, 110 " 53 "	=	5,830 "

Total watts used 57,530

The ammeter in circuit with the balancer as shown in fig. 1 read 49 amperes when the motors were using the total watts stated, which gives us $500 \times 49 = 24,500$ watts supplied, and 33,030 watts saved. It is, of course, more economical to test as many motors as possible at one time, as the balancer takes 9,000 watts when running without load, and a load is required to justify the use of it.

When starting to test a motor, as in fig. 2, it is best to start No. 1 motor first, and in the case of testing a series motor, it is necessary to start up this motor first, as a series motor requires a load to start in order to prevent it racing away. Adjust the speed on this machine by means of the shunt resistance to give the speed required by motor No. 2. All that is then required is to start motor No. 2 up in the ordinary way, and afterwards adjust the load to what is required by the shunt resistance of motor No. 1.

It is necessary to have the shunt resistance of motor No. 1

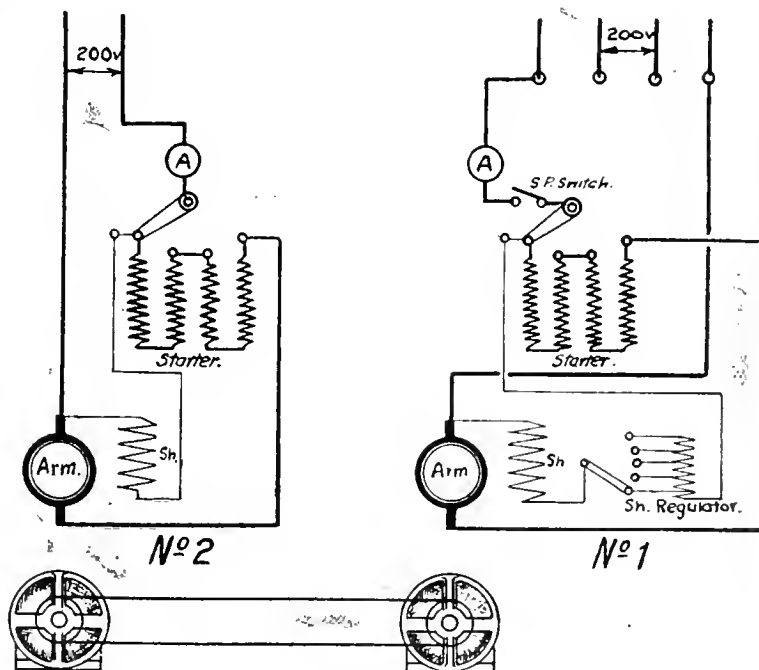


FIG. 2.

in small steps, and suitable for varying the load very slightly.—A. K.

Copper Shell Bands.—Mr. Sherard Cowper-Coles informs us that a plant of considerable size is being erected in the South of England for making shell bands by the Cowper-Coles centrifugal copper process, in which the Government is interested.

NOTES ON ALTERNATING-CURRENT TRACTION MOTORS.

NUMEROUS proposals have been put forward in connection with the development of single-phase commutator motors, suitable for the propulsion of electric trains. Prior to the war a great deal of experimental work was being undertaken, especially on the Midi Railway in France, and it is a matter of regret that this important work has been interrupted.

The single-phase system has, of course, made the greatest headway on the Continent of Europe and in America. What is used largely on the American lines is the series compensated motor: that is, a motor having the armature, the main field winding, and compensating winding connected in series. As the compensating winding carries current equal and opposite to the armature current, the cross magnetisation is neutralised over the entire pole face, and the compensating winding not only counteracts field distortion but also improves the power factor, for any field in an alternating-current machine must of necessity increase the wattless current. The main field that produces the torque and a commutating field are, of course, necessary, but the armature field is harmful, and should be compensated. Motors with a local commutating pole-winding only are satisfactory on direct-current circuits, but not on alternating-current circuits. What is wanted and what is provided in the latter case is a distributed compensating winding embracing the greater part of the armature.

The main advantage of this type of motor, having the main field and compensating windings in series with the armature, is that the machine will work with direct current. Of course, in some cases the compensating winding is short-circuited upon itself when the compensating current is produced inductively. Experiments indicate that the results obtained with the two methods of exciting the compensating windings differ inappreciably, provided the motor always works with alternating current. But when motors have to work with direct current as well as alternating current, it is better to have all the windings in series, for the compensating winding then remains active under both conditions, and will always prevent field distortion and improve commutation. Motors with the compensating winding in series with the armature are used in this country on the electrified line of the Midland Railway and on American single-phase railways.

In addition to the distributed compensating winding, there may be local commutating pole windings, but so far the use of motors built on these lines has been confined mainly to Continental railways usually working at periodicities in the neighbourhood of 15 cycles per second. The Lötschberg locomotives, for instance, are fitted with motors of this kind. The interpole winding may be energised from the secondary of a series transformer having its primary connected in series with one of the motor leads, when the strength of the current passing round the interpoles varies in proportion to the load. The axes of the main and compensating windings are at half the polar distance from one another, and the third, or commutating, winding is arranged inside the compensating winding and between two adjacent slots, so that the commutating turns only embrace a single tooth.

Certain types of so-called repulsion motors have also been used successfully on single-phase railways. The compensated repulsion motor of the Latour, Winter Eichberg type has come into considerable use for light railway work, for which it seems well adapted. The circuits of this machine are similar in most respects to those of the plain series motor, but the motor possesses an additional set of brushes short-circuited upon themselves, and in mechanical line with the windings of the stator. In distinction to the performance of the compensated series motor, in which the effect of speed is to increase the apparent resistance of the armature, which possesses negligible reactance, the armature of the compensated repulsion motor possess at starting the major portion of the apparent reactance of the motor, and the effect of increased speed is to decrease such apparent reactance continually. The motor has the advantage of working at practically unity power factor, due to the property of com-

mutator motors with short-circuited brushes having no inductance at synchronous speed and negative inductance above that speed. When employed for railway work, the speed control is obtained by a series variable-ratio transformer, the primary of which is in series with the main field circuit, and the secondary is connected to the main brushes. There need not, therefore, be any direct connection between the stator and armature, and the variable-ratio transformer permits of obtaining a number of speed-load curves. The motors operating on the electrified lines of the Brighton Railway are, as is well known, of the compensated repulsion type.

Another type of single-phase commutator motor that has proved suitable for traction purposes is the Déri motor, as fitted to the motor-coaches running on the Martigny-Orsières Railway in Switzerland. The advantage of this motor is that speed control may be obtained by shifting the brushes, with the result that all contactors and other voltage-regulating arrangements are eliminated. The stator winding is entirely independent of the armature, and current can, consequently, be supplied to these motors at pressures appreciably higher than those permissible with series compensated motors. On the commutator are two sets of brushes—one fixed and the other movable, and the fixed and movable brushes are connected together by means of flexible cables. To bring the armature to rest the movable brushes are shifted so as to be in line with the axis of the stator; but by turning this set of brushes out of this position, the armature is made to revolve. When the movable brushes shift away from the fixed brushes, the flexible cable maintains electrical connection between them, and when the brushes are brought together there is, of course, no difference of potential across the brushes. Thus no current flows in the armature. Under these circumstances, the only current taken by the motor is the magnetising current, for the conditions correspond to those which prevail when a transformer is connected to the mains without load on the secondary. But as soon as the movable brushes are shifted away from the fixed brushes, current flows in the armature winding and a torque is developed. The Déri motors employed on the Martigny-Orsières Railway are four-pole machines, and are designed for a pressure of 500 volts and a periodicity of 15 cycles per second.

The experiments made on the Midi Railway are very interesting, because every traction motor of importance has been tried. One of the conclusions arrived at was that ordinary repulsion motors are most satisfactory when running at synchronous speeds, a fact that is now pretty generally recognised. It happens that the transformer cross field in these motors is of such phase as to induce in the short-circuited armature coil by rotation a pressure which practically counteracts the harmful sparking voltage, and this cross field is of approximately the correct strength for compensating the sparking voltage when the speed attains the synchronous value. This simple fact, it seems, has settled the future of repulsion motors, for such motors are best adapted for operating near the synchronous speed. At speeds above synchronism the transverse field increases in strength, the commutation becomes unsatisfactory, and the iron losses increase.

On some single-phase motors it is customary to impress a certain voltage on the armature and main field winding, and another voltage on the compensating winding, and these motors are sometimes called series repulsion motors. The two voltages may be taken from different parts of the main transformer or from the same part of it. Imagine an armature connected in series with a main field winding and a compensating winding, and also connected to the secondary of a transformer like an ordinary series compensated motor, then if a tapping be taken from the transformer and be connected to the junction between the main field and compensating winding, we have what is sometimes called the series repulsion or doubly-fed motor. The effect of the additional transformer connection is that at the higher speeds the commutation is improved. The so-called series repulsion connection is therefore adopted as a running connection—that is, when the motor is running above its synchronous speed.

The locomotive built by the French Thomson-Houston Co. for the Midi Railway is fitted with series repulsion

motors. When starting, the brushes are short-circuited, and current is supplied to the stator terminals, so that it passes through the main field and compensating winding. After the motor has attained synchronous speed, however, the short circuit across the brushes is removed, and the armature is connected in series with the stator windings. At the same time, an additional voltage is impressed upon the compensating winding, thus producing a local strengthening of the field, which assists commutation. This voltage, like the main voltage, applied to the terminals of the motor, is taken from the main transformer. The motors on this locomotive have 20 poles: consequently, at the working periodicity of $16\frac{2}{3}$ cycles, the synchronous speed is practically 100 revolutions per minute, and this corresponds to a travelling speed of 25 km. per hour. When the armatures are connected in series with the field windings, however, the maximum speed of the locomotive is 78 km. per hour, or about three times the speed attained when the motors are running at synchronous speed.

The locomotive built for the Midi Railway by the Ateliers de Constructions Electriques du Nord et de l'Est is also fitted with motors that are started as repulsion motors, but the field windings are afterwards connected in series with the armature. At the low speed the repulsion connection gives results in every way satisfactory. There are two commutation or compensating windings, both in the same slots, and for series working they are connected in parallel. They each have a different number of turns and different cross sections, and are, of course, displaced 90 electrical degrees from the main field which provides the torque. When the motors run as repulsion motors the brushes are short-circuited and the current is fed into the machine through the main stator and compensating winding. Under these conditions, however, only one of the commutation windings is active.

The French Westinghouse Co. also built a locomotive for trial on the Midi Railway, and the motors fitted to it are ordinary series compensated motors, which transmit their power to the driving wheels through gearing, whilst the locomotive built by Brown-Boveri is fitted with Déri motors controlled by shifting the brushes. There are, of course, other kinds of single-phase commutator motors besides those which have been mentioned—such as reverse doubly "fed motors." Innumerable schemes of connections have, in fact, been devised for these machines, but it is doubtful if many of them are of any real practical value.

The motors referred to, however, have all proved themselves suitable for electric traction purposes, and some have been in service for a considerable time.

MERCURY RECTIFIERS FOR LARGE OUTPUTS.

EXCEPT in matters of detail, there has been no important change in the construction of large mercury rectifiers during the past five or six years, but there are now a number of installations which have been in satisfactory service for some years, and the popularity of large mercury rectifiers will undoubtedly continue to increase, for they offer the nearest possible approach to the ideal "static converter." Rectifiers of this type have been in use for years without requiring any renewals or repairs, and with only intermittent use of a vacuum pump. The principal features of a modern "ironclad" mercury rectifier may be gathered from fig. 1.* The main working space A and the condensing chamber B are enclosed by steel cylinders with strong steel end plates U and D. The bottom plate carries the insulated mercury cathode K, and the main anodes E pass through the ring D. Six or 12 anodes are used (for 50, 100, or 200 amperes each), and they are mounted concentrically with the cathode on as large a diameter as possible. The condensing chamber is welded to the anode ring D, and the latter makes a gas-tight but removable joint with the main chamber. The top plate of the condensing chamber carries the ignition solenoid, vacuum connection (V), and eye-bolt. The main and condensing chambers are provided with water jackets ST, which lead into annular spaces QR in the anode ring. These spaces are connected by radial cooling channels, hence the leading-in equipment is kept cool. Both the anodes and the cathode are cooled (by F and L respectively); and O P represent the fall and rise pipes for the water circulation. A compound

packing of asbestos and mercury is found most effective in preventing leakage of air through the anode bushes, &c.

A mercury trough U is mounted below the condensing chamber, and arcs emanating from the anodes are received within a funnel-shaped collector, the bottom opening of which is submerged in the mercury cathode. Reaching down to the centre of the cathode screen M is an iron striking anode H, which is operated by the solenoid J, so as to strike an arc on the mercury when commencing operation. One or two auxiliary exciting anodes G are fed with direct or alternating current, and ensure that the rectifier remains ready for immediate service, even though the load current be zero for some time (e.g., in tramway service all the cars may be stopped simultaneously).

The two values of maximum cathode current at present adopted as standard by the Gleichrichter A.G.† are 250 and 500 amperes at 110 to 800 volts. It is remarkable that one and the same rectifier can be used for any voltage within the specified limit. Also, by using 6 or 12 anodes, the same type of rectifier can be used for full output from one, two or three-phase networks. When the output of a single rectifier is insufficient to meet the needs,

several may be used in parallel and put into or out of commission like a single machine. Five 500-ampere rectifiers, for instance, yield 1,875 kw. at 750 volts.

Connections. In order to use several rectifiers in parallel, choke coils are connected in the anode branches. These may be arranged as current dividers (see fig. 2), which arrangement has the advantage of small energy consumption, but generally necessitates simultaneous working of the paralleled units. The choke coils in the circuit shown in fig. 3 have somewhat higher energy consumption and increased inductance, which is useful in damping out the current pulsations. Further, this method of parallel connection permits rectifiers to be switched on and off as desired. If each rectifier has a main transformer, the total voltage drop is sufficient to ensure satisfactory parallel working between rectifiers and/or other current-supplying equipment, without using choking coils. By connecting the transformer primary in star or delta, and using suitable choking coils, the total regulation of the rectifier may be made anything between 5 per cent. and 17 per cent., according to the characteristics of the D.C. source or sources with which it is to be paralleled. By using choking coils connected as in fig. 4, a practically constant D.C. pressure can be obtained from the rectifier at all loads from light to full, without the aid of governors or other

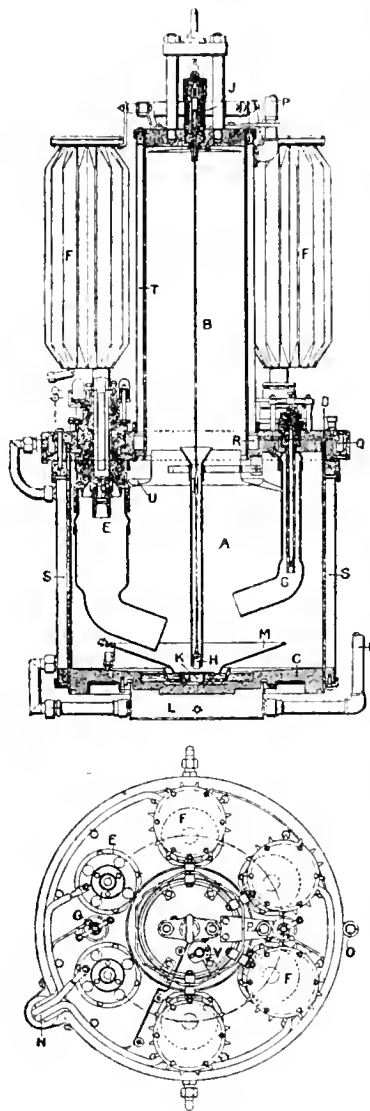


FIG. 1.

special gear. For instance, in a certain case, the open-circuit D.C. pressure of 500 volts fell to 140 volts (i.e., by 12 per cent.) at a current of 5 amperes or less, but thereafter remained practically constant up to a load exceeding 200 amperes.

Induction regulators or step transformers may be used for voltage regulation, and anything up to ± 5 per cent. variation in D.C. pressure may be obtained by tapings on the main transformer of the rectifier. A cheaper and more flexible system for use in charging accumulators consists of three choking coils with an adjustable core, which can be set by means of a hand wheel on the supporting spindle. The choker is connected between transformer and rectifier in the anode leads.

It is one of the advantages of the modern mercury rectifier that

* i.e., the Rectifier Co., founded at Glarus in 1913 by the Brown-Boveri Co. (Switzerland), and Hartmann & Braun (Frankfurt-on-Main). Hartmann has secured a compulsory licence to utilise the Cooper-Hewitt D.R.P. 157,642, so that there is now no difficulty in the way of constructing and marketing large mercury rectifiers. Their sale is said now to be turned over to Brown-Boveri & Co., Baden and Mannheim.

* Reproduced from a recent issue of the E.T.Z., whence these notes are derived.

it needs practically no attendance or maintenance. Neither the mercury cathode nor the iron anodes decrease appreciably in weight during several years' working, and it is generally possible to work without an air pump after a few months' operation. The only attendance then required is to start the rectifier by closing a switch or press-button in the striking-solenoid circuit. Starting occupies only a few seconds, which contrasts favourably with the time required to start a rotary converter.

Until the rectifier has settled down to steady conditions, it is necessary to check its vacuum from time to time. This may be done by the aid of a McLeod vacuum meter, or the electrical device illustrated in fig. 5 may be employed. The principle of this device is obvious from the figure, and the vacuum meter may be placed at any distance from the rectifier.

Commercial Installations.—One of the first commercial installations of large mercury rectifiers was set to work about five years

between a quarter and full load, according to the demand for air. The mercury rectifiers tested are not affected adversely by this fluctuation, and comparison of the high-tension A.C. and the D.C. meter readings shows an average efficiency of 87 per cent., including all losses.

Since the autumn of 1915, two 150-kw., 600-volt mercury rectifiers have been used in the converting sub-station of the Limmattal tramway (Zurich-Dietikon). Formerly two motor-generators had to be kept running in order to cope with the peak loads, and the mean cost of current worked out at 0.59d. per car-mile. Now, however, either of the two mercury rectifiers can deal with the peak loads of 400 to 450 amperes, hence one rectifier is in reserve, and the mean cost of current has been reduced to 0.44d. per car-mile—i.e., a saving of about 26 per cent. Successful tests were made in the way of operating the rectifiers in parallel with existing motor-generators and the overhead network of the tram-

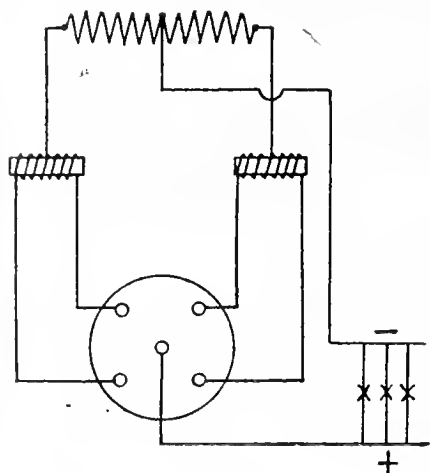


FIG. 2.

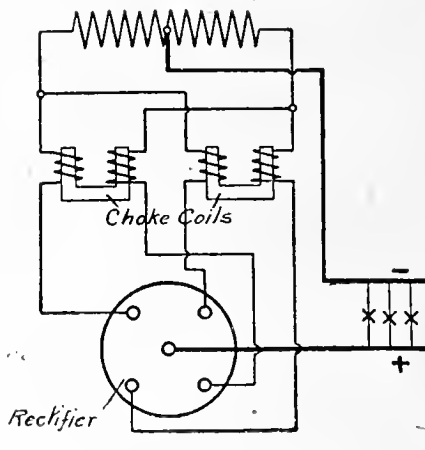


FIG. 3.

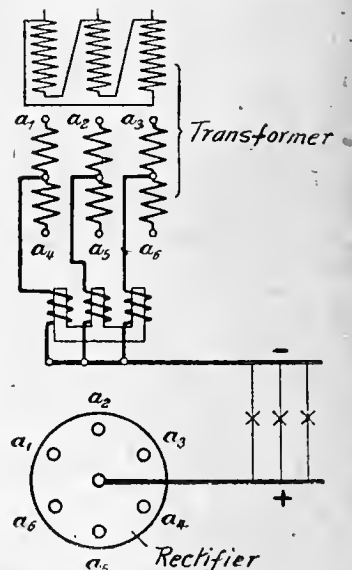


FIG. 4.

ago in J. F. Macks iron foundry at Rodelheim (Frankfort-on-Main). The rectifier concerned delivers 80 kw. at 220 volts, and showed soon after its installation that it was possible to pass leading-in connections through a steel container, and to keep them insulated from the latter, whilst yet maintaining the necessary high vacuum (about 0.03 mm. mercury) without continuous use of a vacuum pump. This rectifier operates on single-phase supply, which is less favourable than polyphase current, and no better evidence of its satisfactory working could be desired than the fact that it is proposed to extend the equipment using similar rectifiers.

A 20-kw. mercury rectifier (110 to 165 volts), installed in the Hordt sub-station (Strassburg) in 1912, realises the good average efficiency of 85 per cent., and in this particular installation its noiseless operation is a valuable feature. More recently, a 53-kw.,

ways, the voltage drop of the motor-generators being about 14 per cent. at full load. Circumstances do not require these rectifiers to be operated regularly in parallel with the motor-generators. A certain amount of disturbance was at first occasioned in telephone circuits, but since correcting defective insulation, speech has been as clear as when the tramways were operated with pure direct current. The oscillograms in fig. 6 show the current and pressure pulsations on the D.C. side of the rectifier. The comparative smallness of the pulsations is due to three-phase supply being used and to the high inductance of the series traction motors. The latter have not run appreciably warmer since the introduction of the rectifiers. The rectifier cylinders employed are each capable of 250 amperes continuous output, but the load conditions require an average output of only 90 amperes, with momentary overloads up to 450 amperes. Each rectifier is cooled by water circulating through an elevated cooling tank of corrugated iron, and, apart from adding water from time to time, the cooling system requires no special attention. After some month's operation, the air pump can be put permanently out of service. Alternating current excitation is provided to ensure that the rectifiers keep in commission, even should the current consumption fall temporarily to zero.

In the Norstadt sub-station of the Pforzheim municipal electricity station, the primary supply at 5,120 volts, 50 cycles, is converted to 110/220 volts D.C. (three-wire system). Four rectifiers,

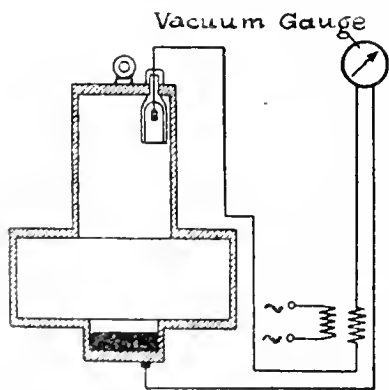


FIG. 5.

230-volt, rectifier has been installed in the Dettweiler sub-station, this rectifier working alone or in parallel with a dynamo, according to the current required. Tests have shown that as little as 10 amperes rectified current may be taken without impairing the stability of working.

A battery-charging rectifier of 15-kw. output at 110 volts has been in use at the Charlottenburg Technische Hochschule since 1914 with satisfactory results; and the Maschinenfabrik Lanz (Mannheim) is putting in a 300-kw. installation of the latest type of mercury rectifier. Messrs. Brown, Boveri & Co. (Baden, Switz.) have had an interesting converting station (115 kw., 220 volts) in service for two years past for testing rectifiers on long-continued load. A 165-kw. D.C. motor with commutating poles forms the load. The motor drives an air compressor, and the load fluctuates



FIG. 6.

each yielding 75 kw. at 110 volts, or 150 kw. at 220 volts, are mounted side by side on a common plinth. The equipment feeds the town lighting and power network, and the rectifiers have to work sometimes in parallel with D.C. generators and with a rotary converter. Primary induction regulators in front of the rectifier transformers permit of ± 10 per cent. voltage regulation. The air pump and induction regulator are mounted inside the plinth. Water circulation is provided to cool the rectifier container; about 10 gallons of water per hour are required per 100 amperes useful current.

In the Plauensche Grund electricity station (Denben-bei-Dresden) mercury rectifiers have been used since the beginning of 1916 to convert primary high-tension two-phase current to direct current at 530 volts for traction purposes. The two phase voltages may

differ by as much as 10 per cent. in the course of a day, and, to compensate for this, a single-phase induction regulator may be connected in the leads of one phase, whilst for overall voltage control a two-phase main regulator may be connected in front of the rectifier. One or two of the rectifiers are generally in reserve. The rectifiers work alone or in parallel with the buffer battery or traction generators. The current output varies generally between 100 and 650 amperes, and the maximum voltage drop on the rectifier bus-bars is about 10 per cent. Another rectifier installation of equal power and voltage is in service at the Döhlen Steel Foundry (Dresden). In this case the current output varies from 600 to 800 amperes at 530 volts. This equipment was set to work early in 1916, and up to last October had delivered more than 1,000,000 mmts (D.C.). The D.C. and high-tension A.C. meter readings show an average overall efficiency exceeding 90 per cent. The rectifiers work in parallel with an 850-kw. Siemens-Schuckert turbine-dynamo and a 300-kw. Brown, Boveri set, except on Sundays, when the steam plant is shut down, and the rectifiers carry the whole D.C. load.

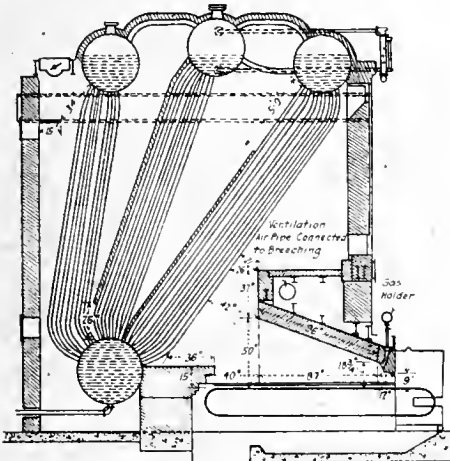
Two large installations which are in course of erection are a 500-kw., 400-volt, rectifier equipment for the Hirschberg electricity station, and a 600-kw., 800-volt, equipment for the Berggeist station.

The capacity and security of working of the mercury rectifier may soon be raised to the level attained in A.C. transformer practice. If it is found possible to deal with pressures up to or exceeding 5,000 volts, a particularly wide and valuable field of application is opened for rectifiers in electric railway practice. At such high pressures the loss in the rectifier would be negligible in comparison with the transformer losses and those in the line. The overall efficiency of the conversion would exceed 97 per cent. Possibly the rectifiers would be installed in sub-stations along the line, or they might be carried on the locomotives themselves, as has already been done experimentally in America. As regards producing very heavy currents for electrochemical purposes—say, 100,000 amperes or more, there is no reason to anticipate any insuperable difficulty, since rectifiers and groups of rectifiers can now be operated quite successfully in parallel.—S. M. POWELL.

COMBINED COAL AND COKE-OVEN GAS FIRING.

In view of the great interest which is being taken in fuel economy at the present time, and the efforts which will undoubtedly be made in the future to utilise all available sources of waste heat, particularly in connection with electrical generating stations, where in many cases it would not be possible to depend entirely on gas firing, the following particulars of the practice followed by the Toledo Railways & Light Co., U.S.A., at its Water Street Station, described in a recent issue of the *Electrical World* by O. W. Morgan, may be instructive:—

This company decided to adopt apparatus for the simultaneous burning of coal and coke-oven gas with a view to increasing boiler output to meet the growing load.



ARCH AND BAFFLE CONSTRUCTION IN TEST BOILER.

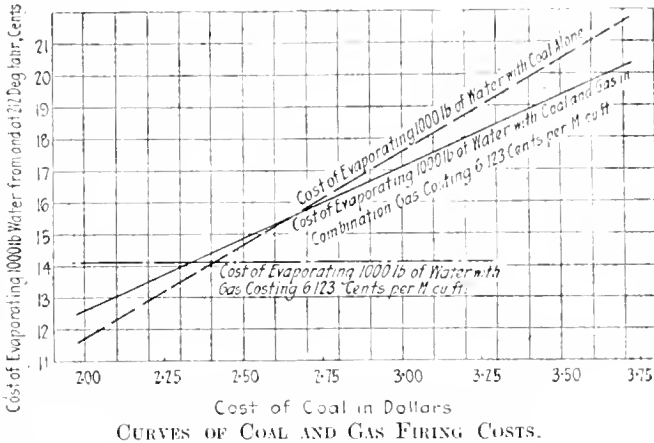
The conditions which made this solution of the problem possible were as follows:—The Toledo Furnace Co. installed a by-product coke oven, and contracted to sell the entire gas output to the Atlas Chemical Co. The latter concern, under its contract, is receiving about 9,000,000 cu. ft. of rich gas each 24 hours in excess of its needs. The chemical company needs only the lean gas for its operations. Therefore the rich gas, which has an average heating value of about 600 B.T.U. per cubic foot, and which is the "first-run gas" from the ovens, is being delivered to the Toledo Railways & Light Co. through a 20-in. main, which is approximately four miles long.

Experiments were tried with several different methods of combining gas and coal firing, but it is now thought that burning coal and gas at the same time in the same furnace proves most economical, and a number of boilers have been equipped for this.

In the earlier experiments gas alone was fired, the flame being directed on to broken fire brick spread over the grate surface, in order to deflect it and prevent it from directly striking the tubes. This arrangement was successful up to 175 per cent. rating, but would not do for higher outputs. To increase the overload one boiler was equipped with a Dutch oven furnace, and 263 per cent. rating could be obtained, but the installation was inflexible.

Finally the gas was burned directly over the coal, a specially-shaped tile, with a 2½-in. gas inlet hole, being fitted in the front of the ignition arch, set so that the gas would be directed down against the coal. No air was admitted except that coming through the fuel bed.

A Stirling type boiler was employed, with 6,680 sq. ft. heating surface and 256 sq. ft. superheat surface; 200 lb. boiler pressure and 100 deg. F. of superheat. It was equipped with a Bailey boiler meter, and chain-grate stoker 10 ft. wide and 11 ft. 7 in. long, having 21.5 per cent. of air space through the links, and a speed of 4 in. to 9 in. per min.



The gas burner consists of a 1½-in. pipe, with a cap drilled with seven 7/16-in. holes, inserted in the hole in the tile.

Five tests were made, some of them being check tests, on coal, coal and gas, and gas firing, and the results are tabulated herewith:—

COMPARISON OF BOILER PERFORMANCE BURNING COAL AND GAS SEPARATELY AND COMBINED.

	Coal alone.	Coal and gas.*	Gas alone.
Pounds of coal used per hour	1,374	1,426.3	—
Pounds of equivalent coal used per hour	—	1,278.5	2,006
Equivalent pounds coal burned per square foot of grate surface	37.8	49.1	17.45
Cubic feet of gas burned per hour	—	29,163.0	47,785.00
Cubic feet of gas burned per pound of dry coal	—	6.61	—
Per cent. of ash and refuse to total coal	18.80	21.43	—
Per cent. of rating developed	162.25	213	88.7
Temperature of flue gases leaving boiler (in deg. F.)	640.1	683.5	516.6
Draught over fire	0.363	0.2875	0.0316
Draught in uptake under damper	0.920	0.820	0.0573
Efficiency of boiler grate and furnace in per cent.	61.4	61.6	72.95
Efficiency of boiler and furnace in per cent.	66.1	68.9	72.95
Pounds of combustible in ash	385.7	517.9	—
Per cent. combustible in ash to total coal burned by weight	8.8	11.7	—
Speed of chain in inches per minute	6.64	6.94	—
Cost to produce 1,000 lb. of steam from and at 212° F. (in cents)	11.65	12.58	14.10
HEAT BALANCE—per cent.:			
CO ₂ in flue gas	10.43	12.37	6.75
O in flue gas	10.50	4.85	7.85
N in flue gas	79.07	82.78	85.40
Over ventilation	102.0	29.1	53.5
Heat absorbed by boiler	61.38	61.62	72.95
Loss by moisture in coal	0.34	0.30	—
Loss by burning hydrogen in coal and gas	4.13	6.16	12.58
Heat lost by dry chimney gases	16.87	13.72	9.59
Heat lost by unconsumed carbon in ash	2.50	9.76	—
Heat lost by apron water	0.72	0.59	0.15
Heat unaccounted and unaccounted-for losses	7.06	7.85	4.73

* Average of two tests.

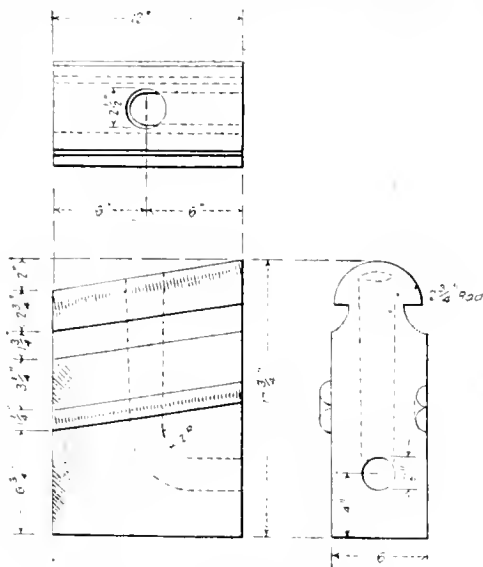
† Average of one test.

Practically equal amounts of coal were burnt with and without gas, so that the additional rating was due to the gas. The additional rating was 31 per cent. over that with coal alone.

The temperature of the flue gas leaving the boiler was 43 deg. F. higher with combined firing than with coal. Better results were obtained with a lower stack temperature with combined firing than with coal firing; the efficiency of boiler, furnace, and grate were a little higher in the former case, also the amount of combustible by weight in the ash was greater than with coal alone.

Owing to the low ultimate CO_2 (10.8 per cent.) obtained by complete combustion of coke-oven gas, the ultimate CO_2 from the combination firing was lower than for coal alone.

The results showed that the cost of evaporating 1,000 lb. of water from and at 212 deg. F. is 8 per cent. higher for



GAS-NOZZLE TILE USED IN TEST BOILER.

combined firing, and 21 per cent. higher for gas firing than for coal alone. The company, however, obtained, with combined firing, 31 per cent. added capacity for the 8 per cent. increase in cost, and at 50 per cent. less investment than would have been required with coal.

IMPEDANCE OF STEEL RAILS.

In the design and operation of alternating-current traction systems in which rails are used as electrical conductors, accurate knowledge of rail impedance is of no little importance. In order to add to this knowledge, the research division of the electrical engineering department of the Massachusetts Institute of Technology has conducted a research to determine, by direct measurement, the impedance offered to alternating currents by standard steel rails of various shapes and sizes, and also to ascertain how this impedance varies with frequency and with current strength. Furthermore, it was desired to find, if possible, a simple theory by means of which the rail impedance can be calculated from physical data concerning the steel used in the rails and from the dimensions of the rails.

The rails employed in the tests were of standard length, 33 ft. (10.07 m.), and ranged in weight from 60 lb. to 100 lb. per yard

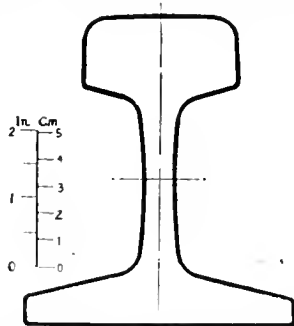


FIG. 1. EQUIVALENT SKIN DEPTH OF ALTERNATING CURRENT PENETRATION OF STEEL RAIL.

(30 kg. to 50 kg. per m.). Frequencies of 25 and 60 cycles per second were used; a few tests were also made at 15 cycles per second. The rail current strengths employed varied from 10 amperes to 800 amperes R.M.S.

In order to obtain the results desired, it was necessary to measure, in addition to the direct-current resistance, the alternating-current voltage drop and current in the rail and the phase angle between them. The alternating current potentiometer was found most satisfactory for these particular tests.

The ratio of alternating-current resistance to direct-current resistance, called "resistance ratio," was found in practically all cases tested to reach a maximum value within the limits of rail current from 10 amperes to 800 amperes R.M.S. This maximum value of resistance ratio, at 25 cycles per second, was observed to vary between 5.3 and 10.1 for 10 track rails and between 10.9 and 13.4 for two contact rails. For most rails the lowest observed value of resistance ratio of a sample was from 40 to 60 per cent. lower

than the maximum value for that sample at constant frequency, the reason for this large range of resistance ratio being the variation in the permeability of the steel at the various flux densities corresponding to different strengths of rail current.

The equivalent skin depth of alternating-current penetration—defined as the thickness of uniform rail skin which would offer the same resistance to a direct current as the entire section offers to an alternating current—was found, by calculation from the experimental results, to be 1.5 mm. ($\frac{1}{16}$ in.) for a typical rail at 25.5 cycles per second and at maximum permeability. (See fig. 1.)

The maximum observed skin-effect resistance ratio was found to vary substantially as the square root of the impressed frequency between the limits of 25 and 60 cycles per second.

The self-inductance of the rails was also found to increase, with increasing current, and to reach and pass a maximum value, for current strengths up to 800 amperes, the total change of inductance varying, for the different rail samples, from 15 to 30 per cent. approximately.

The rail inductance is greater at 25 cycles per second than at 60 cycles per second, but the rail reactance at 60 cycles per second is greater than that at 25 cycles per second.

From the experiments conducted, it would seem that the skin-effect resistance ratio of a rail to a given alternating-current frequency and current strength can be approximately calculated by a simple formula involving measured values of direct-current conductivity and permeability of the steel, the area of cross-section of the rail, the rail perimeter, and an experimentally-determined factor to cover certain discrepancies. This factor appeared to be not more than 1.3 at the maximum skin-effect ratio.

The complete report on the investigation, entitled "Experimental Researches on the Skin Effect in Steel Rails," by A. E. Kennelly, F. H. Achard, and A. S. Dana, is available as Research Bulletin No. 12 of the Electrical Engineering Department, Research Division of the Massachusetts Institute of Technology.—*Electrical World*.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The Teagle Ignition Magneto.

It is not only in this country that increasing attention is being devoted to the manufacture of high-tension magnetos for automobile ignition purposes, in order to make sure that enemy-produced machines shall never again dominate the market as they did in pre-war days. It is the same in the United States, where not only are the older magneto makers extending their factories, but several new magnetos have recently made their appearance. Among the latter is the Teagle, made by the TEAGLE CO. of

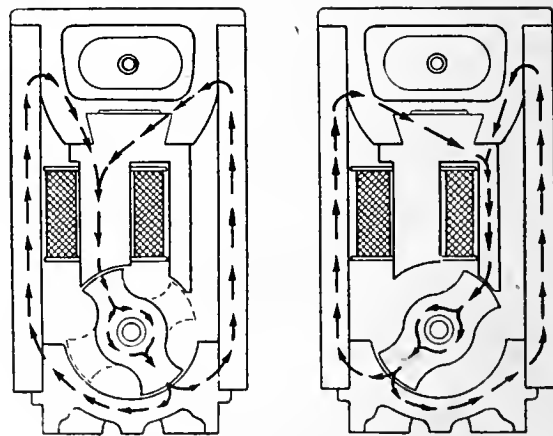


FIG. 1.—MAGNETIC CIRCUITS, TEAGLE H.T. MAGNETO.

Cleveland, Ohio, and of which we are this week able to give some particulars.

The new machine, which has been specially designed for use in connection with the engines of industrial motor vehicles and tractors, is of the inductor type, in which the coils in which the current is induced are stationary, the only rotating parts being the distributor arms and gears, and the shaft with a laminated rotary armature attached to it. There are no moving wires, slip rings, or brushes, with the exception, of course, of the collector brushes in the distributor. The quality of metal used in magneto manufacture has much to do with the efficiency of any given design, on the one hand, while, on the other, the technical difficulties encountered in connection with the working up of the material renders simplicity of design a fundamental of magneto quality and efficiency. It is claimed that this is a special feature of the Teagle magneto, as, instead of being of the usual horseshoe pattern, the permanent magnets are of the bar type, which can be easily ground with the requisite accuracy, and also heat-treated; the magnets are

securely clamped to top and bottom yokes of grey iron, and of liberal section. The field is formed, bored, and ground as a single piece to ensure true alignment of the bearings and pole faces: and the stationary coil, condenser, and laminated pole-piece are likewise assembled as a unit, and mounted integrally with the top. The bottom yoke forms a pole-piece extending nearly half way round the rotor tunnel, while the top yoke has two poles, one carrying the windings or coils, and the other serving as a magnetic by-pass.

The magnetic circuit is shown diagrammatically in fig. 1; in one case, the rotor-pole is shown opposite the pole of a top yoke, which carries the coils, and, with the rotor in this position, the maximum flux passes through the coils. In the other case, the rotor is shown opposite the end of the magnetic by-pass, and in this position all the magnetic flux passes through the by-pass, and none through the coils. As the rotor has two poles, the flux through the coils passes through a maximum, and a minimum twice every revolution of the rotor. Another feature of the machine is the unidirectional direction of the current—that is to say, the same electrode is always the positive, this being due to the special characteristics of the magnetic flux. The further result of this unidirectional direction is that the current goes to build up, instead of to weaken, the strength of the magnets. Again, there is no break in the magnetic flux, with its resulting electrical wear and

The manner in which the luminous radiation from the hot body is balanced against that from a standardised source will be understood by reference to fig. 1. *L* is a lens by which rays from the hot body are brought to a focus in the plane *F*, where there is located a tungsten lamp filament. By means of the eyepiece *E*, the observer views the incandescent filament, which appears to lie upon the image. By means of a rheostat in a case slung about the neck, the case also containing a storage battery and milliammeter, the current through the lamp is adjusted until the brightness of the filament is just equal to the brightness of the image produced by the lens, so that the filament becomes indistinguishable upon the background formed by the hot object. The observer then notes the reading of the milliammeter, which may be provided with a special scale to read in degrees of temperature, or the temperature corresponding to the current may be read from a calibration curve.

The adjustment is made with great accuracy and certainty, as the effect of radiation upon the eye varies some 20 times faster than does the temperature at 1,300° F., and some 14 times faster at 3,000 F.

At high temperatures the light emitted by both the hot body and the filament would become dazzling and comparison would be difficult. For this reason a red glass is placed in the eyepiece at *n*,

which has the further advantage that light of only one colour then reaches the eye, and no difficulty is introduced by lack of colour identity between the light emitted by the hot body and that emitted by the filament. The intensity of light radiation of any one colour increases progressively in a definite manner as the temperature of the radiating body rises, and nothing is therefore lost by eliminating all other light from the comparison. As only brightness, not colour, of light is matched, inability to distinguish colours and colour-

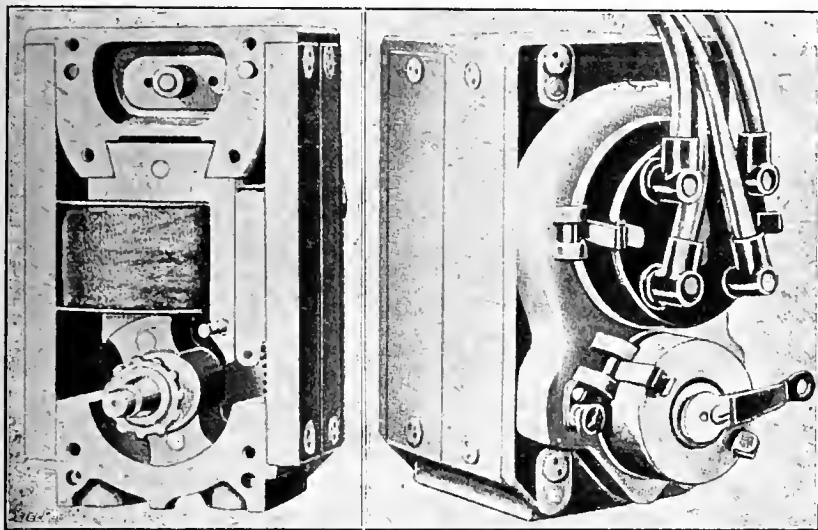


FIG. 2.—MAGNETO WITH END PLATE REMOVED.

FIG. 3.—TEAGLE MAGNETO.

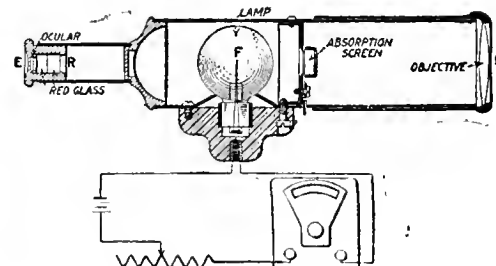


FIG. 4.—SECTION THROUGH PYROMETER, ALSO ELECTRICAL CIRCUIT.

tear, as the flux starts from the magnets, flows up on each side, through the head casting, down through the laminated pole-piece, then through the stationary coil, thence through the vertical (flux) distributor to the base, and, finally, to the lower ends of the magnets. Now, as the distributor to the sparking plugs revolves, it leaves the segment of the laminated pole-piece, extending through the coil, and comes into proximity with the by-pass, through which the flux passes, instead of through the coil, its path being otherwise the same as before.

The plain bar shape of the magnets, of course, facilitates the calculation of the ratio of the cross-section to length in order to obtain the best efficiency, a result that is further assisted by the unidirectional of the current owing to the re-magnetising instead of de-magnetising action thereof. The coils, too, are so proportioned as to minimise all tendency to surging and high-frequency oscillation; and being stationary, there should be no mechanical strains set up by centrifugal action.

The circuit-breaker and the distributor, which are the only parts requiring occasional attention, are both readily accessible for cleaning or adjustment. The electrical connections are protected by insulating material, and excess voltage strains are obviated by an enclosed safety gap, which is visible and readily accessible. The metal of the distributor gears is, as usual, of steel and bronze, while the bearings for the gears are cast integrally with the front die casting. Two sparks are produced per revolution, the sparks having high-initial voltage, and of sufficient duration to ensure complete combustion.

The Teagle magneto is made in two types, in both of which the simplicity of design and construction is claimed not only to result in mechanical and electrical advantages, but to permit comparatively cheap cost of manufacture, notwithstanding the high quality of the material and workmanship. Both types of machine are claimed to be proof against the action of water, dust, and oil, and, as they can be fitted with impulse starters, the hard work of quickly starting up high-powered engines is eliminated.

An Optical Pyrometer.

The eye is very sensitive in comparing the brightness of two surfaces when one is superposed upon the other, and after having arranged to have light from a hot body and light from a standard of comparison viewed in this relation, they can be made equal by varying the intensity of the standard of comparison.

The LEEDS & NORTHRUP Co., of Philadelphia, working under the fundamental Morse patents, has lately developed this type of optical pyrometer. The instrument is suitable for measuring from dull red (about 1,100° F.) up to the highest known temperature.

blindness does not interfere with the use of the instrument. In fact, in the region of temperatures used for hardening steel, for example, different observers using this instrument are said to agree in their readings within 6° Fahrenheit.

The brightness of the image of the hot body produced by the lens *L* is almost constant, irrespective of the distance from the hot body, although the size of the image varies with the distance. Since it is the brightness of the image and not the total radiation received through the lens that is measured, it is possible to measure the temperature of a small body or of a body at a distance equally as well as that of a large body or one near at hand.

In observing bodies at very high temperatures, the light received through the lens would be too blinding for direct observation, even through the red glass of the eyepiece, and the intensity of the image might also become greater than that at which it is practicable to burn the tungsten filament, so that a balance would become impossible. Therefore a screen is used, placed between the lens and the image so that it reduces the light from the hot body, but not that from the filament. The screen can be thrown into or out of the field of view by means of a milled disk projecting through an opening in the tube of the instrument. With the absorbing screen in use, a different milliammeter scale or calibration curve is required; but as the range of the instrument without the absorbing screen overlaps by many hundred degrees the range with the absorbing screen, the accuracy of the two scales can always be checked by observing a hot body whose temperature lies within this range.

The constancy of the lamp has been investigated exhaustively by the United States Bureau of Standards and by the National Electric Light Association, also in the laboratory of the Leeds and Northrup Co., and it has been found that after a tungsten filament is thoroughly aged—that is, burned for some time at a temperature higher than that to which it will be subjected in service—no sensible variation occurs. The instrument is so designed that one lamp can quickly be replaced by another, and by keeping two lamps, their correctness can be insured by checking one against the other.

The instrument itself is handy and portable, weighing but a few ounces, and can be sighted as easily as an opera glass. The case containing the battery, rheostat, and milliammeter weighs about 10 lb.—*Power*.

Engineering Wages.—The executive of the Federation of Engineering and Shipbuilding Trades has placed on record a protest as to the inadequacy of the 3s. award which came into operation on August 1st.

ELECTRIC POWER FOR STEEL MILLS.

The following has been taken from a report of the Central Station Power Committee of the AMERICAN ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS.

The power requirements in steel mills generally range from 1,000 to 10,000 kW. or more. A fair average is about 4,000 kW. The load is characterised by large peaks. Where alternating current is used the power factor will vary from about 65 to 80 per cent. Large generating capacity is required to provide service of the proper regulation. Table I has been compiled from data obtained from a number of steel mills, and shows the generating capacity actually installed, together with the connected load in motors and lighting.

In all large modern central stations the power is generated and transmitted as alternating current at a high voltage. At the receiving end of the transmission line this power must be transformed down to at least two, and generally three, lower voltages, namely, 6,600 or 2,200, 110 or 220, and 110; and where direct current is used it has to be converted from alternating to direct current. The 6,600-volt or 2,200-volt current is used for driving the motors of the motor-generator sets, also the large motors driving the mills and some of the larger auxiliaries (say from 100 H.P. up for the 6,600-volt and 50 H.P. up for the 2,200-volt) for driving pumps, fans, blowers, &c., in situations where these voltages can be used without danger.

TABLE I.—INSTANCES OF GENERATING CAPACITY ACTUALLY INSTALLED.

Generating capacity.			Connected load.			Energy.	
Total kW.	No. of units.	Largest unit.	Motors. No.	Motors. Total H.P.	Light. kW.	Total kW.	kW.-hours per year.
10,400	8	3,500	950	49,790	750	44,565	27,072,000
1,650	3	550	202	6,870	125	6,171	4,325,000
9,503	8	2,500	730	26,570	490	23,871	38,725,000
10,650	8	2,000	464	20,640	490	18,653	30,548,000
6,450	8	3,000	1,280	37,730	750	34,005	18,950,000
15,400	11	2,500	252	9,787	146	8,759	73,117,000
2,000	5	400	400	11,525	563	10,705	9,970,000
2,200	4	550	204	4,531	120	4,106	5,432,000
2,150	4	550	398	13,117	220	11,763	7,594,000

For the remaining auxiliaries the voltage is further reduced to 110 or 220 volts. Motors wound for these voltages have a wide range of application, covering almost all classes of service in the mill, especially where constant-speed characteristics are required. For lighting, 110 volts is generally used and transformed from either of the above voltages. In all of the above transformations a certain percentage of power is lost. In some contracts the purchaser pays for all transformation losses; in others, the power supply company pays for the losses of the first transformation and the purchaser for all others. A summary of the losses is given in Table II:—

TABLE II.—PERCENTAGE OF LOSSES INCURRED IN TRANSFORMATION, &c.

	Original power delivered.	Losses from line to 6,600, or 2,200 volts.	Losses from H.P. trans- former to feeder station.	Losses 6,600 or 2,200 volts to 110 volts.	Losses 440 volts to 110 volts.	Losses in con- version.	Net power deli- vered to feeder station bus- bars.
Mill drives...	100	2.5	7.5	—	—	—	90.2
Alternating-current auxiliaries...	100	2.5	7.5	2.5	—	—	87.9
Lighting...	100	2.5	7.5	2.5	3	—	85.2
Rotary converters...	100	2.5	7.5	2.5	—	5	83.1
Motor-generator sets...	100	2.5	7.5	—	—	12	79.4

The 110 or 220-volt alternating-current auxiliaries can be used in almost all applications where direct-current power is used, the exceptions being where variable speed and dynamic braking are required. The direct-current motors are so much better adapted for this class of service that the disadvantage of greater conversion loss is more than compensated for by their flexibility and adaptability. Direct current will be used for cranes, tables, charging storage batteries, electrolytic work, and variable-speed motors especially those used for driving machine tools.

The alternating current is suitable for driving fans, pumps, hot saws, cold saws, conveyors, straighteners, and drill presses, but is not favoured for table drives. In general, the use of alternating-current motors is recommended where constant-speed, non-reversing conditions obtain, and the direct current where large starting torque, quick-reversing and acceleration, variable speed or dynamic braking are required.

The ratio of alternating current to direct current used will vary greatly in different plants. In general, in those plants where power is purchased and where there are many cranes and variable-speed drives, direct current will probably predominate for auxiliaries about in the ratio of 60 per cent. direct current to 40 per cent. alternating current for voltages of 110, alternating current, or less and of 250, direct current. *Iron and Coal Trades Review.*

TRADE STATISTICS OF EGYPT.

The following statement, showing the imports of electrical and similar goods into Egypt during the year 1916, is taken from the recently-issued trade statistics. The figures for 1915 are added for purposes of comparison, and notes of any increases or decreases are given:—

	1915. £E.	1916. £E.	Inc. or dec. £E.
<i>Steam engines, including boilers, &c.—</i>			
From Great Britain ...	29,000	32,000	+ 3,000
" Switzerland ...	—	3,000	+ 3,000
" United States ...	—	1,000	+ 1,000
" France ...	3,000	2,000	- 1,000
" Holland ...	2,000	—	- 2,000
" Italy ...	2,000	—	- 2,000
" Other countries ...	1,000	1,000	—
Total ...	37,000	39,000	+ 2,000

Electrical machinery.—

From Great Britain ...	11,000	5,000	- 6,000
" Belgium ...	1,000	—	- 1,000
" United States ...	1,000	—	- 1,000
" France ...	1,000	3,000	+ 2,000
" Italy ...	1,000	1,000	—
" Switzerland ...	2,000	—	- 2,000
" Other countries ...	1,000	—	- 1,000
Total ...	18,000	9,000	- 9,000

Other machinery (except agricultural).—

From Great Britain ...	39,000	48,000	+ 9,000
" United States ...	8,000	9,000	+ 1,000
" France ...	8,000	13,000	+ 5,000
" Italy ...	4,000	3,000	- 1,000
" Switzerland ...	1,000	4,000	+ 3,000
" Sweden ...	—	1,000	+ 1,000
" Holland ...	2,000	1,000	- 1,000
" Other countries ...	2,000	2,000	—
Total ...	64,000	81,000	+ 17,000

Petrol and benzine motors.—

From Great Britain ...	19,000	26,000	+ 7,000
" France ...	—	1,000	+ 1,000
" Italy ...	1,000	4,000	—
" Switzerland ...	15,000	36,000	+ 21,000
Total ...	35,000	67,000	+ 29,000

Lamps of all kinds.—

From Great Britain ...	4,000	6,000	+ 2,000
" Germany ...	—	1,000	+ 1,000
" France ...	5,000	6,000	+ 1,000
" Italy ...	3,000	6,000	+ 3,000
" Sweden ...	1,000	—	- 1,000
" Holland ...	2,000	—	- 2,000
" Switzerland ...	2,000	—	- 2,000
" Other countries ...	2,000	15,000	+ 13,000
Total ...	19,000	34,000	+ 15,000

Copper, manufactured.—

From Great Britain ...	5,000	7,000	+ 2,000
" Germany ...	1,000	—	- 1,000
" United States ...	—	2,000	+ 2,000
" France ...	5,000	6,000	+ 1,000
" Italy ...	1,000	1,000	—
" Other countries ...	—	1,000	+ 1,000
Total ...	12,000	17,000	+ 5,000

Scientific instruments.—

From Great Britain ...	14,000	19,000	+ 5,000
" Germany ...	—	1,000	+ 1,000
" United States ...	2,000	4,000	+ 2,000
" France ...	5,000	11,000	+ 6,000
" Italy ...	1,000	3,000	+ 2,000
" Switzerland ...	—	1,000	+ 1,000
" Other countries ...	2,000	1,000	- 1,000
Total ...	24,000	40,000	+ 16,000

Electric, telegraphic, and telephonic apparatus.—

From Great Britain ...	29,000	45,000	+ 16,000
" Japan ...	—	1,000	+ 1,000
" United States ...	1,000	1,000	—
" France ...	9,000	16,000	+ 7,000
" Italy ...	8,000	15,000	+ 7,000
" Sweden ...	1,000	4,000	+ 3,000
" Switzerland ...	3,000	4,000	+ 1,000
" Other countries ...	2,000	2,000	—
Total ...	53,000	88,000	+ 35,000

£E = £1 0s. 6½d.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Underground Signalling Bells.

In your issue of July 27th, 1917, and in previous issues, I have read articles on underground signalling bells, describing various methods of minimising the danger from sparking at the signalling station. These methods range from gas-tight switches placed at intervals along the haulage roads, to specially-wound bells or relays requiring a minimum current for operation.

In no case has any suggestion been made to actually suppress all danger of sparking at the point from which the signals are sent, and it will doubtless interest you to learn of a method of doing this, which I invented in 1914, and which will be placed upon the market at the conclusion of the war by Messrs. Gent & Co., Ltd., of Leicester.

With my method, the usual system, as installed, is retained, having bare wires along the haulage road, the signals being sent by bridging across the wires with a knife, or other suitable conductor. The only alteration is the addition of a special relay near the bell, which has for its function the transference of all sparking to the trembling contacts of the bell itself.

In the accompanying sketches, fig. 1 shows the signal system as usually installed, and fig. 2 shows the alteration by the addition of the special relay.

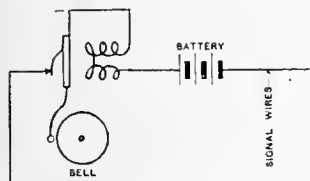


FIG. 1.

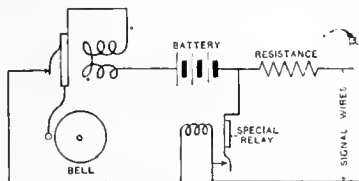


FIG. 2.

This special relay is constructed on the lines of a telephone transmitter, having a very high period of vibration, and consequently able to close or open its circuit in the shortest possible space of time; it is connected with the operating coils in series with the bell, and the contacts are arranged to short-circuit the signal wires. When the signal circuit is closed, by a knife or other means, the relay will vibrate in synchronism with the bell hammer. Sparking can only take place on the signal wires if the current is broken there; therefore, let us follow what occurs when the signal wire circuit is opened at any period during one complete stroke of the bell:—

When the bell-hammer is against the gong, the bell circuit is broken at the trembler contacts, consequently no current is flowing through the circuit, and no spark can take place when the signal wires are separated. When the hammer is away from the gong, and the trembler contacts are together; then the signal wires are short-circuited by the relay contacts, and the current for the bell passes through the relay, and not through the signal wires, consequently they may be separated without any sparking taking place. The only time that current flows through the signal wires is during the extremely short period of the lag in action of the relay, and this period is so short (less than 1/1,000 second) that even a hack-saw blade, or a file, may be rubbed across the signal wires with no danger of a spark taking place.

With this relay, all current is broken at the trembler contacts of the bell, and full provision can be made there for their protection against inflammable gases or coal dust. Practically no alteration is required to existing installations, and either alternating or direct current may be used. It should be noted, however, that it can only be used with trembler bells.

In some cases it may be advisable to place a small resistance, as indicated, in series with the signal wires, but the experiments already carried out show that it is not an actual necessity.

A. W. Brown,

Lieutenant, 3rd Manchester and R.F.C.

Prisoner of War, interned in Switzerland.

August 4th, 1917.

The 10-Mile Limit.

Can you kindly let me know what a disengaged (non-eligible) man is to do? If he lives 10 miles away from a berth, he is not allowed to apply. D.O.R.A.

As I am residing in a non-electrical town, have I got to wait till the war is over?

Wolverhampton.

[The local Labour Exchange should be able to advise our correspondent. Otherwise, we recommend a change of residence (duly notified to the authorities).—Eds. ELEC. REV.]

Staff Organisation in Electricity Works.

The recent letters and articles in the REVIEW on electricity works staff have greatly interested the writer, who is engaged in electric supply work. The last article, by Mr. Stubbings, has called for these few remarks.

With most of this article I am in agreement, particularly as to exaggerated ideas of the importance and status of sales managers. Even in much larger stations than 10,000,000 units per annum, I think these officials are regarded as far too important, especially in comparison with the engineering staff. Concerning this latter staff—and chiefly in the generating department—a little mild criticism may be acceptable.

I would maintain that the engineering assistants should possess the necessary scientific technical knowledge to tackle any problem which may arise in the operation of a supply system. At present there are certainly few men in positions of authority in British stations who have the requisite qualifications and scientific ability. There seems to be a tendency for chiefs to unduly favour marine engineers for the position of station superintendent, and they, in their turn, favour marine engineers as their mechanical assistants. With due respect to the qualifications and ability of these men, so far as marine work goes, it is not a satisfactory state of affairs in power-station work. In station maintenance and routine work they generally give satisfaction; but even in the investigation of structural, mechanical, and steam problems they rarely show sufficient aptitude, whilst in electrical matters their confusion of ideas is notorious.

The new position, which Mr. Stubbings proposes, would be rather difficult to introduce into many stations. Most station and mains engineers would resent the incursion of the new official into their domains. But if, due to lack of scientific training of the existing engineering staff, such an official were appointed, I consider he should be looked upon as more than a "glorified meter superintendent." His work should be of far greater scope than Mr. Stubbings proposes—fuel, water, and instrument testing. His status should be higher than station or mains engineer in order to remove any difficulties as to supposed "trespassing" of the technical assistant in their respective fields. Why not give him the status of the old-time chief assistant? Surely, his qualifications and his value to the undertaking merit it.

Such men are obtainable, and can be found filling junior positions in many stations where little respect for their training or ability is accorded them. They languish through restriction of their scope, and after getting wholesomely satiated with many years of shift or routine work, finally leave the electric supply industry. Perhaps they enter the estimating department of a manufacturing concern. Often they go into technical teaching (wherein such a man may be considered as lost to the engineering profession) or otherwise vanish into a charitable obscurity.

Considerations of space restrain me from giving detailed reasons for the above opinions, and from taking up other aspects of the subject equally interesting and important. I trust this expression of ideas may stimulate further discussion.

Engineer.

Employment of Disabled Soldiers.

I should like to put in a remark or two re the "insult to wounded officers" in offering them positions in power houses and sub-stations, which I notice "E. M. F." and Mr. Bridges has so ably contested.

Being an ex-sub-station man myself, for the present serving in the Navy in an electrical rating, I think I am in a position to assure you that very few officers have a fraction of the responsibilities of the man in charge of a large plant ashore. It seems to me that their whole ability is concentrated in enforcing and interpreting discipline, and that any deftness or engineering skill is rarely expected of them.

Therefore, these men need feel no lowering of their dignity in accepting a job in a power house; rather, in fact, they ought to feel that they have been given yet another chance of demonstrating their nerve and discrimination.

I am burning to give a few details of the typical old woman's jobs the officers in most cases have, but, having to maintain secrecy, I will conclude by saying that the power supplies require staffs consisting of the smartest and most experienced men, and any wounded officer who is given the privilege of helping to run one should consider that he is still doing his bit, perhaps even more than most of his comrades in the Services.

I think that the REVIEW should have been less hasty in decrying so well-recognised a branch of the electrical profession, which is unfortunate enough to be so badly paid.

D. F. Barton.

August 24th, 1917.

Brighouse.—Mr. A. J. Ashton, K.C., has sat as arbitrator in the matter of Corporation employes' wages. The men had demanded an increase of remuneration bringing them to an advance of 12s. per week on pre-war rates: the Corporation offered only 10s.

WAR ITEMS.

Exports to China.—The "London Gazette" for August 25th contains some further names of persons and bodies in China to whom exports may be consigned.

Import Prohibitions.—By a Proclamation dated August 22nd, the importation of the following goods is prohibited:

All machinery driven by power and suitable for use in cutting, working, or operating on wood (as set out in the Proclamation).

Electrical motors up to $\frac{1}{2}$ H.P.

Export Prohibitions.—The "London Gazette" for August 28th contains particulars of certain alterations in the Schedule of Prohibited Exports. The following heading is deleted:—(A) Telegraphs (including wireless) and telephones, and instruments and material for; and in its place there is substituted:—(A) Telegraphs (including wireless) and telephones, and instruments and materials for, including valves for wireless telegraphic apparatus.

The Trade Press and War Loans.—We have received from Mr. Walter Judd, of Messrs. Heywood & Co., Ltd., a communication expressing the opinion that the technical Press has never received from the Government the recognition that it deserves, and suggesting that those responsible for Government publicity should make use of such organs as mediums for appealing to the great industrial classes when next inviting applications for War Loans.

Cost of Electric Railway Materials in U.S.A.—The *Chronicle* (U.S.A.) quotes from the "Weekly News Letter" of W. S. Barstow & Co. (July 11th) a reference to an article in "The Pretzel," published by the Reading Transit & Light Co., with regard to the increase in the cost of materials essential to public utilities operating electric railways and central stations. The article reads:—

"In a recent issue we called attention to the great advance in prices of some of the materials necessary in the operation of electric power and railway systems. We mentioned coal costing us \$200,000 more this year than last, and increases of \$80,000 in the annual payrolls of our employés, and an advance of 44 per cent. in the price of steel rails.

"But we were merely scratching the surface. Copper wire, electrical machinery, and a multitude of other things used in constructing, renewing, repairing, operating, and keeping our properties up to the high standard of efficiency which the public demands, are costing a whole lot more than they did two years ago.

"We also must face the handicap of being compelled to place orders for materials from three months to two years ahead of time of delivery. Some materials can scarcely be procured at any price. Steel car wheels, for instance, have practically disappeared from the market. They were last heard of at \$18 a piece, but for some time it has been impossible to get anybody to quote a price on them: Cast-iron wheels are selling at \$1 80 per 100 lb., on big contracts, compared with \$1 45 two years ago, an advance of about 25 per cent.

"We have noted some figures at random from our purchasing department showing the sharp advance in prices of some materials to-day, compared with two years ago.

"Rails have increased 100 per cent. over normal prices. To-day they are quoted at \$55 a ton for delivery a year hence, and for short-time delivery the price is \$75 a ton. Two years ago steel rails were selling at \$38 20, so that what is regarded as the normal price to-day is an advance of 44 per cent. There is an even greater advance in special track work, which means curves, switches, and the like, the increase in these materials being fully 200 per cent.

"Copper that is required in large quantities for repairs to trolley and electric equipment has nearly trebled its normal price. Copper trolley wire is now quoted at 38 cents a pound, compared with 17 cents in 1915. Copper feeder cable has advanced from 18 cents to 34½ cents a pound in the same period.

"Motor equipment has advanced over 50 per cent., and following are some of the other advances:—

	1915.	1917.
Track spikes...	\$2 15c. per 100 lb.	\$4 per 100 lb.
Steel trolley poles ...	\$1 10c. each.	\$2 10c. each.
Track plates...	2½c. pound.	10c. pound.
Steel and iron bars...	1½c. pound.	4½c. pound.
Cotton waste ...	9c. pound.	13c. pound.
Chestnut ties ...	10c. each.	60c. each.
Cement ...	\$1 29c. barrel.	\$2 9c. barrel.
Gravel ...	\$1 25c. ton.	\$2 ton.
Crushed stone ...	50c. ton.	\$1 ton.

Dilution of Labour and Munitions.—According to an official statement, the Minister of Munitions (Mr. Churchill), accompanied by Mr. Kellaway, Major J. W. Hills, M.P., and officials of the Ministry of Munitions, the Admiralty, and the Ministry of Labour, met representatives of the Engineering and Shipbuilding Trades' Federation at Westminster on Wednesday last week. Mr. Churchill explained to the delegates that the principal object of the meeting was to set up an Advisory Committee of Trade Unionists, the appointment of which had been discussed at previous conferences. He ex-

plained the circumstances which had led to his proceeding with the Munitions of War Bill. He stated that, having gone, as he thought, a long way to meet Labour in his action with regard to the Bill, he felt he could now fairly ask Labour to help him. He appealed particularly for assistance from the trade unions in the enrolment of an increased number of war munitions volunteers, and in seeing that dilution on munitions work was carried out to a fuller extent than at present. He would be glad to have the views of the conference on the setting up of works committees. A friendly discussion followed.

Coal Shortage in Germany.—The "Times" publishes the following dispatch, dated August 26th, from its Amsterdam correspondent:—

"Herr Helfferich, in a speech on Germany's coal difficulties in the Reichstag Main Committee on Friday, said that the maintenance of coal production at the present output demanded uninterrupted and intense labour. Especially there must be no strikes, such as unfortunately occurred last month in Upper Silesia. Every strike deprived the front of munitions and the home of the necessary domestic fuel. The Imperial Commissioner for Coal Supply gave a long explanation of the proposed methods for coal saving, stating plainly that the coal supply was inadequate to the demand. War industries, he said, must be first supplied, and less important consumers must suffer restriction. No system of distribution was possible without hardships. Apart from technical difficulties in the way of greater output, there were difficulties connected with labour, the number of miners being fewer, and their working capacity diminished. In the debate, a member of the Centre said that the average working capacity of miners was less, and was partly due to malnutrition. The strike in Upper Silesia had caused a falling off of about one million tons, which could hardly be made up by withdrawing miners from the front. Industry was of opinion that proper measures would have ensured sufficient coal for an average winter, and that lack of foresight had caused the present situation. The stoppage of works now ordered was the cause of extraordinarily great injury to industrials. The measures contemplated against the smaller industries were simply shocking."

Exemption Applications.—Middleton Tribunal has given conditional exemption to a permanent-way repairs labourer (37, C2), appealed for, on account of the shortage of labour, by the Electric Traction Co.

At Aberdare, the U.D.C. appealed for Mr. A. J. Abraham (41), chief engineer and tramway manager, and he was given six months on condition that he continues in the same occupation.

At Oxford, Messrs. Wyatt & Son, of St. Giles, appealed for E. Green (35, C1), engaged on electrical work. He was given two months' temporary exemption.

At Maidstone, Mr. Micklewright appealed for the retention of E. R. Edwards (27, B1), electrical engineer, and he was given three months, with the Volunteer condition.

Hull Appeal Tribunal has dismissed Military appeals against exemption held by four drivers on the Corporation trams, and in a fifth case exemption until September 1st was substituted. It was stated that women drivers were not able to bear the strain, and that the Amalgamated Association of Tramway and Vehicle Workers was opposed to women drivers.

As the result of a Military appeal, exemption granted until November 23rd to an electrical engineer (39, B1) with the Brandon and Byshottles Co-operative Society has been made final.

Surrey Appeal Court has granted three months' exemption to E. Lown (31, Class A), electrician, appealed for by Messrs. A. E. Read & Co., Farncombe Paper Mills.

On the appeal of the Military, Faversham Tribunal has cancelled conditional exemption held by E. R. Epps (34), switchboard attendant at the Corporation sewage works. He is not to be called up until October 13th.

With the assent of the Military, three months' exemption has been granted to C. W. Read (36), shift engineer at the Reigate Corporation electric light works.

At Aylesbury, Messrs. Mackrill & Sons appealed for T. Pearce (40, Class A), electrical engineer, on the ground that he was indispensable, his work including an installation at the Royal Bucks. Hospital. The Tribunal gave conditional exemption whilst working at the hospital.

The Military applied at Bexley for the withdrawal of certificates of exemption held by M. M. V. Roots (32, B1) and H. J. Sheridan (29, Class A), motormen on the U.D.C. tramways. It was stated that it was very important that the men should be retained on account of the fire at the Dartford tramway sheds. Owing to these circumstances, the Military Representative agreed to the appeals being resented.

At Battle, exemption was sought for C. D. Gear (32, A1), electrical engineer to Viscount Hythe, at Normanhurst Hospital. The appeal was resented for a month to see if a substitute can be found.

Derbyshire Appeal Court has refused exemption to the electrician at Aston Hall, appealed for by Colonel Winterbottom.

Before the Hants Appeal Court, the Bournemouth Electricity Supply Co. appealed for a switchboard attendant (18). The company stated that 130 employés were serving in the Forces, and only six of the 13 men of military age left were

in Class A, and a substitute could not be found for the man asked for. Conditional exemption was conceded.

At Sheffield, final exemption until September 30th has been granted to T. C. Pye (20, B2), electrical engineer.

At Brighton, a review was made of three months' exemption granted to an electrical engineer (38, C2), the Military contending that, although he was on munitions, he would be still more useful in the Army. The Tribunal decided to deal with the case again when the present exemption expires.

A Buxton firm of electrical engineers appealed for an electrician (33), the only man left available for work at hydros, hotels, and military establishments in the town. Lieutenant Kersley: "I know what electricians are, and that it is impossible to replace them." Exemption was granted until January 1st.

Cookham (Berks) Tribunal has refused a request for W. J. Windsor (35, C1), electrician at Stubbings, Maidenhead Thicket.

At Dorsetshire Appeal Tribunal, a discussion took place with regard to the position of Mr. C. B. Burnett, resident electrical engineer at Brechin electricity works, whose exemption had been cancelled by the Burgh Tribunal, with the proviso that a substitute should be provided by the Military authorities. An agent mentioned that an effort had been made by the authorities to substitute this man by a mechanical engineer, who was absolutely useless for such work, and he asked for a certificate of conditional exemption. Sheriff Neish pointed out that the onus was placed upon the Military authorities of providing an efficient substitute, and the local Tribunal's finding was confirmed.

REVIEWS.

Electric Traction. By A. T. DOVER, A.I.E.E., Lecturer on Electric Traction at the Battersea Polytechnic, London. London: Whittaker & Co. Price 18s. net.

This book professedly deals only with the technical considerations involved in the application of electric power to the working of tramways and railways, and is in the main a text-book for technical students, the outcome, doubtless, of the author's experience in his position at the Battersea Polytechnic. Nevertheless, the influence of financial considerations upon technical design, choice of plant, &c., is by no means ignored, and the effect of Board of Trade regulations on the same matters is duly weighed.

A commendable feature is that the book opens with a list of symbols, explanations of the conventions followed in diagrams, and a list of abbreviations, so that in any uncertainty the reader knows where to look for the meaning of the symbols used.

The introductory chapter gives short descriptions of the systems in use, with reference to practical examples, and tabulated data of the principal electric railways.

The advantages of electric traction on railways are shortly set out, and the principal difficulty in the way of main-line electrification is summarised as the excellent performance of the steam locomotive for fast passenger service, coupled with the cost of conversion.

In Chapter II, the mechanics of train movement, the fundamental "speed time" curve is introduced and studied. Typical curves for "city," "suburban," and main-line services are given, and stress is laid upon the differences in the proportion of acceleration, deceleration, and free running required, and the consequential differences in the motor characteristics needed for each. The importance of acceleration in short runs, and the limitations imposed on acceleration by the weight of equipment, peak load on stations, comfort of passengers, financial considerations, maintenance of rolling stock, and cost of energy, are well set out. The relation between acceleration and retardation, and the economic value of high retardation in saving energy by prolonging the coasting period permissible on a given running schedule is emphasised. The value and low cost of high retardation compared with a corresponding increase in acceleration is very clearly brought out. Actual obtained values are given, and the importance of correct design in this respect in relation to financial results is well shown.

The use of simplified speed-time curves for preliminary calculations is explained very clearly and fully, and the construction of such curves is illustrated with figured examples. In the course of this discussion the author gives adequate space to the importance of short stops on urban services involving short runs, showing the economy to be gained by cutting down the station time. The consistent use of the accepted term "schedule speed," i.e., the distance between stops divided by the time from start to start, and "average speed," distance between stops divided by time from start to stop, assists this exposition. The calculation of the minimum acceleration needed to obtain a given schedule speed, with given retardation, is demonstrated by worked out examples.

In the method adopted by the author, the relations between acceleration, maximum speed, average speed, and retardation are expressed in a form which has a rather complex appearance, and, in fact, involves some tedious arithmetic. For example, on page 12 the expression for maximum speed is given as:

$$V_m = \left(\frac{a \beta}{a + \beta} \right) t - \sqrt{\left(\frac{a \beta}{a + \beta} \right)^2 t^2 - 7.2000 \left(\frac{a \beta}{a + \beta} \right)}$$

Where V_m is maximum speed, a = acceleration in mile per hour per second, β = retardation in same units, V average speed in miles per hour, D = distance in miles between stops, T = running time in seconds. This formula gives correct results, but, unfortunately, in working out an example on page 25 an erroneous answer is printed—24 miles per hour instead of 25.8, probably a printer's error.

A somewhat simpler-looking and distinctly more easily computed expression can be derived from the simple geometry of the speed-time curve, and is here offered as an alternative. It is very easy to explain to a class on a blackboard:

$$V_m = V + \frac{V^2(a + \beta)}{a\beta} - 2 \left(T - \frac{V(a + \beta)}{a\beta} \right)$$

V being in this case the average speed.

It is a little curious that writers on this subject make so little use of the elementary fact that the area of a speed-time curve is the distance or length of run—so that all speed-time curves to the same scale between a pair of fixed points must have the same area—and the simple geometrical relations which follow. The author does use that elementary fact, and the full way in which the calculations are set out and their derivation explained is in refreshing contrast to the method one frequently sees in text books, where intermediate steps are silently omitted, on the apparent assumption that every reader knows his algebra as completely as if he were reading for the Tripos. The author's experience with students, the majority of whom cannot have such mathematical readiness, has stood him in good stead in all the mathematical portions of the book, and gives it special value as a work of reference.

From this, the reader passes to a description of the characteristics of continuous-current traction motors, and the way in which motors are selected to suit or fit the speed-time curves derived from the proposed schedule. This work is thoroughly well done, and the suitability of series, shunt, and compound-wound motors for various kinds of service is fully explained.

Illustrations and descriptions of the electrical and mechanical construction of various motors are given, with a considerable explanation of the evolution of the modern D.C. traction motor, and the reasons which have led to the particular materials and constructive features now in use. The mechanical part is as fully discussed as the electrical.

Single-phase and polyphase traction motors each have a chapter to themselves. Probably there is no other English book on the subject which gives such complete details of these two types of motors in all their variety. This is particularly true of the chapter on single-phase motors, which are, perhaps, less well understood by the average traction engineer than any others.

The same characteristic thoroughness of description and co-ordination between theory and design is continued through the chapters dealing with motor control. These chapters form the most complete account of electric traction equipment in these departments which has fallen our way.

In a chapter on regenerative braking, a good deal of information is given, and if this is not quite up-to-date in respect of continuous-current work—*e.g.*, nothing is said of the recent American railway developments—it must be admitted in extenuation that the best examples are of very recent date, and descriptions may not have been accessible at the time of writing. Enough is said to show the modern line of development.

The same characteristic of thoroughly detailed description pervades the remainder of the book. Chapters XIX, on the calculation of speed-time curves and energy consumption, XXIV, on overhead construction for tramways, XXVI, on feeding and distributing systems, and XXVII, on sub-station converting machinery and switchgear, may be specially commended, because they give detailed expositions of the principles involved, the material available, and practical methods of design involving economical considerations, in branches of the subject on which detailed and consecutive teaching is not very readily available.

The book is, on the whole, a valuable compendium alike for the student of electric traction engineering and for the engineer in practice, a text-book and hand-book in one. There is very little room for criticism, and it can be thoroughly recommended for both uses. Naturally, it must fall out of date as a hand-book of current practice, that is inevitable in an art which is advancing so rapidly as electric traction; the remedy is later editions, which ought to be called for in a reasonable time.

The illustrations are copious, well selected, and well presented. The line drawings are particularly good, and many of the photo-blocks much clearer in detail than the average of such illustrations.—H. M. S.

"SYSTEM."

[COMMUNICATED.]

EVERY successful business undertaking is dependent for its success upon the adoption of some form of system in the organisation and control of its various departments and the work that they carry out. To the electrical engineer or manager of an electric supply undertaking, therefore, devolves the necessity for formulating a general system for the efficient working of his department, and for the preservation of accurate and accessible records of the growth and working conditions of his particular undertaking.

That such arrangement will necessarily involve many intricacies foreign to many ordinary business concerns will be at once apparent to all who have had experience in the management of an electric supply department, or who have made a careful study of the facts and figures relating thereto, and, for this reason, there is a grave danger that the electrical engineer who is not the possessor of a keen business ability will fall into the error of adopting a system that is either not complete, or, on the other hand, too complete. Each is as bad as the other.

System, like armour, may be made so heavy that all freedom of motion is lost; whereas, on the other hand, it may be so elastic that it fails to afford the protection that is duly expected from it. Yet it is possible to point out undertakings that are suffering under either one or the other of these evils. A system which cannot be relaxed to meet special conditions, but is most rigidly adhered to in all circumstances, is "red tape," the abhorrence of so many of our Government Offices in past days, and has been the means of losing many a good consumer of electricity. It has often occurred that a prospective consumer has required current very urgently at short notice, but this has been denied him on account of the formalities necessary before such supply could be given. He then applies to the local gas company, who are usually only too anxious to meet his requirements, and thus add another to their already long list of consumers literally snatched from the hands of their electrical competitors. Gas companies seem to have a happy knack of securing very alert business men to manage their affairs. The true explanation may lie in the fact that most gas companies are privately owned, and that their managers are, therefore, more free to speculate in the company's interest than is the tied engineer of a Corporation electricity department, who can do little in this way without the consent of the Electricity Committee. Be that as it may, the fact remains that many an electrical consumer has been absolutely sacrificed on the altar of system.

Against this must be recorded the case of the consumer of electricity who was actually connected and using the light for nine months before the fact was discovered. The system in this case was capable of too much relaxation, and consequently a temporary connection was made late one evening, unauthorised by any head of the department, and remained temporary, without a meter, for almost a year.

Too much centralisation in the management of the affairs of a supply company is, as a rule, the result of over-systematising the concern. In such a case, the concern is rarely a "going" one, for no matter how clever or how keen the chief may be, it is almost beyond human possibility for one brain to organise and control every detail in an undertaking of any size. Under the chief, therefore, must be appointed responsible assistants to whom must be entrusted the arrangements for the proper carrying out of the work.

The chief who says that no information must be given except by himself or through the office, is centralising the work too much, and the assistants under him must feel very small when asked a question, to have to reply, "I must not—or cannot—give this information, but the chief will answer any question if you care to write to him." At the same time, it is not advisable to allow every man employed to answer any question that may be put to him, for if this is permitted, a great deal of time and trouble is likely to be taken up in correcting false or incomplete information.

Rules and regulations for the guidance of officials and workmen are, in their way, excellent things, and many would be quite useless without them; but too many rules and regulations are disastrous, in that they so restrict the

employé that in an extraordinary case he does not know how to act, and is afraid to adopt a method of his own. Consequently his initiative is destroyed, and the application of common sense to every-day problems becomes through want of practice quite beyond his mental capabilities.

A good chief will always welcome suggestions from any member of his staff, and will not discourage any of his men by telling them they are not paid to think.

Repetition and over-lapping in clerical work should be very carefully avoided. This is not always easy, especially in the consumers' department of a Corporation supply undertaking where all money matters are dealt with by the borough treasurer; but if there are difficulties over the question of the simplification of the rendering and collection of accounts, there is no great difficulty in keeping an excellent record of connections and all matters relating to them without duplicating and repeating everything.

The writer knows of one place where a daily and monthly report gives exactly the same information. Either one or the other is superfluous, but both have to be sent in.

For the proper keeping of records a system of printed forms should invariably be used, but these can and should be kept down to reasonable numbers. There is no need for an average supply undertaking to have forms running into hundreds.

The best system for practical utility is, without doubt, the card index system. For consumers' work there should be three distinct cards. The first card should show particulars of the service, pressure, date connected, and apparatus on circuit. These cards can be arranged in street order. The second card, arranged alphabetically, will enable any consumer to be picked out with ease. This card can well show the meter number and any other metering particulars according to the method employed. The third card must be purely a meter stock card, showing particulars of tests on the meter and its general history, where and when installed, and removed.

To enable the mains engineer to do his work in a quick and efficient manner, he should preserve a careful record on large ordnance maps of every inch of main laid. He should also keep a register of all faults that develop, the causes of them, and the remedies. This record must be properly arranged, so that when a fault develops he can turn up the past history of the section involved, and probably gather from this history a good idea of the cause of the present trouble, and where it is likely to be. This knowledge can largely be carried in the head of the engineer concerned, but it is not system to rely on one's memory, and, after all, the best of memories need refreshing at times.

In the central station the whole working is more or less of a systematic nature, and the records to be kept are in practically every case of a similar kind. Consequently, those strange admixtures of system and chaos which are encountered outside are not so frequent inside.

The standardisation of electricity supply practice is something that the majority of those concerned in the business would welcome, but it can only come through proper organisation. Every engineer must, therefore, realise the value and necessity of system by practising it himself, but he must not allow himself to become "system mad," because it is as bad marksmanship to fire over the target as it is to fall short of it.

The 1886 Co. : Strange Development.—The Moscow Town Governor, N. I. Astroff, has received from the Assistant Minister of Trade and Industry information respecting the conditions on which the Provisional Government is disposed to liquidate the 1886 Co. As is known, the original Town Duma calculated that the shares of the 1886 Co. should pass over to the town at their nominal value, but the Duma afterwards changed its point of view, and found it necessary to state that the price of the shares, in consequence of the new industrial laws, should be reduced by 20 per cent. However, this view of the Town Duma not only was not taken into consideration by the Provisional Government, but it even fixed the price of the shares at 160 roubles. The announcement of the Assistant Minister caused complete confusion in the Council, for the new conditions were so onerous for the town, that even the old Government would not have agreed to them. Therefore, the Town Government has sent specially to Petrograd a member of the Council, L. N. Lyutoschenko, who will submit a report to the Assistant Minister, and supplement it with his personal explanations.

BUSINESS NOTES.

Book Notices.—"Conditions in Germany." London: Boswell Printing and Publishing Co., Ltd. 3d.—Thirty-page pamphlet discussing the accumulating Press and other evidences that inside Germany there is no longer the old unity, confidence, and expectation of success in the war, and that matters appear to be taking the inevitable downward course. The pamphlet is written anonymously.

Brazil Commercially Considered. London: The Syren and Shipping, Ltd. 5s. net.—In the 100 pages of fully illustrated matter contained in this publication the publishers have set forth the first results of a tour of Brazil, Argentina and Chile, which was made on their behalf by a Special Commissioner, Mr. D. Paterson Maitland, with the object of helping British trade in South America after the war. The articles are very numerous, and cover many aspects of Brazilian affairs. The history of Brazil, its geography and economic progress, its foreign trade, its waterfalls and their industrial potentialities, its different industries (rubber, cotton, sugar, mining, meat, &c.), and many other such matters are reviewed and described; finely illustrated descriptions appear of the undertaking of the Brazilian Traction, Light and Power Co., Ltd., and the Rio de Janeiro and Sao Paulo systems, also of the system of the Companhia Telefonica do Estado de Sao Paulo. Some pages are devoted to an account of shipping services, especially that of the R.M.S.P. Co. Altogether, the work contains a great deal of information which should be of use to firms who are interested in export trade to Brazil.

"Journal of the Institution of Electrical Engineers" and Index. Vol. LV, No. 268, July, 1917.—This issue contains the following papers:—"Magnetomotive Force of Armature Windings," by Mr. B. Hague; "Magnetic Shielding of Large Spaces," by Prof. E. Wilson; "Pressure Drop Curves for Copper Overhead Lines," by Mr. G. N. Wright; also the twelfth list of 63 members on military service.

"Registration and Publication of Directors' Names, under the Companies (Particulars as to Directors) Act, 1917." By Herbert W. Jordan. London: Jordan & Sons, Ltd. 6d. net.

"Miniature Electric Light." By B. E. Jones. London: Cassell and Co., Ltd. Price 1s. 3d. net.

"La Formation des Ingenieurs en France et a l'Etranger." Paris: Librairie, Armand Colin. Price 2 fr.

"Proceedings of the Physical Society." Vol. XXIX, Part 5, August 15th, 1917. London: The Fleetway Press, Ltd. Price 4s. net.

"Proceedings of the American Institute of Electrical Engineers." Vol. XXXVI, No. 8, August, 1917. New York: The Institute. \$1. Report No. 19 of the Second Section of the Electro-Technical Laboratory, Tokio, on "Telephonic Transmission Losses of Bridged Impedances, Series Resistances and Capacitances."

Trade Inquiries.—According to the *Board of Trade Journal*, a Brisbane firm of electrical engineers and merchants desires to get into touch with firms in this country supplying electric motors and generators, accessories, wires and cables, fittings, batteries, lamps, &c., with a view to representing them in Queensland.

The Acting British Consul at Turin reports that a firm of manufacturers' agents in that city desires to obtain agencies for United Kingdom manufacturers of machinery and electrical apparatus, who may obtain the name and address of the firm referred to on application to the Department of Commercial Intelligence, 73, Basinghall Street, London, E.C. 2. (Inquiry No. 315.)

Electrical Trade in South Africa.—The *S.A. Mining Journal* for July 7th states that the shortage of household filament lamps is getting into the acute stage, as the wholesale houses are said to be out of the 50-c.p. globes, therefore many of the shops either have to use 32 or 100 c.p. "The price has advanced from 6s. to 9s. per dozen for all lamps. There is a demand for small electric meters, as property owners are being compelled to protect themselves against the unfair consumption for radiators, electric kettles, irons, &c. In one instance, a block of rooms in the less fashionable part of the town, under a Kaffir caretaker, used over £20 worth of current last month, as compared with an average of £6. This extra could only be accounted for by the use of radiators and other warming apparatus, as a set-off against the cold weather experienced of late. The Municipal Supply Branch has given notice that owing to there being no suitable cable, due to circumstances arising out of the war, the Town Council is unable to entertain new applications for electric supply in Johannesburg and 26 suburban townships."

Catalogues and Lists.—BRITISH THOMSON-HOUSTON CO., LTD., 77, Upper Thames Street, London, E.C.—New 20-page list of illuminated glassware. It is printed very attractively in three colours, a life-like effect being given to the various illustrations of glassware by the use of coloured background panels. The types of glassware listed and illustrated are the well-known types of glass associated with the name of the company—Veluria, Alabas, and Calla. The list also illustrates new forms of Veluria dishes and bowls, and a new type of glass known as "Druid," which is similar to Alabas, but less expensive. Two pages are devoted to listing and illustrating pure alabaster bowls. Copies of the list have already been distributed to holders of the B.T.H. Lamp and Wiring Supplies Handbook Binder.

MESSRS. JOHNSON & PHILLIPS, LTD., Charlton, London, S.E. 7.—Three new illustrated leaflets:—No. 5 (8 pages) shows the company's standard range of underground non-disconnecting boxes (straight

through, three-way, four-way) for all types of cables, also armouring clamps and wiping glands; No. 1 (2 pages) tabulates particulars of J. and P. switch fuses (tubular pattern); and No. 2 (2 pages) deals similarly with isolating switches.

Trade Announcements.—MESSRS. BROOKS' ELECTRICAL SUPPLIES CO. have commenced business as dealers in electrical supplies at 3, Goddliman Street, London, E.C. 4. Mr. Alex. D. Brockhuijsen (Dutch) is the sole proprietor.

THE ENTERPRISE MANUFACTURING CO., LTD., state that they have terminated their arrangements with Messrs. Andrews & Co., and have appointed as their sole agents for Scotland Messrs. Paterson & Service, 38, Bath Street, Glasgow.

Liquidations.—RURAL DISTRICTS ELECTRIC UNDERTAKINGS, LTD.—Creditors must send particulars of debts, &c., to the liquidator, Mr. G. W. Brown, 21, Martin's Lane, E.C. 4, by August 31st.

LEITNER ELECTRICAL CO. LTD., Maybury. A second dividend of 1s. in the £ is payable on September 10th at the offices of Messrs. Corfield & Cripwell, 119, Finsbury Pavement, E.C.

LIGHTING AND POWER NOTES.

Argentina.—The Buenos Aires Provincial town of Patagonas has been without public lighting for some time past, the service having been suspended by the company owing to non-payment of the debt due to it by the community.

The inhabitants of the town of Pergamino (Province of Buenos Aires) were notified recently by the local management of the electric light company (Compania de Electricidad de la Provincia de Buenos Aires) that the service would be suspended in view of the difficulty the company had in collecting the municipal lighting debt, which amounts to over \$107,000 m/n.

At the last moment an arrangement was come to for the continuance of the service, the Municipal authorities giving to the electric company the blank receipts for public lighting collectible from householders, and renewing their "pagaré" for \$41,149.94 m/n., which fell due on May 1st last.

It is reported from San Justo and from San Antonio de Arco (both in the Province of Buenos Aires) that the local electric light companies have the intention of suspending the public service owing to non-payment of accounts by the communal authorities.—*Review of the River Plate.*

Burnley.—The electrical engineer has reported to his Committee that, owing to the shortage of refuse for fuel, the coal consumption has been seriously increased. He has prepared a statement showing the failure of supplies, and this is to be submitted to the Cleansing Committee.

Crayford.—STREET LIGHTING.—The West Kent Electric Co. has informed the P.C. that it cannot supply current for public lighting on London Road until the further mains are laid towards the parish.

London.—HAMMERSMITH.—PRICE INCREASE.—The Electricity Committee has had under consideration the financial position of the electricity undertaking, more particularly the revenue now received in respect of supply to consumers. The Committee points out that the present charges for supply were fixed in 1905. The increase in the output during the past few years alone has enabled the Council to delay making any advance in the prices, but owing to the greatly increased generating costs (coal alone being 11s. per ton in excess of the price paid in 1913-14), and the high prices of materials, new plant, &c., the Committee recommends that, as from September 29th next, the charges for lighting and power, including special supplies, be increased by 12½ per cent.

Rawmarsh.—A Sub-Committee of the U.D.C. is to meet the Rotherham Electricity Committee on the question of supplying power in the Rawmarsh district.

Southend-on-Sea.—A motor-generator for charging at the refuse destructor the batteries of electrical-driven tip wagons for dust collection is to be purchased, with other plant, at a cost of about £500.

Stalybridge.—The Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board has resolved that motor rentals be increased by 20 per cent. from January 1st, 1918, and that notice of the increase be given to consumers.

Straits Settlements.—GEORGE TOWN (PENANG) ELECTRICITY DEPARTMENT.—The report of Mr. O. V. Thomas, engineer and manager of the municipal electrical undertaking, on the year's working (1916) shows that 1,697,619 units were sold, an increase of 5.8 per cent. on the previous year's figures: the revenue amounted to \$304,193.42, representing an increase of \$31,418.31, or about 10.3 per cent.; the gross profit was \$201,139.23 (being 19.5 per cent. on the total expended capital, as compared with 18.22 per cent. in the previous year). After paying all charges due to capital there remained a net profit of \$97,703.87, or approximately 9.5 per cent. on the capital expended. At the end of the year the total number of installations being supplied was 2,676, with an aggregate demand of 87,395 30-watt lamps, representing a net increase during the year of 388 installations, with a demand of 10,779 30-watt lamps. During the year capital expenditure was forcibly restricted by war conditions: a spare balancer set (cost \$2,600) was ordered for No. 1 sub-station, and arrived during the year. The total costs per unit sold amounted to 7.74 cents and the works costs

to 6'05 cents. During the year four faults occurred on the mains, three in the old V.B. sheathed cables and one in a lead-sheathed cable; the latter was traced to mechanical damage in connection with repairs to water mains.

In his report Mr. Thomas remarks that the question of the reduction of the charges for lighting and power would doubtless commend itself to the Commissioners in normal times, but having in view the fact that any reduction in charges would be followed by an increase in the number of applications for supply, and would hasten the time when capital extensions in plant and mains would imperatively be needed, it has been decided to make no change until the war is ended.

U.S.A.—A recent issue of *Power* described the remodelling of the Ashley Street station at St. Louis. This plant as originally designed had a capacity of 12,000 kW. (in 1903), made up of five vertical-compound reciprocating engines and generators, with 28 Scotch marine boilers.

In 1905, after the station had been in use a little over a year, it was decided to install four 5,000-kW. turbine units, for which space was found in the engine room, and to provide steam, 40 water-tube boilers were installed on a second floor in the boiler house.

In 1908 it was found necessary to further increase the plant, and 12,000-kW. turbine sets were installed in place of the 5,000-kW. sets, the original condensers and auxiliaries serving for the new plant. Twelve of the old marine boilers were replaced by a similar number of Babcock boilers, and the capacity of the station reached 64,000 kW.

In the meantime, the Keokuk hydro-electric plant was built, and the St. Louis Co. obtained further power from that source for several years.

In 1915, however, it was decided to increase the steam plant by substituting a 20,000-kW. horizontal Curtis turbine set for one of the original reciprocating sets. The generator is a 4,500-volt, 60-cycle, three-phase unit, with four poles, and is rated at 20,000 kW. at 80 per cent. power factor; speed, 1,800 R.P.M.

To supply additional steam, the remainder of the old marine boilers were removed, and 10 modern water-tube boilers replaced them. It is intended to proceed with this substitution by large plant units to bring up the station-plant capacity to 116,000 kW.

Tests on the latest turbine show that it is running well under the guarantees of steam consumption, viz., 11½ lb. per kW.-hour with 1 in. absolute back pressure, 225 lb. steam pressure, and 150° of superheat.

When the present plans are complete, the original station designed for 12,000 kW. will contain an installation of 116,000 kW.

Wigan.—PRICE REVISION.—The Corporation has given notice that the scale of charges for electricity supplied for power purposes by the Corporation to all ordinary consumers will, as from October 1st, 1917, be revised as follows:—For the first 500 units supplied per quarter, 2d. per unit; between 500 and 1,000, 1½d. per unit; between 1,000 and 1,500, 1½d. per unit; between 1,500 and 2,000, 1½d. per unit; and for all over 2,000, 1d. per unit, plus in each case 25 per cent.

TRAMWAY AND RAILWAY NOTES.

Blackpool.—A Corporation car proceeding along Lytham Road on August 25th ran off the line; the driver was injured, and had to be removed to hospital.

Bolton.—The rail wear problem is being solved at Bolton by the employment of the Woods-Gilbert rail planer, recently described in our pages, a couple of which machines are now at work in the borough. On the invitation of the Woods-Gilbert (British) Rail Grinding and Milling Co., representatives of various tramway authorities in Lancashire met at Bolton, last week, to see the machines at work. The borough engineer, Mr. E. L. Morgan, who is responsible for the maintenance of the track, has recommended that 44,667 yards of single rail require to be re-grooved, 16,710 yards to be planed, and a large number of joints treated for "hammering." The contract price for the whole of the work is £6,140. He considers that the cost of removing the corrugations, £1,253, should be charged to revenue, and the balance would thus work out at £383 per mile of track treated. Even if only three years are added to the life of the rails, the saving of the depreciation fund by the extended life of the track will amount to £552 per mile.

Bradford.—HOLIDAY TRAFFICS.—Approximate figures of the tramway traffic during the Bowling "Tide" week—an increasingly popular general holiday for a big proportion of the industrial population, which immediately follows the Bank Holiday period—show greatly increased takings as compared with last year. The bookings of through tickets between Bradford and Leeds for this period totalled 25,200, as against 22,100 for the same period last year, though last year there was a 10 minutes' service, as against a through-car 15 minutes' service this year, owing to labour shortage.

Dover.—A B. of T. inquiry has been held regarding the recent tramway accident, which resulted in 11 persons being killed and 59 injured.

At the Coroner's inquest, held on August 29th, a verdict was returned that the accident was due to an error of judgment on the part of the driver, whom it was considered was too inexperienced.

Glasgow.—The traffic receipts of the Corporation's tramways last week were £25,901, as compared with £23,638 in the corresponding week of August last year, and the number of passengers carried, 7,883,645. The car-miles run were 509,940. Compared with last year, there is an improvement on the receipts since the beginning of the financial year on June 1st, the figures for 1917 being £296,800, as against £264,256.

Ipswich.—In order to save time and expense in the maintenance of the cars, and also in view of the frequent collisions between cars and other vehicles in the streets due to the absence of street lighting, the Corporation has decided that, for the remaining period of the war, the fancy painting of the cars shall be abandoned, and that in place thereof the cars shall be painted two shades of grey with a limited amount of black lining.

Leeds.—A recent statement on the Corporation tramway services shows that the receipts since the beginning of the current financial year have increased by over £1,000 per week on the figures of last year, though last year the total income, for the first time in the undertaking's history, exceeded half a million pounds. The actual figure was £515,806. It is confidently expected that this record will be much surpassed at the end of the present year. The receipts of the first 20 weeks of this year are higher by £22,433 than for the corresponding period of last year.

London.—L.C.C.—The traffic returns of the L.C.C. tramway undertaking for the week ended August 22nd show receipts £58,527, as compared with £49,848 in the corresponding week last year. From April 1st to August 22nd the receipts were £1,146,260, as against £1,002,591 in the corresponding period in 1916.

Manchester.—TRAFFIC CONGESTION REPORT.—The Special Traffic Congestion Committee of the City Council has issued its report, and the far-reaching proposals for dealing with a pressing problem, and involving an estimated cost of a million and a-half sterling, are exciting keen comment. The Tramways Committee had pointed out the need for new arterial roads into the city, and other Committees had reported upon the great traffic congestion in the centre of the city. The Special Committee considers that there should be a limitation of tramway traffic within a certain prescribed area in the centre of the city, that additional arterial routes should be opened out, and that tramway terminals should be established. The following sites are suggested as terminals: Old Infirmary site, St. Peter's Square, Cannon Street, Albert Square, Marsden Square, and Stevenson Square. The Congestion Committee is of opinion that these terminals are absolutely necessary, and by their adoption the number of cars passing along the principal streets in the centre of the city can be reduced by at least 50 per cent.

Nottingham.—Due to a car which was descending Derby Road temporarily getting out of control, several alarmed passengers attempted to jump off, and six of them were removed to the hospital for treatment of their injuries.

Straits Settlements.—GEORGE TOWN (PENANG) TRAMWAYS.—During the 11th year of operation the municipal tramways carried 5,560,398 passengers, as compared with 5,177,874 in the previous year; the car-mileage was 502,731. The total revenue during the year amounted to \$151,408.42, and the operating costs to \$91,735.95, or 18'40 cents per car-mile.

TELEGRAPH AND TELEPHONE NOTES.

Australia-New Zealand Telegraphs.—The first message by the new Eastern Extension cable from Wellington to Sydney was sent by Sir Joseph Ward on August 23rd.

Leeds Wireless School.—Under instruction of the Marconi Co., in co-operation with the Admiralty, the Leeds Education Authority is to undertake the training of wireless operators on a large scale. Early in September a start is to be made with 40 youths, but arrangements are to be made for the provision of training for 200 students at a time, for a six months' course.

South America.—It is reported from Rio de Janeiro that the Brazilian Government has refused to accede to a petition presented by the Marconi Co. for the installation of a high-power station in Amazonas.—*Review of the River Plate.*

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—MELBOURNE.—October 10th. Department of the Navy. Pumping plant and equipment for the Commonwealth Naval Dockyard, Cockatoo Island, Sydney. Specifications from the Director of Navy Contracts, Melbourne.

Dublin.—September 11th. Electricity Supply Committee. Twelve months' supply of cables, troughing, bends, section pillars, service boxes, &c. See "Official Notices" to-day.

Dunfermline.—September 6th. School Board. Installation of electric lighting at the Rosyth New School. Mr. D. Gorrie, Clerk to the Board, 104, High Street.

London.—BERMONDSEY. —Sept. 7th. B.C. 500-KW. rotary converter. See "Official Notices" August 3rd.

Stockton-on-Tees.—September 10th. District Fund Gas and Electricity Committees. Stores, &c., for six months. See "Official Notices" to-day.

CLOSED.

Southend-on-Sea.—T.C. Accepted tenders:—

Ransome, Sims & Jefferies.—Four electric 2-ton "Orwell" vehicles, with electric tipping bodies, and "Ironclad Exide" batteries, £932 each. J. G. Brill & Co.—Tramway castings and journal boxes, £44 11s.

Swindon.—Electric bells and fire-alarms for new factory: Napier-Kimber, Ltd.

Tilbury.—U.D.C. Refuse destructor: Heenan & Fronde, £5,308.

NOTES.

Electrolytic Disinfecting Fluid.—During the year 1916, according to the report of Dr. F. W. Alexander, Medical Officer of Health to the Borough of Stepney, 26,790 gallons of electrolytic disinfectant were manufactured, making 53,580 gallons as diluted for distribution. The cost was, for materials, £74; electrical energy, £40; total, £114; on account of the war, the price of materials has considerably increased. Since the installation of the plant, a period of 11 years, 445,569 gallons of the fluid have been manufactured at a cost for electricity of £490, and materials £455 (about 1d. per gallon).

Volunteer Notes.—COUNTY OF LONDON VOLUNTEER ENGINEERS (FIELD COMPANIES).—Headquarters, Balderton Street, Oxford Street, W. 1.

Orders for the week, by Lieut.-Colonel C. B. Clay, V.D., commanding:—

Extract from *London Gazette*, August 23rd:—

COUNTY OF LONDON VOLUNTEER ENGINEERS.—Lieut.-Colonel C. B. Clay (Lieut.-Colonel, late Lancs. Volunteer Artillery) to be Temporary Major (May 15th); E. C. P. Monson (late Major City of London Rifles) to be Temporary Major (second in command) (May 15th).

To be Temporary Captains.—W. D. Bentley, E. G. Fleming, W. Hynam (late Captain, Reserve of Officers), F. M. Yearsley (late Captain, 16th Midx. Volunteer Rifles) to be Temporary Captain and Adjutant (May 15th).

To be Temporary Lieuts.—W. J. A. Watkins, A. J. N. Gerard (May 15th).

To be Temporary Second Lieuts.—P. Bowden, C. E. Campbell. A. Champion to be Temporary Hon. Lieut. and Quartermaster (May 15th).

Officer for the Week.—Lieut. W. J. A. Watkins.

Monday, September 3rd.—Technical instruction (searchlight) for No. 3 Company, Right Half Company, at Regency Street. Drill, No. 3 Company, Left Half Company. Signalling Class, 6.30. Recruits' Drill, 6.30.

Tuesday, September 4th.—Physical drill and bayonet fighting, 7.30.

Wednesday, September 5th.—Drill and elementary bridge construction for No. 1 Company, Left Half Company.

Thursday, September 6th.—Drill and elementary bridge construction for No. 2 Company, Left Half Company. Signalling Class, 6.30. Ambulance Class, 6.30.

Friday, September 7th.—Technical instruction (searchlight) for No. 3 Company, Left Half Company, at Regency Street. Drill, No. 3 Company, Right Half Company. Recruits' Drill, 6.30.

Musketry.—All N.C.O.'s and men who have signed the "A" and "B" agreements are required to attend during this month to re-classify in order to enable the corps to obtain the capitation grant. Preference will be given to those men in firing. This does not apply to those who hold the proficiency badge.

Armbands.—The new issue armbands can now be had at Headquarters, and every enrolled man must obtain one without delay; at the same time, all old red armbands (now obsolete) must be returned.

Note.—Unless otherwise indicated, all drills will take place at Headquarters.

(By order) MALEON YEARSLEY.

War Honours.—THE ORDER OF THE BRITISH EMPIRE.—

On August 25th there were published the first lists of men and women who have been appointed to the new Orders instituted in recognition of services rendered in connection with the war. The appointments to the Order of the British Empire include the following:—

Knight Grand Cross.—Lord Emmott, G.C.M.G. (Director of the War Trade Department); Baron Moulton, K.C.B., F.R.S. (Director-General of Explosives); Sir Eric Geddes, K.C.B. (Transportation); the Hon. Arthur Stanley (British Red Cross Society).

Knight Commander.—G. J. Carter, Esq. (Cannell, Laird & Co., Birkenhead); Dugald Clerk, Esq. (Board of Invention and Research, Admiralty, and Ministry of Munitions Inventions Department); C. W. Fielding, Esq. (Chairman of Materials and Metals Economy Committee, Ministry of Munitions); A. E. Herbert, Esq. (Deputy Director-General of Machine Tools, Ministry of Munitions); John Hunter, Esq. (Director of Factory Construction and of Iron and Steel Production, Ministry of Munitions); Prof. H. S. Jackson, F.R.S. (Chemical Adviser to the Optical Research Branch of Ministry of Munitions); L. W. Llewellyn, Esq. (Director of Materials, &c., Ministry of Munitions); Lynden Macassey, Esq., K.C. (Director of Shipyards Labour, &c.); Cecil Partridge, Esq. (Manager and Secretary, Metropolitan Munitions Committee); E. M. Pollock, K.C., M.P. (Controller Foreign Trade Department); Sir Vincent L. Raven (Deputy-Controller, Navy); F. W. S. Stokes, Esq. (Chairman of East Anglian Munitions Committee); Richard Threlfall, Esq., F.R.S. (Advisory Council of Industrial and Scientific Research).

Commanders.—Prof. H. B. Baker, F.R.S., Professor of Chemistry, Imperial College of Science and Technology (Ministry of Munitions); Leonard Bairstow, Esq., F.R.S. (Chief of Aerodynamics, National Physical Laboratory); C. W. Bryant, Esq. (managing director of Messrs. Brotherhoods, Ltd.); J. T. Brownlie, Esq. (Amalgamated Society of Engineers); Prof. W. H. Bragg, F.R.S. (Board of Invention and Research, Admiralty); A. E. L. Chorlton, Esq. (Board of Invention and Research, Admiralty); W. Duddell, Esq., F.R.S. (Board of Invention and Research, Admiralty, also Munitions Inventions Board); A. S. Esslemont, Esq. (Director of Optical Munitions and Glassware); F. W. Harbord, Esq. (Consulting Metallurgist, Ministry of Munitions); A. Laing, Esq. (Wallsend Slipway and Engineering Co.); C. S. Parker, Esq. (Member of the Commission Internationale de Ravitaillement); P. J. Pybus, Esq. (Labour Supply Department of the Ministry of Munitions), Phoenix Dynamo Manufacturing Co., Bradford; Prof. J. F. Thorpe, F.R.S. (Chemical Advisory Committee); Sir G. Croydon Marks, M.P. (Labour Department, Ministry of Munitions).

Officers.—G. Cumming, Esq. (engineering managing director, Harland & Wolff); G. K. B. Elphinstone, Esq. (managing director of Elliott Bros., Ltd.); M. B. Field, Esq. (director of Kelvin, Bottomley & Baird, Ltd.); G. P. Harben (Anglo-Italian Trade Commissioner); Prof. J. C. McLenman (Professor of Physics, Toronto University).

Members.—G. H. Baillie, Esq. (Chief Technical Officer, Labour Supply Department, Ministry of Munitions); R. Clarke, Esq. (Aviation Electrician, Telegraphist, &c., Admiralty); H. Schofield (Principal of Loughborough Technical Institute); W. Simeon (Amalgamated Society of Engineers); C. Taylor (Amalgamated Society of Engineers).

Inquiry.—The maker of the Angelus electric fire is asked for.

Miners' Wages.—The Executive Committee of the Miners' Federation of Great Britain met the Controller of Coal Mines, on Tuesday, and put before him a request for an increase of 25 per cent. on present earnings. Mr. Smillie, the president, and Mr. Herbert Smith, the vice-president, of the Federation, stated the grounds on which the request was based. The Controller undertook to lay the matter before the Government and to communicate the result to the secretary of the Federation at the earliest possible moment. It was reported that the miners in one of the important Midland areas were at present working out their notices, and threatened to come out on strike unless an immediate advance in wage was given. The Controller of Coal Mines and the Executive of the Miners' Federation expressed the hope that no action of this kind would be taken until the Government had had time to consider the application now put forward.

Charity Sports at Chelmsford.—Three large works in the town—viz., Messrs. Crompton & Co., Ltd., the Hoffmann Manufacturing Co., Ltd., and Marconi's Wireless Works Co., Ltd.—carried out a most interesting sports meeting arranged amongst the employees on the ground kindly lent by the Crompton Club, on Saturday, August 25th. There was a record attendance of the public, who not only had an enjoyable afternoon, but also helped three worthy objects—the Essex Regiment Comforts' Fund, the Essex Regiment Prisoners of War Fund, and the St. Dunstan's Hostel for Blinded Soldiers and Sailors. Most of the events were restricted to employees of the works, but the few open ones attracted large entries, many of the men being in khaki. The races were got off in splendid time, the punctuality being remarkable, and upon this the officials are to be warmly commended. In the reserved enclosure were many wounded soldiers from the local hospitals, these being guests. The prize money was kindly provided by the directors of the three companies. The band of the 270th Battalion provided excellent music, and there were amusements of every kind. The Chelmsford V.A.D., under Instructor Runter, were in attendance, but there were no accidents. Mr. Percy G. Cheverton, of Compton's, acted as hon. secretary. The Executive Committee was composed of three representatives from each of the three works. Mr. J. Barker was starter.

The events included running, walking, cycle, hurdle, blindfold, and combination races, and tug-of-war. Crompton's easily secured pride of place in the matter of prizes, winning 9 firsts, 5 seconds, and 5 thirds; Marconi's were second with 5 firsts, 5 seconds, and 3 thirds; while Hoffmann's secured 2 firsts, 5 seconds, 5 thirds. The prizes were distributed by Mrs. Britten, wife of Mr. Thomas Britten, director to Messrs. Crompton & Co., Ltd. Thanks to Mrs. Britten were voiced by Mr. T. Clarkson, and Mrs. Britten suitably replied. Mr. Geoffrey Barrett thanked the hon. sec., Committee, and officials, and Mr. Percy G. Cheverton acknowledged the compliment. In the evening a grand *ad libitum* concert took place on the bowling green, and there was a record attendance; several London artistes appeared. During the interval of the concert, a very popular draw took place, for which 2,500 tickets had been sold. The first prize was a bicycle; the second, two War Savings Certificates; and the third, one War Savings Certificate. There was also dancing, the music being provided by the Yorkshire Regiment Band.

Road Damage by Motor-buses.—Mr. Chapman, the surveyor for Kent, in a report to the County Council on the damage done to main roads by motor-bus traffic, states that 314 miles of county main roads and 104 miles of borough and urban roads carry this traffic. He estimates that 4,550,000 would be required to re-surface with bituminous material those of the main roads not already so treated, including the cost of strengthening the roads, and suggests that legislation is necessary to ensure a more adequate contribution from heavy and high-speed traffic for this purpose.

Strike at Belfast.—With reference to a strike of members of the Electrical Trades Union employed in the tramways department of Belfast Corporation, we learn that a number of men in the electricity department have been called out in consequence. We understand that the dispute arises out of a difference of opinion between the manager of the tramways and the Electrical Trades Union as to whether or not the men engaged in maintaining the overhead equipment of the tramways should be paid the standard rate for electrician's work.

Prohibited Exports.—The Supplement to the *Board of Trade Journal* of August 30th contains complete lists of articles which, according to the latest information received by the Board of Trade, are prohibited to be exported from Denmark, France (including Algeria), Italy, Japan, and the Netherlands. The Supplement also contains the list of articles (complete to date) which are prohibited to be exported from the United Kingdom.

Institution and Lecture Notes.—Iron and Steel Institute.—At the autumn meeting to be held on September 20th and 21st at the Institution of Civil Engineers, London, the following papers are down for consideration:—

- G. Barrett and T. B. Rogerson, "Present Practice in Briquetting of Iron Ores."
- W. J. Brooke and F. F. Hunting, "Microstructure of Commercially Pure Iron between Ar₂ and Ar₃."
- E. D. Campbell and W. C. Dowd, "The Influence of Heat Treatment on the Electrical and Thermal Resistivity and Thermo-Electric Potential of some Steels."
- G. Charpy and A. Cornu-Thenard, "New Impact Testing Experiments."
- J. E. Hurst, "Heat Treatment of Grey Cast-Iron."
- E. F. Law, "Effect of Mass on Heat Treatment."
- T. D. Morgans and F. Rogers, "Investigation upon a Cast of Acid Open-Hearth Steel."
- F. Rogers, "The Acid Open-Hearth Process."
- J. H. Whiteley, "The Eggertz Test for Combined Carbon in Steel."
- E. B. Wolff, "Failure of Boiler Plates in Service and Investigation of Stresses occurring in Riveted Joints."

Mr. Gerard's Disclosures.—In the course of Wednesday's contribution to his work "My Four Years in Germany," in the *Daily Telegraph*, Mr. J. W. Gerard, late U.S. Ambassador in Berlin, mentions a visit paid by himself and Prince Henry, in company with Mr. S. Bergmann, to the Bergmann electrical works. Later he refers to a delayed cable contract as follows:—"Before the war there was but one cable direct from Germany to America. This cable was owned by a German company, and reached America via the Azore Islands. I endeavoured to obtain permission for the Western Union Co. to land a cable in Germany, but the opposition of the German company, which did not desire to have its monopoly interfered with, caused the applications of the Western Union to be definitely pigeon-holed. After the outbreak of the war, in August, 1914, when I told this to Ballin, of the Hamburg-American Line, and Von Gwinner, head of the Deutsche Bank, and when they thought of how much they could have saved for themselves and Germany and their companies if there had been an American-owned cable landing in Germany, their anger at the delay on the part of official Germany knew no bounds. Within a very short time I received an answer from the Foreign Office granting the application of the Western Union Co., providing the cable went direct to America. This concession, however, came too late, and, naturally, the Western Union did not take up the matter during the war."

Hints to Traders with Italy.—The following hints to British manufacturers are taken from the Annual Report for 1916 of the British Chamber of Commerce at Nice:—

"Many German goods are simply cheap imitations of British manufactures. Of course, if and when British labour is fully occupied, it would be undesirable to divert it from making high-grade goods (for which there is a good demand) in order to turn out low-grade goods in which competition is severe. Nevertheless, some German goods, particularly hardware, are exactly suited to certain markets, owing to their lightness and cheapness, and Colonial and foreign buyers often find the German articles more convenient if not of better value. Again, when the British manufacturer refuses to pack his goods in a form convenient to his customers, he deliberately puts himself out of the market. So long as British manufacturers persist in such an attitude they will find it impossible to drive the German trader from the markets where he has been established. At the present time, no doubt, these markets are being tempted to test the dearer and better British goods; but this will not last. In many cases, of course, British goods are better by much more than the difference in price, but where it is impossible to cheapen production the buyer should be stimulated by a more active advertising policy, and by other methods, such as for instance, the placing of goods prominently in wholesale showrooms; the distribution of leaflets setting out in the language of the country the selling points and merits of the particular goods; and by generous advertising in foreign newspapers. The primary need is, however, to supply goods so that they can be disposed of with a minimum of trouble, which is of special consequence where labour is scarce and costly. Another point of great importance is that few manufacturers do their own shipping. They do not realise sufficiently that the price which determines the sale of goods is not the cost at the factory, but the cost delivered in the consumer's market. As regards the ultimate buyer, it makes not the slightest difference whether a low price is brought about by economies in manufacture, packing, freight, or reduction of breakages. If manufacturers are working on too small a scale to do their own shipping at rock-bottom cost, they should either utilise the services of merchants or adopt some co-operative method which will enable them to share in a single efficient and economical selling organisation. If they do their own selling they should

realise that it is as much to their interest to make economies in the packing and shipping of goods as in reducing the cost of manufacture."—*Board of Trade Journal*.

Educational.—CITY AND GUILDS TECHNICAL COLLEGE, Leonard Street, E.C.—The entrance examination for students who have not matriculated will be held on September 18th.

UNIVERSITY OF LONDON, KING'S COLLEGE FACULTY OF ENGINEERING.—Next term begins on October 3rd. For full particulars see our advertisement pages to-day.

THE GOLDSMID SCHOLARSHIP.—The examination for the Goldsmid Engineering Entrance Scholarship at University College, London, value £30 a year for three years, will take place in September. Candidates should apply to the Secretary of University College, London, for full particulars as soon as possible, and not later than September 11th.

Appointments Vacant.—Five assistant foremen for the Government of India Gun and Shell Factory, Cossipore; switch-board attendant (35s.), for the Swindon Corporation electricity works; wireman-jointer, for the Heckmondwike electricity works; men, with experience of up-to-date power station or distributing practice, are wanted by the Rotherham Corporation; assistant mains superintendent for the Darlington Corporation Electricity Department; charge shift engineer (£250) for the L.C.C. tramway generating station; shift engineer for the Eccles Corporation electricity works. See our advertisement pages to-day.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station Officials.—Southend-on-Sea T.C. has declined to allow the electrical engineer, Mr. BIRKETT, to serve two or four days per week for three or four months with the Coal Control Board. The refusal is owing to the depleted staff.

Major W. A. VIGNOLES, borough electrical engineer, Grimsby, has relinquished the acting rank of lieutenant-colonel on ceasing to command a service battalion of the Lincolnshire Regiment.

General.—Messrs. Kincaid, Waller, Manville & Dawson have removed to 3, Central Buildings, Westminster, S.W.1, the Government having requisitioned St. Stephen's House.

In the electrical engineering shop at Rosyth Dockyard, David Adamson, recently a boy writer, was presented with a Carnegie Hero Fund watch for heroism displayed in rescuing a child from drowning. In the presence of members of the staffs of the several departments the watch was handed over by Rear-Admiral H. H. Bruce, Commander Superintendent. Mr. A. J. Ford, of the electrical department, replied for Adamson.

Mr. R. G. SCOTT, of the Sunderland Forge & Electrical Engineering Co., Ltd., was married on Saturday last in the Wearside borough to Miss F. O. Huntley, local organising secretary of the Red Cross Society.

It is announced that the Minister of Munitions has appointed Mr. A. H. Collinson, who is at present Director of Inspection in Munition Areas, to be Controller of Inspection, in place of Sir Sothorn Holland, appointed to the Admiralty for special work.

Roll of Honour.—We regret to learn that Lieutenant J. S. B. PLUMMER, Leicester Regiment, who only returned to France on the 7th inst. (his return was mentioned in our issue of August 10th) is reported by the War Office to be wounded and missing.

Private R. FLOYD, Highland L.L., who has fallen in action, was an apprentice to electrical engineering at the works of the British Westinghouse Co., Ltd., Manchester.

Corporal D. C. DAVIS, R.E., who has been killed at the Front by a bullet from an enemy aeroplane, was formerly on the staff of the Isle of Thanet Tramways & Electric Light Co., Ltd., and enlisted whilst holding an important position with the Argentine Railway Co. at Buenos Aires.

Rifleman A. BURROWS, K.R.R., killed by shell, was employed by the Chloride Electrical Storage Co., Ltd., Clifton Junction.

Rifleman J. CRABTREE, K.R.R., killed in action, was an electrician at Rochdale.

Private T. SCRUFFE, Royal Inniskilling Fusiliers, who is in hospital wounded, was employed on the clerical staff at Rochdale Corporation electricity works.

Private W. PARKER, King's (Liverpool) Regiment, who has died from heart failure after gas poisoning, was employed by Messrs. Dick, Kerr & Co. Private BOWEN, L.N.L. Regiment, also employed by the same firm, has been killed in action.

Second-Lieutenant F. NEWTON, of the Cheshire Regiment, killed in action, was employed by Messrs. Electromotors, Ltd., Openshaw.

Private E. G. WHITEHEAD, Machine Gun Company, Grenadier Guards, of Manchester, who has been killed whilst serving in France, aged 21 years, was employed at the Clayton electricity works.

Electrical Wireman G. E. WILLIAMS, of Marsh Green, Warrington, aged 21, has lost his life at sea. He was serving

on a destroyer which struck a mine. He was a switchboard attendant at the Wigan Corporation electricity works.

Private J. R. BOWES, Loyal North Lancs. Regiment, killed in action, was employed by Messrs. Dick, Kerr & Co., Ltd., Preston.

Private J. WILLIAMSON, Lancs. Fusiliers, presumed killed, after being reported missing, was a former employé of the British Westinghouse Co., Ltd., Trafford Park.

Private N. DENNIS, West Riding Regiment, formerly employed in the Halifax Corporation tramways department, has been awarded the Military Medal.

Corporal T. H. KIRBY, R.F.A., killed in action, was on the clerical staff of Messrs. R. Galsworthy & Sons, electrical fitters, Leeds.

Lance-Corporal J. W. ALBECK, R.E., wounded, was employed at the Bradford city electricity works, Valley Road.

Private J. PRINCE, of the King's (Liverpool) Regiment, killed in action, was employed by Messrs. Dick, Kerr & Co., Ltd., Preston.

Second-Lieutenant JOHN C. JACKSON, Manchester Regiment, reported missing and believed killed, was a student for electrical engineering at the School of Technology, Manchester, prior to the war.

Bombardier W. H. AIREY, R.G.A., who has fallen in action, was on the staff of the Croydon Corporation electricity works.

The Military Medal for bravery has been awarded to Bombardier E. S. HOWARD, R.F.A., who was electrician at the Victoria Hall, York.

Mr. PERCY JOHN PYBUS, who is a Commander of the new Order of the British Empire, and who is described in the honours list as having rendered valuable services to the Labour Supply Department of the Ministry of Munitions, is the managing director of the Phoenix Dynamo Manufacturing Co., Ltd., Bradford, and is at present in charge of hydro-plane construction work. In connection with the work for which he has received his honour, Mr. Pybus carried out an investigation for the Prime Minister with regard to the application of women to the manufacture of munitions, the inquiry leading to the publication of a book by him, entitled "Women on Munitions of War," for which Mr. Lloyd George wrote a preface.

Lance-Corporal C. BISHOP, Sussex Regiment, a former employé of the Brush Electrical Engineering Co., at Loughborough, has been killed in action.

Private J. W. WARDELL, Seaforth Highlanders, who was employed at the power station of the Leeds Corporation tramways, is in hospital at Etaples wounded.

Private R. ASPINALL, of the Loyal North Lancashire Regiment, who was previously reported missing, is now stated to have been killed. He was employed by Messrs. Dick, Kerr & Co., Ltd., Preston.

Signaller J. SHERRINGTON, Heavy Trench Mortar Battery, an employé of Messrs. Dick, Kerr & Co., Ltd., Preston, is in hospital at Leicester, having been gassed in France in July.

Bombardier W. BINGLEY, R.F.A., formerly in the general office of the India-Rubber Co., Silvertown, has been killed in action, and Sergeant F. HIBBARD, R.F.A., formerly in the same department, was wounded on the 17th inst.

Obituary.—MR. J. F. CUMMINGS.—The *Electrical World* contains an account of the career of Mr. James Fulton Cummings, who died on July 26th, aged 48 years. Mr. Cummings was a Canadian, whose electrical work took him to the United States, and after service with some of the best-known electrical organisations there he developed considerable interests on his own account, in connection with underground conduit and interior conduit work. He sold his American patents and business interests in 1897, and came to London, where he opened a large contracting office in the interest of prominent American manufacturers of conduit material. He carried out important installations of this class in this country, also in Milan, Turin, and Petrograd. His father was the author of the Canadian anthem, "The Maple Leaf for Ever."

Will.—The late Captain JOHN CHAMBERLAIN, of Birmingham, left £114,402 gross, and £104,843 net personally.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Wright & Wood, Ltd.—Particulars of £1,000 second mortgage debentures created August 10th, 1917, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £900. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Spensers, Ltd.—Debenture for £3,250, dated July 30th, 1917, to rank *pari passu* with £7,000 first mortgage debentures and a debenture for £750, and in priority to the second debentures.

Bournemouth & Poole Electricity Supply Co., Ltd.—Capital, £500,000 in 25,000 ord., 7,500 $\frac{1}{2}$ per cent. pref., and 17,500 6 per cent. second pref. shares of £10 each. Return dated March 28th (filed July 11th), 1917. 15,000 ord., 7,500 $\frac{1}{2}$ per cent. pref., and 17,500 6 per cent. second pref. shares taken up; £400,000 paid. Mortgages and charges: £187,500.

Telegraph Manufacturing Co. (Colonial), Ltd. (71,854).—Capital, £2,000 in £1 shares. Return dated March 28th, 1917. All shares taken up. £2,000 paid. Mortgages and charges: Nil.

Tudor Accumulator Co., Ltd. (54,080).—Capital, £100,000 in 8,000 "A" and 1,200 "B" shares of £10 each. Return dated August 7th, 1917. 3,800 "A" and 1,200 "B" shares taken up. £10 per share called up on 2,600 "A" and £2 10s. per share on 1,200 "B"; £29,000 paid, £21,000 considered as paid, being £10 per share on 1,200 and £7 10s. per share on 1,200. Mortgages and charges: Nil. A. B. Pescatore, one of the directors, is a native of Luxembourg. All the others are British.

CITY NOTES.

Oxford Electric Co., Ltd.—Interim dividend of 5 per cent. per annum, less income-tax, on ordinary shares for half-year.

Stock Exchange Notice.—Application has been made to the Committee to allow the following to be officially quoted:—

Madras Electric Supply Corporation, Ltd.—100,000 six per cent. cum. pref. shares of £1 each, fully paid.

Companies to be Struck Off.—The following companies are to be struck off the register unless cause is shown to the contrary within three months:—

Advisory Engineers Corporation.
All-British Electrical Co.
Alphons-Custodis Chimney Construction Co.
Flocher's Electric Fittings.
Fuel Patents Syndicate.
Krupka & Jacoby.
Lighting Supplies.
Magna Time Co.
Midland Magneto Co.
Ship Carbons.

County of London Electric Supply Co., Ltd.—Interim dividends on the preference shares at the rate of 6 per cent. per annum for the half-year to June 30th, and on the ordinary shares for the same period at the rate of 5 per cent. per annum, both less income-tax.

STOCKS AND SHARES.

TUESDAY EVENING.

THERE is a very considerable amount of activity in the industrial market as a whole; and in the animation electrical shares are participating. Not only the electricity supply group is better, but shares in the manufacturing companies are also good, to account for which latter there are interesting rumours afloat. Those whose business leads them into the prosaic paths of stocks and shares are probably in the worst position for judging whether or not such rumours have any truth in them; but, repeating gossip for what it may be worth, report has it that something in the nature of an understanding is on the tapis between a number of the best-known British interests and some of the biggest American companies.

These may be too early days in which to do more than hint at the direction which rumour is taking; and, as just observed, the insider connected with the electrical industry is far better able to judge of the possibility of such a combination of interests than the mere financial scribe. But certainly the recent improvement in some of the manufacturing shares is interesting, to say the least of it, in view of the whispers that are current at the moment.

Among the rises in the shares of the electricity supply companies, this week's include $\frac{1}{4}$ in Metropolitans and $\frac{1}{4}$ in Westminster, while the half-a-score of rises which occurred last week are well held, and there is a noticeable demand for all the best shares. In the manufacturing group, British Aluminium are noticeably good, and have attracted a really large amount of business at 33s. 3d. Although this shows a rise of no more than $7\frac{1}{2}$ d. on the week, the market is a good one, and the improvement follows upon a steady rise within the past two or three months.

Westinghouse preference, too, are firm at 2 11/16, and every day there is a lot doing in the £3 shares of the Edison Co. The price, which a little while ago was 10s., has come up to the neighbourhood of 19s.; and it is generally understood that the shares will be split into £1 shares before the end of the year. Being now regarded as £3 shares, this splitting would mean that on the present basis of 19s., the price would be about 6s. 4d.; and having regard to the demand which there is at the present time for any industrial with good prospects, it is thought that the price may easily improve upon the equivalent of its present position. British Insulated have risen 5s. to 13 $\frac{1}{2}$, following upon their advance of 7s. 6d. last week. India-Rubber 5 per cent. debenture stock at 95 is also harder.

One of our readers asks whether we do not regard India-Rubber shares and Telegraph Constructions as being favourable investments, and our answer is a decided affirmative, though we fear that our correspondent will have some difficulty in picking up the shares. As we have pointed out on previous occasions, the fact that these companies, or any other concerns, have paid in the past their dividends free of tax does not necessarily mean that they will continue the practice in the future, although, of course, they will do all that is possible to maintain the tradition.

The foreign group, with the exception of Brazil Traction, is also strong. Substantial rises have taken place in Mexican

issues, Mexican Electric Light & Power Common being 12 points up. Big advances have occurred in the various other shares of the company, in Mexico Tramways, and in the Monterey and the Pachuca bonds. Confidence is becoming more assured that President Carranza is really friendly to the Allies and to peace, with the result that nearly everything Mexican has appreciated materially. The rise in the price of silver is a minor factor in the situation.

Brazil Tractions have gone back to 48, the Rio rate of exchange being lower. Anglo-Argentine Tramways are better, the first preference hardening to 2 15/16. There have been big rises in various Canadian industrials, including the light and power issues; and a feature of strength during the past day or two is the activity in Pernambuco Trams, the price having risen a shilling or so to 7s.

The Home Railway market is dull, in consequence of the labour position; but the Underground group keeps fairly steady, by reason of the revision of fares on some of the bus routes. This has helped Underground incomes to 83, a rise of 1; but the assented ordinary of the Central London is dull at 60 1/2.

The telegraph market is firm throughout, with the exception of West India & Panama shares. These eased off to 30s. Eastern ordinary at 145 is harder. Cuba Submarine preference rose 10s. to 11 1/2. The Marconi group is quiet. Oriental Telephones and United River Plates are both strong. The revival of activity amongst industrials as a whole has somewhat detracted from the allurements of rubber shares; and the market for these has become less animated, though prices are firm. The armament group is quiet. There has been a renewal of activity and better prices in the shares of various mining companies dealing with base metals.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.					
	Dividend	Price	Rise or fall	Yield	
	1915. 1916.	Aug. 23, 1917.	this week.	p.c.	
Brompton Ordinary ..	10 9	64xd	—	£7 4 0	
Charing Cross Ordinary ..	6 6	87xd	—	6 9 0	
do. do. do. 4 1/2 Pref..	4 1/2 4 1/2	87xd	—	6 13 4	
Chelsea ..	4 3	24	—	6 4 4	
City of London ..	8 8	13	—	6 3 3	
do. do. 6 per cent. Pref.	6 6	10	—	6 0 0	
County of London ..	7 7	11 1/2	—	6 3 1	
do. do. 6 per cent. Pref.	6 6	10 1/2	—	5 17 1	
Kensington Ordinary ..	7 6	64xd	—	5 11 3	
London Electric ..	8 9	1	—	Nil	
do. do. 6 per cent. Pref.	6 4	8 1/2	—	5 6 8	
Metropolitan ..	6 8	3	+ 1/2	5 0 0	
do. do. 4 1/2 per cent. Pref.	4 1/2 4 1/2	8 1/2	—	7 4 0	
St. James' and Pall Mall ..	5 8	7	—	5 14 6	
South London ..	5 5	2 1/2	—	7 5 6	
South Metropolitan Pref.	7 7	21 1/6	—	8 10 3	
Westminster Ordinary ..	7 7	12	+ 1/2	5 9 10	

TELEGRAPHS AND TELEPHONES.					
	Dividend	Price	Rise or fall	Yield	
	1915. 1916.	Aug. 23, 1917.	this week.	p.c.	
Anglo-Am. Tel. Pref. ..	8 8	98	—	6 2 5	
do. do. Del. ..	8 1/2 1 1/2	22 1/2	—	6 15 4	
Chile Telephone ..	8 8	7 1/2	+ 1/2	5 11 4	
Cuba Sub. Ord. ..	6 6	8 1/2	—	6 17 8	
Eastern Extension ..	8 8	14 1/2	—	5 9 4	
Eastern Tel. Ord. ..	8 8	14 1/2	+ 1/2	5 10 4	
Globe Tel. and T. Ord. ..	7 7	12 1/2	—	6 9 10	
do. do. Pref. ..	6 6	10 1/2	—	5 16 8	
Great Northern Tel. ..	22 21	86	—	6 13 4	
Indo-European ..	18 13	54 1/2	—	5 19 3	
Marconi ..	10 15	3 1/2	—	4 15 10	
Oriental Telephone Ord. ..	10 10	8 1/2	+ 1/2	3 4 0	
United R. Plate Tel. ..	8 8	6 1/2	+ 1/2	5 15 4	
West India and Pan. ..	6d. 6d.	1 1/2	—	1 12 0	
Western Telegraph ..	8 8	14 1/2	—	5 10 4	

HOME RAILWAYS.					
	Dividend	Price	Rise or fall	Yield	
	1915. 1916.	Aug. 23, 1917.	this week.	p.c.	
Central London, Ord. Assented	4 4	60 1/2	—	6 12 1	
Metropolitan ..	1 1	22 1/2	—	4 8 6	
do. District ..	Nil Nil	15	—	Nil	
Underground Electric Ordinary	Nil Nil	18	—	Nil	
do. do. "A" ..	Nil Nil	5 1/2	—	Nil	
do. do. Income ..	8 4	83	+ 1/2	5 16 5	

FOREIGN TRAMS, &c.					
	Dividend	Price	Rise or fall	Yield	
	1915. 1916.	Aug. 23, 1917.	this week.	p.c.	
Adelaide Sup. 8 per cent. Pref.	6 6	5	—	6 0 0	
Anglo-Arg. Trams, First Pref.	6 6 1/2	21 1/2	+ 1/2	9 7 2	
do. do. 2nd Pref. ..	5 1/2	2 1/2	—	—	
do. do. 5 Deb. ..	5 5	67	—	7 9 3	
Brazil Tractions ..	4 4	18	—	—	
Bombay Electric Pref. ..	6 6	9 1/2	—	6 4 8	
British Columbia Elec. Rly. Pice.	6 5	17 1/2	—	10 10 6	
do. do. Preferred Nil Nil	Nil Nil	81	—	Nil	
do. do. Deferred Nil Nil	Nil Nil	29	—	Nil	
do. do. Deb. ..	4 1/2 4 1/2	55	—	7 14 7	
Mexico Trams 5 per cent. Bonds	Nil Nil	49 1/2	+ 5	Nil	
do. do. 6 per cent. Bonds	Nil Nil	35 1/2	+ 3	Nil	
Mexican Light Common ..	Nil Nil	30	+ 1 1/2	Nil	
do. do. Pref. ..	Nil Nil	82 1/2	+ 3	Nil	
do. do. 1st Bonds ..	Nil Nil	53	+ 4 1/2	—	

MANUFACTURING COMPANIES.					
	Dividend	Price	Rise or fall	Yield	
	1915. 1916.	Aug. 23, 1917.	this week.	p.c.	
Babcock & Wilcox ..	15 16	3 1/2	—	4 15 10	
British Aluminium Ord. ..	7 10	13 1/2	+ 7 1/2	8 1 3	
British Insulated Ord. ..	17 1/2 20	13 1/2	+ 1/2	7 8 3	
British Westinghouse Pref.	7 1/2 7 1/2	2 1/2	—	5 11 6	
Callenders ..	20 20	14 1/2	—	7 0 6	
do. do. 5 Pref. ..	5 5	4 1/2	—	6 1 8	
Castor-Kellner ..	22 22	8 1/2	—	6 8 0	
Edison Swan, fully paid	—	1 1/2	+ 1/2	Nil	
do. do. 4 per cent. Deb. ..	4 4	71 1/2	—	5 12 0	
Electric Construction ..	7 1/2 7 1/2	4 1/2	—	8 6 0	
Gen. Elec. Pref. ..	6 6	10 1/2	—	5 17 1	
do. do. Ord. ..	10 10	18	—	6 5 0	
Henley ..	25 25	18	—	7 16 3	
do. do. 4 1/2 Pref. ..	4 1/2 4 1/2	19 1/2	—	6 12 8	
India-Rubber ..	10 10	19 1/2	—	7 6 10	
Telegraph Con. ..	20 20	38 1/2	—	5 6 5 1/2	

* Dividends paid free of income-tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, August 29th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic ..	per lb.	1/6	..
a Ammoniac Sal ..	per ton	£75	..
a Ammonia, Murate (large crystal)	"	£64	..
a Bismuthide of Carbon ..	"	£23	..
a Borax ..	"	£38	..
a Copper Sulphate ..	"	£81	..
a Potash, Chlorate ..	per lb.	2/6	..
a Perchlorate ..	"	2/1	..
a Shilao ..	per cwt.	£12 10	30/- inc.
a Sulphate of Magnesia ..	per ton	£16	..
a Sulphur, Sublimed Flowers ..	"	£35	..
a Lump ..	"	£25	..
a Soda, Chlorate ..	per lb.	10d.	..
a Crystals ..	per ton	120/-	..
a Sodium Bichromate, caske ..	per lb.	..	..

METALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
c Brass (rolled metal 2" to 12" basis)	per lb.	..	..
c " Tubes (solid drawn) ..	"	..	..
c " Wire, basis ..	"	..	..
c Copper Tubes (solid drawn) ..	"	1 7/8 to 1 1/2	..
z " Bars (best selected) ..	per ton	£160	..
z " Sheet ..	"	£160	..
z " Rod ..	"	£160	..
d " (Electrolytic) Bars ..	"	£137	..
d " Sheets ..	"	£162	..
d " Wire Rods ..	"	£145	..
d " H.C. Wire ..	per lb.	1/5 1/2	..
f Ebonite Rod ..	"	3/-	..
f " Sheet ..	"	2/6	..
n German Silver Wire ..	"	2/3	..
h Gutta-percha, fine ..	"	6/10	..
h India-rubber, Para, fine ..	"	3/2 1/2	..
i Iroo Pig (Cleveland warrants) ..	per ton	Nom.	..
l " Wire, galv. No. 8, P.O. qual. ..	"	£42	..
z Lead, English Pig ..	"	..	..
z Mercury ..	per bot.	Nom.	..
e Mica (in original cases) small ..	per lb.	6d. to 8/-	..
e " " medium ..	"	8/6 to 6/-	..
e " " large ..	"	7/6 to 1/- & up.	..
d Silicon Bronze Wire ..	per lb.	1/9 1/2	..
r Steel, Magnet, in bars ..	per ton	..	..
s Tin, Block (English) ..	"	..	..
n " Wire, Nos. 1 to 16 ..	per lb.	8/6	..

Quotations supplied by—

a G. Boor & Co.	James & Shakespeare.
c Thos. Bolton & Sons, Ltd.	h Edward Tilt & Co.
d Frederick Smith & Co.	i Bolling & Lowe.
e F. Wiggins & Sons.	l Richard Johnson & Nephew, Ltd.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	n P. Ormiston & Sons.
	r W. F. Dennis & Co.

Energy Released by Boiler Explosion.—Writing in *Power*, Mr. C. H. Berry, Assistant Professor of Power Engineering, Cornell, gives an explanation of the very destructive effect of boiler or economiser explosions, though only moderate working pressures are employed.

Referring to the explosion of a cast-iron economiser, he points out that the displacement of the atmosphere must have been responsible for the displacement of 5,000 sq. ft. of roof, and injury to buildings, &c., as flying fragments of iron would not account for this. The resistance of the atmosphere and sudden movement—its inertia—tends momentarily to blanket the sudden expansion; but this phase passed, and the air is set moving violently, tending to keep moving and thus piling a high pressure against any obstructing object, much as in the case of "water hammer" action.

The work done in moving the atmosphere cannot be measured as a product of its pressure by any change of volume, since this is not a slow pushing back of the surrounding medium, but a sudden movement which necessarily does much work in developing a high velocity of the air.

Since the velocity and the weight of air moved are unknown, it is not possible to compute the energy required to overcome the resistance. Prof. Berry therefore decides that it is impossible to make deductions from the energy liberated on account of atmospheric resistance.

Electrification of Swiss Federal Railways.—The United States Consul at Berne reports that the electrification of the Swiss Federal Railways has now emerged as a very practical economic question. The Government has created a special department, attached to the direction of the Swiss Federal Railways. This department announces that it is prepared to consider proposals for sale and delivery of such electrical material as may be necessary for equipment in connection with this work, and that bids will be received from all countries. A statement by the management shows that large orders for copper wire already have been placed with certain firms in the United States.—*Electrical World*.

SOME NOTES ON BRITISH AND CONTINENTAL ENGINEERING METHODS AND TRAINING.

By A. G. ELLIS, A.M.I.E.E.

(Abstract of lecture delivered before the BRITISH WESTINGHOUSE ENGINEERS' CLUB.)

At no time in history has there been so much discussion of British industrial and trading methods as compared with those of our Continental neighbours, both allied and (chiefly) enemy, which differ in many points from ours. I have endeavoured in these notes to bring out a number of such points which I have observed during several years of engineering work on the Continent.

GENERAL INDUSTRIAL CONDITIONS.

Living and Wages.—Living is, on the whole, rather cheaper on the Continent, but wages and salaries are correspondingly lower. Skilled manual workmen in the engineering trades earn only about 75 per cent. of the hourly rates of corresponding trades in this country. In spite of this, the general conditions of living are better, and thrift is much more observable than among the manual workers in this country.

This is in many cases partly to be attributed to the natural environment and situation of the factories. Only in the largest industrial centres of France and Germany does one meet conditions approaching the congestion and monotony of English manufacturing districts. Apart from these, factories are located individually, or in small groups, in or adjacent to medium-sized towns, from which egress into the surrounding country is an easy matter.

This question of environment has undoubtedly its effect on the morale and life of the manual workers, which is especially noticeable in the industrial districts of Switzerland. In that country, partly by reason of the brighter environment, and partly because of the innate democratic nature and the national educational system, the manual workers are remarkably thrifty and independent, and in general living are very simple and hygienic.

The same ends (apart from independence) are reached in Germany, for instance, by means of official inspection and control.

An important factor in this question is that of housing. On the Continent nearly everyone, including the manual workers, live in flats, built in blocks of usually three to five stories with common gardens behind. Central heating and electric lighting are common, and rooms larger and better arranged than in the orthodox five- or six-roomed small house are obtained. Such blocks do not generally suffer from the depressing "soullessness" of the working people's tenement dwellings found in the industrial cities in England.

There is also a greater tendency among the working people to build their own dwellings, which is fostered and assisted by the popular banks, who make a practice of lending money for such purposes at low rates of interest.

Relations of Capital and Labour.—In every European country there continually arise practically the same questions between Capital and Labour. In general, the relations between the two parties appear to be more cordial the more democratic the country, and, conversely, the more difficult the more autocratic the country.

To take two extremes: In Germany, Socialism is strong and discontent is fairly rife among the manual workers, but it rarely gets under way owing to being kept down under the iron heel of militarism; in Switzerland, on the other hand, democracy is advanced to such an extent that employés are often shareholders in the industrial concerns they are working with, and there is seldom, and little, industrial discontent.

Trade Unions exist in all the industrial countries, but they are usually wrapped up in Socialistic propaganda, and are generally not nearly so powerful as in England.

Technical Staff.—Salaries of the technical staff are also rather lower than in England, but living and travelling are cheaper. For young, single engineers life is less of the dreary proposition it often is in England, as good apartments are more readily obtainable, and more generally developed restaurant life renders the restaurants and "Bier-halle" very habitable places. At least one of the large European firms has built a colony of houses for its staff and their families, which are let out as single villas, or as two or three flats at moderate rentals.

The lower scale of salaries is partly due to the over-production of university-trained engineers in Germany during the past 10 to 15 years. This has led, incidentally, to a better class of man, technically, being available for intermediate and lower positions, such as draughtsmen, test assistants, &c.

The bonus system has been generally in vogue for a good many years, with satisfactory results. The actual amount is determined by the individual work accomplished, initiative, and personal relations with other departments and individuals.

Rents, Rates, and Taxes.—On the whole, the sum total of house rent, rates, and taxes approximates to the same figures

as in England, though living, travelling, and amusements cost generally rather less.

Working Hours.—The total number of working hours per week for workshops and offices is approximately the same in England and on the Continent. Works hours for manual workers total 52.53 hours per week, and office hours average 45 hours per week. Up till recent years it was quite common practice to work right through Saturday afternoon, and this practice has never been abandoned or relaxed in France. This is not without its influence on the physique and morale of the race. The British traditional Saturday afternoon of sport is, on the whole, much more beneficial, even to working capacity, in the long run.

GENERAL WORKS ORGANISATION.

Relation of System to Size of Firm.—Up to a certain point the organisation on any industrial undertaking is practically the same anywhere. There are usually three main divisions:—

1. The technical side, comprising engineering, design, and manufacture.

2. The sales side, comprising selling, publicity departments, &c.

3. The commercial side, comprising the accounting, purchasing, and similar departments.

Beyond this point the organisation depends to a large extent upon the size of the undertaking and the number of employés.

Small Continental firms generally have the whole of the engineering work grouped together in one common design office and one general drawing office. This is the most workable and efficient plan for small undertakings. In the larger Continental firms it has been found necessary to sectionalise the departments according to the class of machine or apparatus manufactured.

The sales departments are also similarly grouped in the general sales office in the case of small firms, and sectionalised according to the different classes of machinery in large firms, the necessity for which is obvious when dealing with large amounts of business.

Comparison of British and Continental Practice.—Turning now to British organisation of medium and large firms, we find a compound of the above two systems. In a typical organisation, certain specialised departments, such as traction, transformers, and apparatus, are segregated from the main engineering departments, while others are left collectively under the general engine and machine departments. This segregation is carried out for the same departments on the sales side, the engineering and sales divisions being located in close proximity, and working in close co-operation. This point is a step in advance of the organisation adopted by large Continental firms, and I should say it forms the most satisfactory basis for the organisation of a large works.

Probably the most efficient working would be obtained by also sectionalising the factory as far as possible into a number of component factories producing each one class of machine or apparatus, under the control of the corresponding engineering unit working in conjunction with its own sales department.

The standardising department prepares lists of all standard materials, parts, tender and specification forms, &c., and the department chief is charged with lining up the general practice of, and ensuring co-operation between, the several engineering departments, to prevent unnecessary waste and overlapping. This is of great importance in reference to economising on stocks and sizes of frames, copper, angle irons, &c., and it is, in fact, a very live department if properly organised. It is not sufficient that a certain amount of necessary standardisation of parts and stocks common to all engineering departments has been done once and for all, but it is essential continually to line up progress in all the different departments, and thus reduce development expenses by preventing overlapping.

Research.—Research departments are not far developed in other than a few of the leading engineering works. In general, research work is conducted on much the same scale and in much the same way as in England. A large amount of investigation is carried out at the technical high schools and universities, but this often suffers from the common complaint of being too academical. In the engineering works, though the largest firms have their own research laboratories, this work is not carried on on anything like such a lavish and far-reaching scale as in America. What is missing on the Continent, as in this country, is a comprehensive scheme of co-operation for the systematic carrying-out of research work, and distributing the results and preventing overlapping and repetition.

Weights and Measures.—The advantages of the metric and decimal system of weights, measures, and money in universal use on the Continent are nowadays sufficiently apparent to be past controversy.

In this country our conservative clinging to unwieldy and cumbersome systems of weights and measures handicaps our business in foreign markets, and is responsible for considerable waste of time and many errors, particularly in engineering work.

The influence of Continental engineers who have been employed in responsible positions by British firms is observable in some quarters in a mixture of metric and British units

in calculation and design work. Such a state of affairs is, if anything, more hopeless than sticking to one system, however bad.

Another point I would make is that of ease of conception of magnitudes in the metric system. Small magnitudes are expressed in millimetres, and the magnitude of the millimetre becomes a clear and fixed quantity to the mind and to the eye.

In general, I believe that the presumed difficulties in changing over and getting used to a new and rational system, even for the man in the street and the old woman in the market, would be found not nearly so insurmountable as has been supposed. The sweeping changes in national ideas and conventions since the war have demonstrated the rapid adaptability of the British national mind, and, in addition, the influence of closer contact with the Continental nations since the war renders the present time (or the immediate after-war period) very suitable for such a change.

Relations between Manufacturers and Customers.—General business relations, conditions of sale, terms of payment, &c., do not differ to any extent in most of the Continental countries from those obtaining in this country. Technical relations between manufacturers and customers, however, differ considerably, being more co-operative on the Continent than in England.

Industrial Banks.—The first reason for this is that a large part of the engineering business for the Continental market is conducted through the industrial banks which finance industrial concerns and power schemes, ensuring a market for their manufactures.

The largest German electrical and manufacturing concern is conducted on these lines, this undertaking comprising not only machine factories and power schemes, but also mines and factories for the internal supply of raw material. Under such conditions, a large demand for manufactured machines is automatically created, which facilitates production in large quantities (massenfabrikation), which, with the cheap supply of raw material, results in low cost of production and consequent easy competition in the open markets. This has been one of the important factors underlying German competition in the world's markets.

In concerns financed by subscribed capital, and not by the industrial banks, there are also instances of correlated power companies who finance and engineer large power schemes, for which the necessary machinery and apparatus is automatically ordered from the mother manufacturing company. This ensures a certain minimum "load factor" of works production at reasonable prices.

Consulting Engineers.—The second reason for the closer co-operation between manufacturers and customers is the practical absence on the Continent of the consulting engineer. This is chiefly due to the method of conducting affairs referred to immediately above. By reason of this, the consulting engineer has become practically short-circuited and superseded by skilled engineers on the staffs of the manufacturing and power-scheme companies who are, as a matter of fact, more intimately in touch with the conditions obtaining and manufacturing possibilities. The result is certainly beneficial, and leads to closer co-operation and sounder engineering work.

Standardisation.—Closely related to this question is that of standard specifications and standard apparatus. In this country it appears that practically every individual consulting engineer and power company issue their own pet specifications for electrical machinery, and seldom are content with the manufacturers' standard apparatus. Even the Standardisation Rules of the Engineering Standards Committee appear to be specified only in the minority of cases. Apart from the question whether these rules represent the most desirable set of specifications, it is to be deplored that they should not be more widely adopted by purchasers of electrical machinery.

The lack of uniformity in different customers' requirements (the difference often being of relatively little importance) necessitates manufacturing numbers of special types of apparatus, resulting in needless loss of time in offices and works, and increased cost of production.

On the Continent, the state of affairs is just the reverse. Each country of importance has its own set of standardisation rules, issued by an authoritative body representing the industry.

The German rules for electrical machinery (issued from year to year by the V.D.E., corresponding to our I.E.E.) are adopted by all the German, Austrian, and Swiss firms, and most of the rules of other countries (among them France, Belgium, Russia, and Italy) follow them very closely. The consequence is a fairly uniform specification throughout Europe, as the standardisation rules are respected and worked to by practically all manufacturers and customers' engineers.

The manufacturers are thus in a position to standardise and get out lists of their apparatus in accordance with the standardisation rules, and they are sufficiently strong to compel the customer to accept their standard apparatus, or go elsewhere, if possible.

This is the fundamental difference between this country and the Continent in this important matter. I know of one instance where a Continental manufacturing firm some years ago gave up the idea of English business, in spite of the "open door," solely on this account.

Electrical Machinery for British and Continental Markets.—I will only refer to the three principal specification conditions for electrical machinery, viz.:—

- (a) Temperature rise.
- (b) Overload capacity.
- (c) Insulation tests.

(a) and (b). In the matter of temperature rise there has been a certain amount of timidity in this country. The general figure for the temperature rise of electrical machinery at continuous normal load on the Continent is now 60 deg. C., while according to the British standard rules it is 50 deg.—55 deg. C.

Here we still find many different individual customers or consulting engineers each specifying a different temperature rise, ranging from 30 to 50 deg. C., and often after varying periods of time. The usual reason given is the different degree of overload required, according to the duty the machine has to perform, some preferring what they call a "liberally rated" machine.

This leads also to a variety of specifications as regards overload capacity. The most rational way to designate a machine is by its *normal continuous rating at the standard temperature rise*, for which rating standard overload capacities are available. The size of machine can easily be selected by determining the permissible normal rating in conjunction with the overload capacity required. In the case of machines for varying load (crane, rolling mill, traction motors, &c.) the normal rating should be determined from the root-mean-square value of the load diagram.

(c) As regards insulation tests there is less discrepancy of ideas in the different countries. This uniformity is at least gratifying, but it prompts the question why we should not be able to establish international standards. There is, after all, little radical difference between British and Continental machinery (electrical or otherwise), and it is to be hoped that in the course of time the International Electrotechnical Commission will be able to achieve something in this direction.

Tolerances.—In the various standardisation rules I find no standard tolerances to guarantees specified, although it is not uncommon for manufacturers to demand such, both on the Continent and in this country.

Most of the large Continental firms have these tolerances scheduled and prescribed in their standard lists. There have been cases of a firm utilising part of the tolerance in order to present apparently better guarantees than correspond to reality, a practice which is to be deprecated.

General Applications of Electricity.—In the utilisation of electrical energy for factories, mills, shipyards, public lighting and tramways, and suburban railways, we are as far as, and in some cases further advanced than, on the Continent. Main-line electrification has, however, gone ahead quicker across the Channel, notably in Italy and Switzerland.

A good deal might be done in this country on Continental lines in the more general domestic application of electricity, partly as an aid to the solution of the servant problem. On the Continent the use of electricity for village lighting, cooking and heating, and driving of looms and machines for home industries is very widely developed. The application of electricity to agricultural machinery, at any rate in the mid-European countries, is also far developed.

It is usually thought that this is the outcome of cheap electrical energy being obtainable from the large sources of water power available. So far as I have seen, electrical energy is not, on the whole, very much cheaper on the Continent than in this country, and against this must be taken into consideration the fact that wages are generally lower.

The domestic use of electricity is facilitated by the simplicity of house and shop wiring, covered wires being run on porcelain cleats on walls and ceilings without casing or tubing; also by the ease in connecting-up small consumers to the distributing networks, which are usually bare overhead wires on wood poles in the smaller towns and villages.

Of course, we have been handicapped to a certain extent by being pioneers, and also by the Board of Trade limit of 20,000 volts transmission voltage. It is to be hoped that the after-war period of development will see the removal of this limit, and the development of high-tension overhead transmission.

Training of Engineers and Manual Workers.—It is generally reckoned that the educational system of the majority of the European countries is more highly developed than in England. The chief point of contrast is the continuous national system, from the primary school to the University, usually found on the Continent. While in England individual sections of our educational systems, notable the public schools and universities, do not show up at any disadvantage, there is a serious handicap in lack of continuity throughout the whole system.

Training of Skilled Engineers.—For the training of skilled engineers the Continental system follows the invariable course of primary school, intermediate school, technical preparatory school, technical high school or university. Attendance for a prescribed number of years in each is obligatory in order to become a diploma engineer.

In this country a youth is taken straight from a secondary or public school to a technical college or university without any preliminary technical education. The result is that a large amount of technical ground has to be covered during the first year, at such a rapid rate, that it is difficult to assimilate it properly; nevertheless, it is remarkable how

rapidly English students pick up and progress during the remaining years of study.

The English engineer is finished sooner than the Continental, and at the age when the latter has finished his studies and works experience the former has already had several years of valuable practical experience, and is of more use to the industry, and a better man for his job. This often shows itself in the young engineers in England being more practical, and on the Continent being more academic.

On the whole, the finished product of the British technical college or university shows up quite favourably against the Continental. This statement must, however, be qualified for the partially-trained men in intermediate positions.

On the Continent there is generally more or less systematic training to be obtained for draughtsmen, test assistants, erection engineers, and the like, for whom no specific course of education obtains in this country. On the Continent such positions are usually filled by men designated "Techniker," usually drawn from the more intelligent artisans and trade apprentices, who spend two complete years at a technical school, the "Technikum." This school is not of university rank, and men who have taken its courses do not rank as engineers, though a certain number attain to positions usually filled by university-trained men. So far as I have seen, the average level of capability and intelligence of draughtsmen and the like is thereby greatly enhanced.

Training of Manual Workers.—The trade apprentice usually enters works at about the age of 14 years, as in this country, and continues his education systematically at the national schools in subjects connected with his particular trade. These classes are compulsory for regular trade apprentices, and are held during working hours on several afternoons of each week, the apprentices being granted the necessary leave to attend them regularly.

It is only of recent years that attempts have been made in this country to secure continuation schooling for trade apprentices during works hours, and this has been by individual effort. On the Continent, such schemes have been in vogue and under national supervision for many years, and the beneficial results are apparent.

A proper scheme of apprentice training should be incorporated in a reorganised national system of education in England, under the central education authority controlling a continuous scheme of education up to the technical colleges and universities.

SECOND REPORT OF THE COMMITTEE FOR THE INTERCONNECTION OF THE LANCASHIRE AND CHESHIRE ELECTRICITY SUPPLY SYSTEMS.

(Concluded from page 191).

49. The total capacity expended by municipalities on power stations, mains, and sub-stations in the area covered by this report is £7,425,266, of which £3,166,274, equal to 43 per cent., has been paid into the sinking fund, and the outstanding capital indebtedness is £4,339,183.

In addition to the amount paid into the sinking fund, there stands to the credit of reserve and renewals funds a total of £337,672.

The capital expenditure of companies on power stations, mains, and sub-stations amounts to £1,341,690, of which £126,567, equal to 9 per cent., has been written off.

50. A joint board, constituted on the lines set forth in Clause 4, consisting of nominated or elected representatives of all the statutory authorities in the area, together with an advisory committee of engineers, would, in the opinion of the Committee, form the most suitable authority to exercise full statutory powers in regard to all power stations and transmission lines in the area of Lancashire and Cheshire.

These representatives and engineers have for many years had a close and intimate knowledge not only of the possibilities of economical production from the supply authorities' point of view, but also of the requirements of the various industries established in the district.

A board so constituted might be relied upon to furnish the necessary enterprise to develop the power supply business in the best interests of the industrial community.

51. In Lancashire and Cheshire the majority of electricity undertakings are owned and operated by municipal authorities. Amongst these undertakings are some of the largest and best-equipped stations in the country, and the prices charged for industrial purposes compare favourably with the lowest charges made elsewhere. There would appear to be no valid reason, therefore, why the present measure of control by municipalities should be disturbed in setting up the constitution of the joint board, the important point being to constitute one single authority for the whole area so that future developments can be co-ordinated along sound, technical, and commercial lines.

52. The Committee feel that the time has passed when power to generate electrical energy, which is so vital to the interests of the trade of the nation, and to the efficient employment of the nation's principal source of wealth, i.e.,

coal, should continue to be exercised solely for the purpose of supply within a limited area, and, in order to deal efficiently with future requirements, they consider it essential that extensions of existing power stations or the provision of new power stations should only be proceeded with after due consideration has been given not only to the requirements of the particular area in which such power stations may be situated, but also of the actual or potential requirements of the surrounding districts. In other words, the provision of efficient generating plant has ceased to be a matter which only concerns each separate undertaking as at present constituted, but has become an important element in the welfare of whole districts, without regard to municipal or other boundaries.

53. In order to secure the most efficient results, developments should take place along the following lines:—

(a) Large units of plant—of not less than, say, 10,000 kW. to 15,000 kW.—must be provided in order to obtain the most economical employment of capital expenditure.

(b) Such plants must be concentrated in the most suitable localities for the purpose.

(c) High-tension transmission lines for interconnecting purposes must be constructed between the large power stations, so that the large plants may be used to the greatest advantage.

(d) All suitable sources of waste heat must be utilised.

By effecting these changes not only would there be a considerable reduction in the annual costs incidental to a lower capital expenditure per kW. of plant installed, but there would be an enormous saving in the fuel consumption per unit generated, in addition to reductions in other working expenses.

54. The Committee would point out that under these proposals supplies would be given to authorised distributors at cost prices, and, whilst reserving to the authorised distributors their full and existing rights under their provisional orders, it may be necessary to introduce safeguards to ensure that the advantages of cheap production arising out of a federation of interests shall not be neutralised by the distributing authorities charging unduly high prices to the consumers within their area.

The Relation of the Joint Board to the Existing Government Departments, or to any New Electricity Tribunal that may hereafter be set up.—55. The Committee are in accord with the recommendation tendered to the Board of Trade Electrical Trades Committee, advocating the appointment of a new tribunal consisting of a limited number of electricity commissioners, who would be entrusted with the jurisdiction of matters affecting the supply of electricity.

56. The Committee would go further, and suggest that the commissioners should be the central authority in technical matters, and should possess all other powers now exercised by Government departments, and such other powers as may hereafter be conferred upon them by Parliament, with regard to electricity supplies for the whole country.

57. The establishment of the one single authority referred to above for owning and operating the power stations and high-pressure transmission lines in the Lancashire and Cheshire area does not appear to the Committee to be inconsistent with the proposal to set up electricity commissioners.

58. On all technical matters the advisory committee of engineers to the joint board would form the medium of relationship between the central authority of the electricity commissioners and the local joint board.

Summary of Committee's Further Recommendations.—59. Inasmuch as the interconnecting proposals are but the preliminary steps in the direction of co-ordinating the existing undertakings, the Committee would strongly recommend that favourable consideration should be given to the proposals set forth in the latter sections of the report, namely:—

That in addition to the powers conferred upon the joint board (as set forth in Clause 7) for the purpose of interconnection, the board should also possess powers enabling them to erect new power stations and to acquire—when and where desirable—the ownership, control, and operation of all or any power stations (existing and future), and all high-pressure transmission lines.

60. That a new tribunal, consisting of electricity commissioners, should be set up to administer the powers now exercised by Government departments in relation to electricity supplies, and such other powers as may hereafter be conferred upon them by Parliament.

61. *Note.*—The signatories to both sections of this report wish to make it quite clear that the recommendations and suggestions contained in the report represent their own personal opinions, and do not necessarily represent the views of the respective undertakings with which they are connected.

S. L. PEARCE, Chairman.	
B. WELBOURN, Vice-Chairman.	
J. A. ROBERTSON, Hon. Secretary.	
S. E. BRITTON,	} Members of the Committee.
H. DICKINSON,	
S. J. WATSON,	
P. P. WHEELWRIGHT,	
W. J. H. WOOD,	

July, 1917.

Sir John A. F. Aspinall, Mr. Edwardes, and Mr. Purrett do not sign this section of the report, owing to the position that would be created for their companies if the foregoing proposals were given effect to.

Mr. Blackmore does not sign this section of the report, as he is not in agreement with the proposals to invest the joint board with the following powers:—

1. The purchase of the existing power stations owned by the municipalities.
2. The purchase of the undertakings owned by the companies.
3. The erection of new power stations.

Schedules attached to the report contain the following particulars relating to the method employed in determining bulk and reciprocal supply costs:—

BULK SUPPLY COSTS AT BUS-BARS OF STATION SUPPLYING.

Load factor 30 per cent.

(a) CAPITAL CHARGES.

Cost of installing complete plant, using modern sets of not less than 5,000 KW. ...	Per KW.D.
Depreciation or sinking fund = 5 per cent. per annum on 16 years average life of assets.	
Interest	= 5 per cent. per annum.
Total charges on capital ...	= 10 per cent. per annum.
10 per cent. on £10 ...	= £1 per KW.D. per annum.

(b) WORKING EXPENSES. (Generation.)

Coal (stand-by)	} = £1 6s. per KW.D. per annum.
Oil, waste, water, and stores	
Wages and salaries	
Repairs and maintenance	
Management	
Rates and taxes excluded.	

(c) COAL. (Running.)

At 17s. 6d. per ton = 168d. per unit delivered to feeders.
Provision should be made for a variation in the price of fuel, viz., 1001d. per unit corresponds to an increase or decrease of 1d. per ton.

Note.—In the fuel costs is provided a sum sufficient to cover the removal and disposal of ashes.

(d) SUMMARY OF COSTS.

	Per KW.D. per annum.
Fixed charges.—Capital charges	£1 0 0
General working expenses	1 6 0

£2 6 0

Running charges.—Coal 168d. per unit delivered to feeders.

The following additions and deductions are suggested for load factors other than 30 per cent.:—For a load factor of 50 per cent. and over, a deduction of 5s. per KW.D. per annum; 15 per cent., but under 50 per cent., a deduction of 3s.; 40 per cent., but under 45 per cent., a deduction of 2s.; 35 per cent., but under 40 per cent., a deduction of 1s.; 30 per cent., but under 35 per cent., basic charge; 25 per cent., but under 30 per cent., an addition of 2s.; 20 per cent., but under 25 per cent., an addition of 6s.; 15 per cent., but under 20 per cent., an addition of 14s.; 10 per cent., but under 15 per cent., an addition of 22s.; below 10 per cent., an addition of 34s.

Over-all costs per E.H.T. unit at station bus-bars, with coal at 17s. 6d. per ton, for varying load factors:—Load factor of 50 per cent. and over, 280d.; 45 per cent., but under 50 per cent., 298d.; 40 per cent., but under 45 per cent., 318d.; 35 per cent., but under 40 per cent., 341d.; 30 per cent., but under 35 per cent., 377d.; 25 per cent., but under 30 per cent., 430d.; 20 per cent., but under 25 per cent., 524d.; 15 per cent., but under 20 per cent., 715d.; 10 per cent., but under 15 per cent., 1100d.; below 10 per cent., 1440d.

RECIPROCAL SUPPLY COSTS—LIGHT LOAD PERIODS.

	30 per cent. load factor.	Per KW.D. per annum.
(a) 33½ per cent. of the capital charges		£0 6 8
(b) 25 per cent. of the general working expenses		0 6 6
Total		£0 13 2

(c) Running charges with coal at 17s. 6d. per ton = 0168d. per unit delivered to feeders.

Subject to the same provision for a variation in the coal price as in the case of bulk supplies.

For load factors other than 30 per cent., the corresponding values given for bulk supply "capital charges" and "general working expenses" would be taken, but the above percentages of 33½ and 25 per cent. would still apply.

Manganese Dioxide in Canada.—A message from Calgary, Alberta, to the Central News, says that practically inexhaustible deposits of manganese dioxide have been found in the Cypress Hills, in South-East Alberta. Eight hundred thousand tons, worth approximately £11,000,000, have been blocked out in the last few months. The manganese lies at the surface of the ground, and, therefore, the deposits are very easily worked. The staff of the Department of Mining of the University of Toronto have discovered a process by which low-grade concentrates of molybdenite can be made at little cost. The new process will render available the deposits of low-grade molybdenum ore which have been discovered in Manitoba and British Columbia. *Financial Times.*

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C.1, and at Liverpool and Bradford.

- 11,607. "Electrical measuring instruments." R. D. GIFFORD AND NALDER BROS. & THOMPSON. August 13th.
11,658. "Apparatus for concentration of electric waves in a single direction or upon a fixed point." E. BINETTI & L. ROTA. August 14th.
11,659. "Electric heating devices." R. K. HEARN. August 14th.
11,660. "Electromagnetic friction clutches." W. LANGDON-DAVIES & A. SOAMES. August 14th.
11,669. "Device for indicating electrical leakage in insulation of sparking plugs." A. E. LAMKIN. August 14th.
11,677. "Starting apparatus for electric motors." G. LAYTON. August 14th.
11,765. "Selective signalling systems and selectively operable devices therefor." WESTERN ELECTRIC CO. (Western Electric Co., U.S.A.). August 16th.
11,777. "Producing electricity and mechanical power by permanent magnets." D. SUCHOSTAWER. August 16th.
11,785. "Variable electric resistances." W. E. BAKER. August 16th.
11,791. "Sparking plugs for ignition in internal-combustion engines." K. E. L. GUINNESS. August 16th.
11,806. "Electricity generating plant." O. STOTT. August 16th.
11,820. "Electric annunciators." AUTOMATIC TELEPHONE MANUFACTURING CO. & S. R. SMITH. August 17th.
11,830. "Trolley heads of electric tramways." W. H. COTTER & R. H. HOLLINGSBEE. August 17th.
11,860. "Ignition magnetos." A. R. J. FOSTER. August 17th.
11,862. "Electric furnaces." W. B. LAKE. August 18th.
11,864. "Telephone receivers, &c." A. MARR. August 18th.
11,867. "Heating conductors of thermic telephones." NAAMLIOOZE VENNOTSCHAP DE NEDERLANDSCHE THERMO-TELEPHOON. August 18th. (Holland, September 15th, 1916.)
11,883. "Art of stereotyping, electrotyping, &c." J. THOMLINSON. August 18th.
11,878. "Telegraph systems." AUTOMATIC TELEPHONE MANUFACTURING CO., LTD., & H. H. HARRISON. August 18th.

PUBLISHED SPECIFICATIONS.

1916.

The numbers in parentheses are those under which the specification will be printed and abridged, and all subsequent proceedings will be taken.

- 5,947. WIRE-DRAWING MACHINES. H. A. MARVIN. May 4th, 1915. (100,398.)
10,402. ELECTRIC IGNITION ARRANGEMENTS FOR INTERNAL-COMBUSTION ENGINES. H. R. WRIGHT. July 24th, 1916. (108,183.)
10,573. ROTATABLE CONTACT-BREAKERS FOR MAGNETOS AND OTHER PURPOSES. E. J. PILBLAD. July 26th, 1916. (108,194.)
10,626. SLIDE-RULES FOR USE IN WIRELESS TELEGRAPHY CALCULATIONS. A. J. MARTIN. July 27th, 1916. (108,197.)
10,721. MAGNETOS AND LIKE ELECTRIC MACHINES. W. O. KENNINGTON. July 28th, 1916. (108,203.)
11,100. ELECTRICAL SIGNALLING APPARATUS FOR USE IN MINES AND FOR OTHER PURPOSES. H. R. WADDINGTON & I. H. PARSONS. August 7th, 1916. (108,213.)
11,982. SPARK PLUGS. J. J. PLATT. August 23rd, 1916. (108,220.)
12,704. APPARATUS FOR PRODUCING UNIDIRECTIONAL ELECTRIC CURRENTS OF A POTENTIAL SUFFICIENTLY HIGH TO OPERATE X-RAY TUBES. F. KIEBER. September 7th, 1916. (108,226.)
13,269. ART OF ELECTRICAL SIGNALLING. G. O. SQUIER, L. W. AUSTIN & L. COHEN. September 19th, 1916. (108,230.)
13,285. SEARCHLIGHT IN COMBINATION WITH A GUN FOR USE AGAINST AIRCRAFT. A. J. REYNOLDS. September 19th, 1916. (108,232.)
13,390. ELECTRIC POCKET LAMPS, ELECTRIC TORCHES AND THE LIKE. E. A. BELLOW. September 21st, 1916. (108,234.)
13,893. ELECTRIC MOTOR CONTROL. British Thomson-Houston Co. (General Electric Co., U.S.A.). September 28th, 1916. (108,237.)
14,643. ELECTRIC INCANDESCENT LAMPS FILLED WITH ARGON. Allgemeine Elektricitäts Ges. November 11th, 1915. (102,141.)
14,991. APPARATUS FOR BENDING AND SHAPING WIRE. British Thomson-Houston Co. (General Electric Co., U.S.A.). October 21st, 1916. (108,246.)
15,561. ELECTRIC ARC LAMPS. A. H. RAILING & A. E. ANGOLD. November 1st, 1916. (Addition to 16,694/15.) (108,252.)
16,512. IGNITION DYNAMOS. C. T. MASON. June 19th, 1915. (Divided application on 8,584/16.) (102,265.)
17,987. IGNITION DYNAMOS. C. T. MASON. January 7th, 1916. (103,291.)

1917.

- 1,578. METHOD OF ELECTRICAL EDGE-WELDING. T. E. MORRAY. March 2nd, 1916. (104,504.)
1,678. PORTABLE ELECTRIC HAND LAMPS AND THE LIKE. N. McLEAN. February 2nd, 1917. (108,270.)
2,869. REGENERATIVE BRAKING SYSTEMS FOR ELECTRICALLY-DRIVEN VEHICLES. W. V. TURNER & T. H. THOMAS. September 6th, 1916. (Addition to 103,659.) (108,276.)
4,370. ELECTRIC IGNITION DEVICES. W. O. KENNINGTON. April 19th, 1916. (105,908.)
4,644. MAGNETOS. W. L. GULLETTE AND C. A. VANDERVELL & CO. March 30th, 1917. (108,281.)
5,825. CENTRIFUGALLY-ACTUATED SHORT-CIRCUITING DEVICES FOR DYNAMO-ELECTRIC MACHINES. British Westinghouse Electric & Manufacturing Co. May 3rd, 1916. (106,484.)
5,929. OZONISERS. W. S. GRAFF-BAKER. April 26th, 1917. (108,293.)

Tramway Workers: Wage Awards.—The August issue of the *Journal* of the Tramways and Light Railways Association contains particulars of a number of awards recently made by the Committee on Production affecting different classes of tramway workers.

THE ELECTRICAL REVIEW.

VOL. LXXXI.

SEPTEMBER 7, 1917.

No. 2,076

ELECTRICAL REVIEW.

Vol. LXXXI.]

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INDUSTRIAL RESEARCH.

THE second annual report of the Committee of the Privy Council for Scientific and Industrial Research (the first part of which is abstracted elsewhere in this issue) is characterised by a practical spirit which augurs well for the success of its important undertakings. The Committee has a very difficult task to accomplish, and is cultivating ground which has hitherto remained almost unbroken; in order to reap a satisfactory harvest within a reasonable period many weeds will have to be uprooted—the jealousies of rival firms, the bonds of traditional secretiveness, the inertia of old-established firms, the inefficiency or total absence of organisation in certain trades, and other adverse influences; but by avoiding the attempt to establish rigid lines of procedure, and by showing a disposition to treat every question that arises, on its own merits, the Committee has retained an elasticity of administration which immensely facilitates the progress of its work, and affords good grounds for confidence in the ultimate success of its endeavours. Quite typical of this elasticity is the decision of the Government to allocate a sum of one million sterling for expenditure spread over a period of five years, instead of an annual subsidy which must not be exceeded, while any balance that remained, being re-absorbed into the State funds, would not have been available to augment the allowance in the following year. Thus the hands of the new Department are set free to cope with any conditions that may arise, and to provide for initial outlay on a generous scale, such as is likely to be found essential to the rapid promotion of important researches. One million pounds would not suffice to build a single battleship; but in the light of past experience, of the rich returns already derived from the meagre allowances doled out to the National Physical Laboratory in pre-war times, and of magnificent results accruing from the outlay on researches in connection with optical glass, dye-stuffs, and other war-time necessities, there is no room for doubt that the expenditure of this modest capital will not only provide its own justification, but will quickly lead to the devotion of vastly greater sums to this most profitable service.

Another welcome trait which marks the Committee's proceedings is the readiness which it manifests to take its own medicine, and to co-operate cordially with any and every Government Department or public body whose aims are in harmony with its own, or whose specialised knowledge can be utilised to the national advantage. It is, to our mind, of the utmost importance that the wealth of

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The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 8d.; Canada, £1 8s. 10d. (\$5.80). To all other countries, £1 10s.

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THE "ELECTRICAL REVIEW'S"
ELECTRICAL & ALLIED TRADES DIRECTORY
(THE RED BOOK),

1917 EDITION

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knowledge and experience which is represented by our great scientific and technical societies should be drawn upon most freely, and that their advice should be sought and duly weighed before any important action is taken by the Government in industrial affairs. This course has not been followed in the past; the officials whose influence in Government Departments is paramount have usually, whether intentionally or in blank ignorance, refrained from consulting such bodies, with the natural result that their decisions have often done more harm than good to the industries they professed to help. Our Government is, in fact, far more bureaucratic and reactionary than the public generally are aware, and this is largely, if not entirely, owing to the narrow classical curriculum of the public schools, in which history, geography, and science are practically ignored.

While the exceedingly valuable results already obtained in various applications derive their origin mainly from independent researches that were set on foot by the Government, with the assistance of the Board of Scientific Societies, soon after the outbreak of war, and by our scientific and industrial associations, long before the Committee was appointed to organise research, they are of the same order as those which may be expected to accrue from the efforts of the Department, which, moreover, has taken steps to ensure their continuance, and to extend their scope. The Committee does not pretend that the nation "will reap the fruits of these preparatory labours" until after the return of peace. Nevertheless, good results are beginning to flow in from the new work put in hand by the Committee, which is methodically laying a sure and solid foundation for the development of industrial research. Unfortunately, owing to the exigencies of the time, the Committee has found it impossible to devote attention to the subject of research in pure science, but it recognises that this is the seed with which the industrial field is sown, and that to neglect it would be a fatuous error. We must see to it that the Committee shall not fail to discharge its duty to pure science at the earliest possible moment—otherwise its labours will prove futile.

Lastly, we commend the attitude of the Department towards the rights of the inventor, whom it appears determined to encourage and support. Invention has too often been the mother of necessity, and the poor inventor in particular ought to be protected and assisted.

Our Commercial Intelligence Service.

In our last issue, in referring to the decision to appoint additional Trade Commissioners, we mentioned that the Cabinet had given its approval to the scheme for re-organising the Commercial Intelligence Service of the country by bringing the operations of the Foreign Office and of the Board of Trade in this connection under unified control. The full details of this scheme are now published in the form of a Memorandum, which was reprinted in the *Times* on August 31st. As would be expected, difficulties were encountered when those responsible for dealing with the matter tried to define and adjust the limits of responsibility of the Foreign Office and the Board of Trade with respect to the collection and distribution of commercial intelligence obtained through the medium of the Commercial Attachés and Consuls in foreign countries. A Committee which, in addition to eminent men from the two Departments, included Lord Faringdon, Mr. Dudley Docker (Federation of British Industries), and Mr. Pennefather, M.P., representing the

Chambers of Commerce, sat to try to solve the difficulties, but these gentlemen were not able to arrive at a unanimous agreement. They agreed that the control of the Commercial Attachés should be left to the Foreign Office, acting in consultation with the Board of Trade as regards instructions and appointments, and that both this service and the Consular Service should be enlarged and improved. Another Committee has been appointed to carry these recommendations into effect with the least possible delay. Where the Committee could not agree was on the question of whether the work of collating and distributing commercial intelligence from foreign countries among the commercial community in this country should continue to be performed by the Department of Commercial Intelligence of the Board of Trade or should be dealt with by a Department to be created at the Foreign Office. The majority of the Committee favoured the work being done by the Foreign Office. The two Departments, therefore, considered the matter further, and arrived at a scheme, which has been approved by the War Cabinet, and is set forth in detail in the Memorandum from which we quote below:—

An enlarged Commercial Intelligence Department will be created on a scale adequate to meet the reasonable requirements of British trade after the war. Parliamentary control over the Department will be exercised through a new Parliamentary Secretary, who will occupy the position both of Additional Parliamentary Secretary at the Board of Trade, and also Additional Parliamentary Under-Secretary for Foreign Affairs. This Parliamentary Secretary will be responsible to the President of the Board of Trade for all matters within the competence of that Department, and responsible to the Secretary of State for Foreign Affairs for all matters concerning the Foreign Office. By matters concerning the Foreign Office is meant all questions concerning the direction and organisation of the Commercial Attaché and Consular Services and the commercial work of officers of these services, and of the Diplomatic Service, so far as these matters are not dealt with by the Consular or other Departments of the Foreign Office, and also matters concerning the personnel of the Foreign Office and of the above services who may be temporarily attached to the Department, and any matters arising out of the work of the Department involving questions of foreign policy. All instructions issued to Commercial Attachés or other Diplomatic or Consular Officers will be issued in the name of the Secretary of State for Foreign Affairs. On all other matters the responsibility will lie with the Board of Trade. The Commercial Intelligence Department will eventually comprise the existing Department of Commercial Intelligence of the Board of Trade and the Foreign Trade Department of the Foreign Office, and will take over such of the staff and records of the War Trade Intelligence and Statistical Departments as may be available and required.

The official head of the Department will be an officer appointed jointly by the President of the Board of Trade and the Secretary of State for Foreign Affairs, working under the new Parliamentary Secretary. The appointment and control of the Trade Commissioners within the Empire will, as at present, rest with the Board of Trade, and the appointment and control of the Commercial Attachés and Consular Service with the Foreign Office, but the work of the new Department will comprise all matters dealing with commercial intelligence, and, so far as is necessary for that purpose, it will give directions to the overseas services and make the necessary arrangements for keeping them in close touch with the commercial classes in this country.

There will be a constant interchange of staff between the Department and both the Foreign Office and the Board of Trade, so that members of those Departments may be thoroughly acquainted with the work. The Department will be assisted by an Advisory Committee of business men.

Duality of control is one of the great errors that has been developed in connection with such matters in the past, and the foregoing represents a serious effort to devise means for getting rid of it. The end sought by those who have devoted so much anxious thought to the scheme is to secure that the direction of the commercial work of the foreign services and the distribution of commercial intelligence collected by them shall be under a single Department, which shall also direct the activities of the enlarged Trade Commissioner service. It is anticipated that by so doing there will be assured a uniformity of policy for our entire overseas trade.

THE MODERNISATION OF STUART STREET GENERATING STATION, MANCHESTER.

THE history of the Stuart Street generating station will be found to synchronise very closely with the industrial electrical development of Manchester.

As in the case of other industrial centres, the local problem during recent years has been to keep pace with the increasing requirements of power users, with this difference, that the Manchester problem has all along been on a magnified scale, which, needless to add, has become increasingly difficult during the last three years.

In 1913 the electricity undertaking exceeded the 100 million mark in output sold, and during the year ended March last, over 172 millions of Board of Trade units were disposed of, a total which might easily have been 200 millions had all anticipations been realised.

The Stuart Street generating station, which dates back some 17 years, marked the decision to generate three-phase E.H.T. energy in place of the L.T. direct-current which had previously sufficed for local requirements; this latter supply was given from the original Dickinson Street station, supplemented in 1901 by the adjacent Bloom Street Station.

The Stuart Street station was constructed in two parts, the earlier portion to the design of Sir (then Dr.) Alexander Kennedy, while the second portion was originated by Mr. G. F. Metzger, city electrical engineer at that time, and reciprocating plant in comparatively large units was installed by both these engineers.* With the advent of Mr. S. L. Pearce, the present city electrical engineer and manager, the installation of reciprocating plant was discontinued, he having decided for various reasons to install turbine plant in future. We must refer our readers to the various articles which have appeared in our pages for details of the extensions which have been carried out from time to time; it will be sufficient to say that under Mr. Pearce's direction the reciprocating plant was supplemented by three turbo-alternators of 6,000, 6,000, and 7,500[†] kw. capacity respectively, followed by a 15,000-kw. machine,§ which was the first really large turbine set to be installed in this country. In addition to these high-pressure turbines, a 4,500-kw. exhaust steam turbine|| and jet condensing plant was installed to operate on the exhausts from three of the six 2,500-H.P. Corliss engine sets which comprised the generating equipment of the first portion of Stuart Street station.

Contemporarily with these extensions, additions were made to the boiler and cooling tower installations, and prior to the outbreak of war it was agreed, in view of the limited condensing facilities and necessity of making adequate provision for coal storage, that some 60,000 kw. of installed plant capacity represented the economic limit of the Stuart Street site.

In view of this the Manchester authorities, on the advice of Mr. Pearce, decided to launch out a bold scheme for meeting the rapidly increasing electrical necessities of the area, and as a result, what would have been the first super-station in the Kingdom was planned, with a projected capacity of 160,000 kw.‡ A site was selected at Barton, about five miles from the centre of the city, all sanctions were obtained, and all preparations made for the actual construction of this station, but in view of the now well known difficulties as

regards industrial developments which arose as a result of the concentration of the country's resources on the war, it was found necessary to postpone the carrying out of this project, and to concentrate attention on the Stuart Street station, which policy offered the only means of meeting the urgent demands for power arising from the war. This policy involved the supersession of the then existing reciprocating plant by turbine plant, and when the scheme of reconstruction now being carried out is completed, only one 6,000-H.P. reciprocating engine set will remain in the station.

Since the outbreak of war, two 6,000-kw. turbo-alternators, one of Westinghouse-Siemens and the other of Westinghouse construction, each running at 3,000 R.P.M., and operating in conjunction with Mirreles-Watson jet condensers, have been installed in the place of two of the original 2,500-H.P. cross-compound vertical Corliss engine sets.

The 4,500-kw. Howden-Siemens exhaust steam turbine, which operated in conjunction with three other of the above engine units, has been reconstructed on high-pressure lines to use live steam, and this incidentally freed one half of the existing condensing plant for use with the additional turbines.

A second 15,000-kw. Richardson-Westgarth turbine coupled to a Westinghouse alternator, running at 1,500 R.P.M., is now being installed in place of one of the 6,000-H.P. (4,000-kw.) Wallsend-Electrical Co. sets; this is fitted with Richardson-Westgarth surface condensing plant.

There is also on order for delivery in the autumn of 1918 a 20,000-kw. turbo-alternator set, by the last-mentioned firm; it may be mentioned that both these large turbine sets are very conservatively rated, and would under Engineering Standards conditions be regarded as of 20,000 and 25,000 kw. maximum continuous rating respectively.

As previously mentioned, one of the difficulties of the Stuart Street site has always been water shortage; some of the condensing plant is, of course, jet condensing, the Manchester and Ashton-under-Lyne Canal furnishing the necessary water, but for the surface condensing plant, cooling towers and tank storage have been provided, and this latter installation will be greatly extended when the large contracts which have been entered into with the Klein and Davenport Companies for new natural and fan draught towers are completed.

The disproportionate increase in generating capacity as compared with floor area, due to the large increase in turbine plant, naturally involved certain reconstruction in the steam raising installation to meet the increased demand for steam.

Prior to the war, the boiler plant comprised 46 boilers—of the Babcock & Wilcox land and marine types—installed in two boiler houses; a third boiler-house has now been added, in which two Babcock and Wilcox marine type boilers, each of 60,000 lb. per hour evaporative capacity, have been installed. These boilers are self-contained units, one having straight induced draught and the other the Prat ejector draught plant, while both have chain-grate stokers; they were originally intended for the projected Barton station.

The first boiler house, constructed under the Kennedy scheme, is being modernised, and its equipment of 24, 12,000-lb.-per-hour Babcock & Wilcox boilers is to be swept away; two new 60,000 lb.-per-hour boiler units, similar to those in the third boiler house, will shortly be in use in this boiler house, and orders have been placed for four 100,000 lb.-per-hour Babcock & Wilcox marine type boilers as a further installation.

These are probably the largest capacity boilers so far contemplated in this country, and are to be single-ended and fitted with both forced and induced draught. Each will have 416 sq. ft. of grate area.

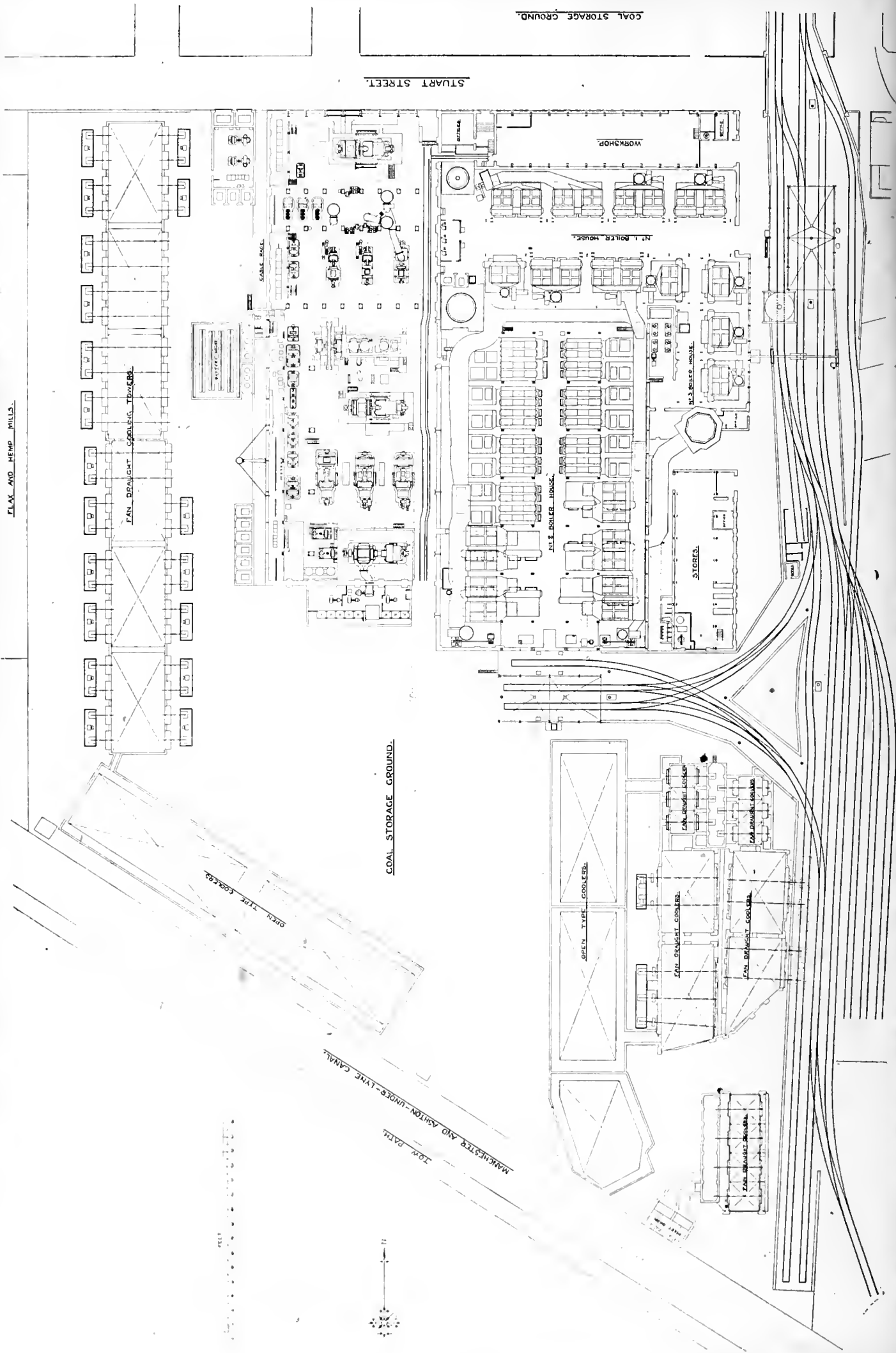
* ELEC. REV., June 26th, 1903.

† ELEC. REV., July 4th, 1913.

‡ ELEC. REV., July 3rd, 1914.

§ ELEC. REV., June 27th, 1913.

‡ Barton Power Scheme; ELEC. REV., January 8th, 1915.



FLAX AND HEMP MILLS.

FAN DRAUGHT COOLING TOWER.

TOW COCKERS.

MANCHESTER AND ASTON UNDER-LYNE CANAL.

TOW PATH.

COAL STORAGE GROUND.

STUART STREET.

WORKSHOP.

N. 1. BOILER HOUSE.

N. 2. BOILER HOUSE.

STORES.

OPEN TYPE COOLERS.

FAN DRAUGHT COOLERS.

FAN DRAUGHT COOLERS.

FAN DRAUGHT COOLERS.

COAL STORAGE GROUND.

This is an Open Air System. Open Air System. Manufactured in Birmingham with Turbine Plant. No.

14,000 sq. ft. of heating surface, 7,500 sq. ft. of economiser surface, and 5,145 sq. ft. of superheater surface, and be constructed as a self-contained unit. Large boiler units are essential to secure the utmost development of the Stuart Street site, hence the drastic action in connection with the older plant.

To supply the increased coal requirements of the station, a third line of conveyors is being added in the first and second boiler houses, and in connection with these and other industrial developments in the neighbourhood, the coal railway facilities will be doubled, and in the result the cost of delivering fuel will be greatly reduced.

The large increase in plant capacity at Stuart Street has necessitated the remodelling of the E.H.T. switchgear, and large-capacity switches are being installed throughout, the bus-bars are being sectionalised with reactances, and a reactor house is being constructed to contain the latter.

In addition to this work, a turbine set is being installed in the Bloom Street station, to allow of which one of the four 1,800-kw. Musgrave-Westinghouse direct-current vertical Corliss engine sets has been removed.

The new plant is being supplied by the British Westinghouse Co., and will have a rating of 10,000 kw., speed of 1,500 R.P.M., and supply three-phase current into the E.H.T. system; its use will also enable the three remaining reciprocating sets to be shut down. It will further supply the local direct-current requirements for lighting and traction, through the converting plant, some 7,000 kw. of which is installed, in the adjoining Dickinson Street station, and be supplemented when necessary by the remaining direct-current generating plant in these stations.

As many of our readers are aware, the electrical development of the Manchester area has made rapid strides during the last 10 years, during which period its output has increased fourfold. Even with Stuart Street station remodelled, and containing between 90,000 kw. and 100,000 kw. of generating plant, and the additional plant at Bloom Street, the problem of meeting future requirements, by the construction of the Barton station, must still remain.

This problem has, however, been raised to a new plane since the wider aspects of electrical supply became emphasised, and we venture to prophesy that the rôle of the Barton power station, when it materialises, will be of a different character than was anticipated when the original proposal took shape. One need only point to the proposed establishment for manufacturing nitric acid from the air, which may ultimately require some 15,000 kw., the carbide factory which is being built and will take some 10,000 kw., and to the growing list of factories, including electric furnace and electric rolling mill equipments, to indicate that the future large scale requirements of this area are by no means visionary.

In conclusion, our thanks are due to Mr. S. L. Pearce, the chief engineer and manager of the Manchester electricity undertaking, for enabling us to briefly indicate the trend of events in the department under his control.

ELECTRIC VEHICLE NOTES.

THE industrial possibilities of the electric truck and tractor in this country offer an exceedingly wide field for speculation; so far we have touched the fringe of the development in sight, and the as-yet unconsidered possibilities of this form of transport represent probably an equally large field of usefulness.

Apart altogether from private and municipal users of the industrial electric, probably the most hopeful sign of future progress is in the extensive purchases of these vehicles by great railway companies, whose interest in a new proposition is anything but experimental in character. If the railway companies prove to their own satisfaction that the movement of freight from their yards and warehouses can be more economically dealt with by electric than other types of vehicle, the time will not be far distant when our dock and harbour authorities, and the carrying companies connected with them, will begin to hold similar views.

Railway and dock premises in large cities are always costly matters, and a portion of this cost can, of course, be debited to the horse when making comparisons, inasmuch as goods yards, loading docks, and the sheds, which often cover the latter, have to be made proportionately larger to allow for the increased standing and manœuvring space required by the horse-drawn vehicles as compared with that needed by electric vehicles.

The handiness and adaptability of the "electric," and the ease with which it can be manœuvred, are of supreme importance where rapid handling of deliveries is essential, added to which is its freedom from fire risk, which often makes it the only type of motor vehicle which can be admitted into warehouses where combustibles are stored. The horse vehicle is a luxury in the case of a large transport organisation, and one for which not only does it pay, but the surrounding community also, through congestion of traffic in the streets, loss of time, &c.

A typical example of what may come in this country is shown by the practice of the Brush Terminal Co., of New York, whose premises cover some 200 acres along a mile of water front, and include eight piers to accommodate ocean shipping, a railway yard with 23 miles of track and 123 warehouses. In addition, a large cold storage installation is provided, and an unusual departure is the provision of 16 industrial buildings, in which space is available for manufacturing, at attractive rentals.

The feature of the terminal is the use of electrically-operated appliances throughout; the railway cars are shunted by electric locomotives, of which there are three 40-ton and one 60-ton trolley-type G.E.C. machines. What transportation is required between piers and railways and warehouses is handled by electric tractors, battery trucks, battery cranes, motor-driven hoists, elevators and motor-driven piling machines, while delivery and collection of freight outside the terminal are handled by electric trucks.

Shipments received by water may go direct to freight cars, or to lighters, or to trucks delivering in the city, or to warehouses or factories; similar possibilities are open to goods received by rail.

To supplement the ships' winches, portable electric hoists are provided on the piers; goods are unloaded into trucks, four or five of which are drawn by battery tractor to the warehouse, and as 12 trucks are provided to each tractor, sufficient are available for continuous loading and unloading at each end of the route, while the tractor can be kept always on the move. Where packages weigh 1,000 lb. or more, crane tractors are employed, which not only haul, but load and unload when required. Sixty portable electric hoists are employed for lifting freight into warehouses, &c., where also the electric piling machines are used for stowing.

With the older method of handling mixed freight, something like 50 per cent. of the operating cost was eaten up by inefficiencies, delays, wastes, excessive labour costs, &c.; this is eliminated by the electro-mechanical methods now in use.

For city deliveries the electric vehicles are loaded at night, for delivery early in the morning; the batteries are

Platinum.—A Reuter's correspondent at New York states that the discovery of platinum in Alaska has aroused Government agencies to the greatest activity in the hope of finding sufficient quantities of this metal to meet the war needs of the Allies. Four Government experts have been assigned to study the Alaskan situation and report if the discoveries may replenish the platinum supply cut off recently by the virtual cessation of activities in the Ural Mountain mines, the source of the world's greatest supply. So acute is the world shortage of platinum that the metal has advanced from \$45 to \$105 an ounce since the beginning of the war.

charged at night, and receive a boosting charge during the day.

The *Electrical World* says that the data thus far available shows that the tractors have performed their duties with a current consumption of 331 ampere-hours per ton-mile. The average weight transported has been 123 tons, and the length of haul between 100 ft. and 6,000 ft., or an average of 0.4 mile. Four-wheel platform trucks, 14 ft. long by 4.5 ft. wide, and equipped with roller bearings, are employed in this service. Among the various forms in which the miscellaneous warehouse commodities are handled in the raw state are bales, bags, cases, barrels, mats, &c. Of the 1,325,000 tons of freight handled at the Bush terminal per year, about 324,000 tons is moved by tractors between the piers and warehouses. The remainder is transported in trucks or trains handled by electric locomotives.

Several typical examples will serve to show the relative advantage of handling material by electric tractors instead of by hand or with horse trucks. For instance, in loading trailers with bales of fibre, the battery cranes and tractors can perform the work at a cost of 7.2 cents per bale, whereas with hand operation it costs 8.8 cents per bale; 300 lb. bags of ore can be loaded on to cars by battery cranes at a cost of 21 cents per ton, whereas with hand operation it costs 32.4 cents per ton. In addition, the battery crane permits an average increase in speed of handling of about 40 per cent. Comparing the use of horse trucks and tractors for loading and unloading ease goods and transporting them, it costs 16.1 cents per case with horse truck and 14.2 cents per case with tractors. The last two values are based on hauling the commodity 450 ft.

Storage battery tractors show an advantage also when the cost of operating them is compared with that of moving commodities in box cars. For instance, suppose that 400-lb. bales are to be moved from a lighter to a pile in the storehouse: the complete cost of operation with a battery tractor is 8.7 cents per bale, whereas when moving the material in the box cars the cost is 26.2 cents per bale. At the Bush terminal the cost of energy for loading, unloading, and transporting materials amounts to a small percentage of the total operating cost per year. Labour expenses represent 41.7 per cent. of the total operating cost. The yearly operating cost of the tractors is 66.3 per cent. of their initial cost.

The performance noted in the preceding data is rather remarkable, in view of the fact that some of the batteries are operated at 75 per cent. overload, and are unprotected from the excessive jar and vibration due to the trucks and tractors operating over the rough cobble stones and boards between the piers and warehouses. Edison batteries are used in the trucks and tractors.

The company has recently ordered 20 more 5-ton tractors.

The energy used at this terminal for freight handling, light, and power is furnished by the Brooklyn Edison Co., and averages 12 million KW.-hours a year.

The relatively high operating efficiency of electrical, as compared with other apparatus, suggests the general assumption that the energy used per ton handled—in the case of the Bush terminal, roughly 9 KW.-hours per ton—is a direct measure of the operating efficiency of the terminal organisation: especially would this be so under dear labour conditions.

The enclosed non-tidal British dock estates would probably account for a good deal more power than the river piers of the Bush terminal, especially where there are grain silos and heavy pumping requirements, and if we take the 1913 shipping tonnage figures for British ports (exclusive of coastal tonnage) as an approximate indication of the possible electrical requirements during a normal year of certain British ports, using as an overall basis figure 10 KW.-hours per ton handled, instead of the 9 KW.-hours used by the Bush Co., we obtain some startling figures, viz.:—Liverpool, 150 million KW.-hours; London, 200 million KW.-hours; Southampton, 120 million KW.-hours per annum, &c.

These ports handle general merchandise, grain, &c., and are, therefore, to some extent comparable with the Bush terminal, though as their planning often dates back a good many years, even the most efficient reorganisation of method could probably involve a higher average use of energy than the American figure quoted. It is, of course, fully admitted that electrical methods are very largely employed in railway and dock terminals in this country, but the electric truck, tractor and vehicle are usually conspicuous by their absence, and the really intensive electrical methods employed by the Bush and other American concerns are unknown here.

COSTS IN ELECTRIC FURNACE OPERATION.

AN interesting study of the relation of the costs of electrodes, refractories, electricity, labour, and raw materials, to total expense in electric furnace operation, particularly with reference to single electrode furnaces, was recently contributed to our contemporary, the *Electrical Review* of Chicago, by Mr. F. T. Snyder.

The author points out that there are six items of expense in electric furnace operation, viz.:—(1) Cost of electrodes, (2) cost of refractories, (3) cost of electricity, (4) cost of labour, (5) maintenance, depreciation, and investment charges, and (6) cost of raw materials.

The last item is practically unaffected by type of furnace or form of current supply, and need not be further considered.

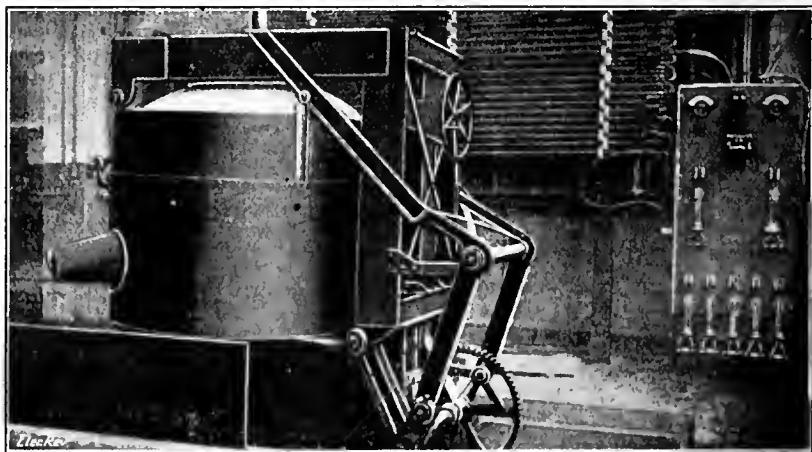
Electrode Cost.—The electrode costs the user in two ways—viz., by the burning away of the electrode and by the heat which it conducts out of the furnace. The sum of these items constitutes a charge per hour of furnace operation, and for a well-designed furnace melting 1,000 tons of steel a month represents some \$5,000 (£1,200) a year per electrode.

It is evident that a reduction of the number of electrodes warrants serious consideration: with capital worth 20 per cent. a year the elimination of one electrode would justify an investment of \$30,000 (£6,000). The ideal furnace would have no electrodes, and the induction furnace met this requirement, but unfortunately introduced defects which rendered it commercially impracticable. By using the metal bath in the furnace as one terminal of the arc, a furnace can be operated with one electrode per arc.

As three-quarters of the cost per year of each electrode is due to surface burning, the smaller the electrode the lower will be the electrode cost. The size of the electrode is determined by the current, and this (and the size) will be smaller, the higher the voltage between electrode and bath. The voltage is limited by a roof condition; silica bricks used for roofs are fairly good electrical conductors at white heat, and at steel finishing temperatures the furnace gases are rather good conductors. When current is switched on the arc will jump a considerable distance, which limits the pressure between a single electrode and the bath to about 220 volts.

If two or more electrodes are used through the same roof, experience shows a limit of 110 volts between electrodes to avoid breakdown roof leakages; that is for two electrodes, 55 volts between each electrode and bath. With the same energy input each of the two electrodes has, therefore, to have double the cross section of the single electrode with the higher voltage, or a combined cross section four times as great, and therefore four times the heat losses of an equivalent single electrode, and three times the sum of heat losses of the single electrode and a contact to the bath. The burning surface of the two electrodes is double that of a single one, and the equivalent cost of two electrodes with two arcs in series, on the basis of 1,000 tons of steel a month is \$13,500 (£2,700) a year, as compared with \$7,500 (£1,500) for one electrode and its contact.

If three electrodes are used through the same roof, so as to introduce directly three-phase current into the furnace, the limiting



SINGLE-PHASE DOORLESS ELECTRIC FURNACE.

voltage is usually kept at about 110, and this results in a potential of about 65 volts between electrode and bath. With the same total input each electrode will carry one-third of the energy of a single electrode at about one-third of the voltage, and therefore each electrode will carry the same current as does the single electrode, and be the same size, the three having heat loss and surface burning equal to three times those of a single electrode.

Thus for 1,000 tons of steel per month, the electrode cost for the three electrodes will be \$18,000 (£3,600), as against \$7,500 (£1,500) for a single electrode and contact.

Refractories Cost.—It is the common knowledge of electric steel operation that the bulk of the refractory cost is due to roof wear, and that the roof wears most around each electrode—in other words, it is substantially proportional to the number of electrodes. The cost figures from different furnaces show a total refractory cost

for three-electrode furnaces of substantially three times the total refractory cost for single-electrode furnaces. With a well designed furnace melting 1,000 tons of steel a month, this refractory cost may be kept down to \$4,000 (£800) per electrode per year.

It is the maximum temperature at the end of the heat that wears the refractories in a steel furnace. As the roof walls and slag are near the same temperature, they are radiated to each about the same. Part of this energy is absorbed by and passes through the roof and wall. In a well designed furnace this amounts to less than 10 per cent. of the total power input. Of the energy radiated by an arc, about one-half goes directly to the slag; the

of the roof bricks can be improved by water cooling, but the heat lost to the water is greater than the heat saved by increased energy input.

Increasing the energy input does not necessarily result in higher furnace temperatures; the latter are determined by the melting point of the metal, and cannot rise above the melting point of steel, so long as there is unmelted metal in the furnace. With a single electrode furnace no limit has been found to the rate at which power can be put into a furnace and the efficiency correspondingly raised if certain simple metallurgical precautions are taken. If energy is put in faster than the steel can be "killed" (freed of

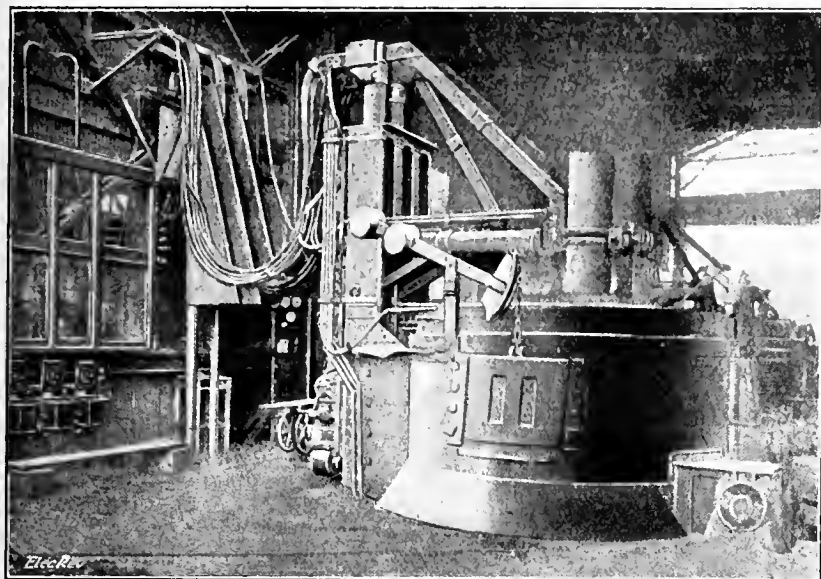
oxygen), after the steel is melted, the excess only operates to raise the temperature and melt the walls. To permit a high rate of energy input the elimination of oxygen must be speeded up; air leaks through furnace doors prevent this; the air burns up the electrode, oxidises the steel, and carries away heat in escaping. The value of the heat loss for each door of the sliding type has been determined at some \$1,500 (£300) a year. Two ordinary doors may easily double the time required to finish a heat.

As it is in practice almost impossible to keep a door tight, the difficulty can be overcome by having a doorless furnace, with a tilting roof to admit the charge. A simple self-sealing joint was made by putting a narrow ring of sand on the top of the furnace wall. Any piece of scrap that the furnace will hold can be put in through the roof, while the scrap has to be cut to enter a door. The heat loss in opening up a roof is found to be much less than through a single door. The steel can be deoxidised as it is melting, and, when melted, can be poured, reducing the time taken.

Labour Cost. The open roof furnace enables charging to be done with a dump bucket and crane, and such a furnace can be operated by one melter and a helper, or, if of less output than 500 tons a month, without a helper.

A single high-voltage electrode is lighter to handle, and requires less time for adjusting than three electrodes; high voltage has another advantage, as with a single electrode are about 185 volts available for arc length, which gives an arc about 5 in. long, and the rising of a slag bubble $\frac{3}{4}$ in. reduces the arc resistance less than 20 per cent., whereas the 30 volts available in a 65-volt three-electrode arc only allows of $\frac{3}{4}$ in. arc length, so that each time a slag bubble comes up under an electrode, the power load is short-circuited in the arc.

For this reason the boiling of the bath does not take any of the melter's time with a single-electrode furnace, but takes all the time of one man with a three-electrode furnace. To overcome this difficulty



SIX-TON, THREE-PHASE FURNACE, WITH THURY REGULATOR.

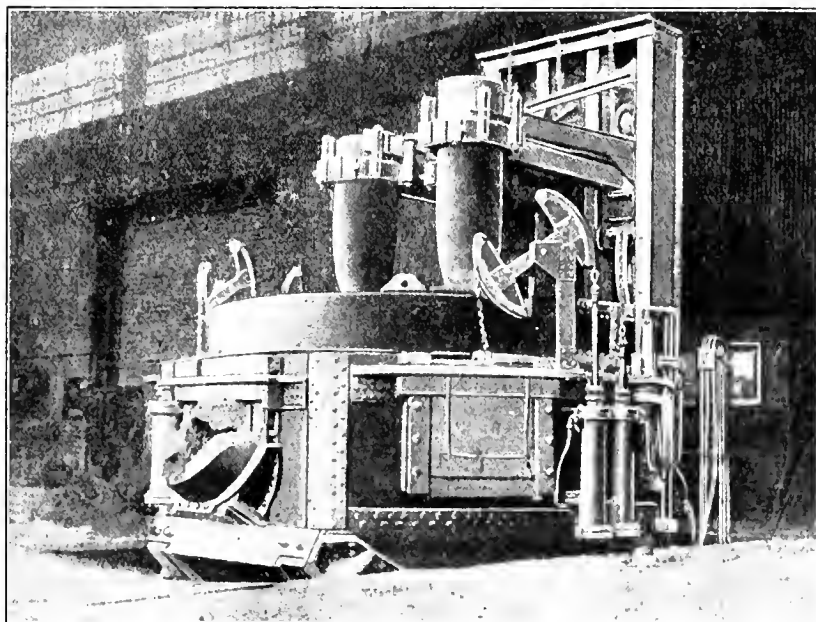
other half is reflected by the roof and walls. The roof and walls are therefore at a temperature between the temperatures of the slag and the arc.

The energy to be radiated per sq. in. of arc surface determines the temperature to which the arc must rise to get rid of energy at the input rate. If the arc is twice as long, and remains the same diameter, it will have twice the surface and radiate twice the energy at the same temperature, or will radiate the same amount of energy at a lower temperature. The three-electrode arc voltage is 65; the single-electrode arc voltage is 220; and in each case about 35 volts are absorbed by the arc terminals. This leaves 30 volts per arc to determine the length of each of the three arcs of the three-electrode furnace and 185 volts for the single arc of a one-electrode furnace. Therefore, the total length of the single arc is more than twice the sum of the lengths of the three arcs. As this single arc has consequently to radiate only half the energy per sq. in., it will be cooler than each of the three arcs, as it does not have to back up so far to radiate its energy, and the walls from which its heat is reflected will be cooler also. While the reduction in temperature of the long, high-voltage arc does not amount to a great many degrees, the reduction in temperature comes near the melting point of the silica brick of the roof, and makes a large actual increase in the number of heats that the roof will last.

Electricity Cost.—The molten metal poured into the ladle, the hot slag, and the gases given off during melting, contain a definite amount of energy, approximating 350 kw.-hours per 2,000 lb. of steel. There are also direct losses by radiation through the furnace shell and the heat loss through the electrodes, which go on continuously after the furnace is heated up, and would represent about 120 kw. continuously in a furnace producing 1,000 tons of steel per month. If the furnace input were 210 kw.-hours, only 120 kw.-hours would be available for steel melting, at which rate it would take about three hours per ton melted, and 360 kw.-hours of heat energy would be lost, making a total energy consumption of 360 plus 350 or 710 kw.-hours per ton of steel.

If the furnace were given an energy input of 820 kw., the net energy available for melting, after losses were supplied, would be 700 kw., which would melt the ton of steel in half an hour, during which time the heat losses would only be 60 kw.-hours, so that the total energy for melting would be 410 kw.-hours per ton.

It is evident that the higher the energy input the higher will be the heat efficiency. With a three-electrode furnace the limit is soon reached, owing to lack of room to space the electrodes far enough apart to prevent current leakage through the roof. The insulation



SIX-TON ELECTRIC ARC FURNACE.

three-electrode furnaces are provided with automatic regulators, which, however, have yet to demonstrate their value as labour-savers.

A doorless single-electrode furnace only uses $\frac{1}{2}$ the weight of the electrode per ton of product used by a three-electrode door-type furnace, and this represents a substantial saving in labour in handling; the roof with one electrode hole also lasts longer, and these items, summarised, mean that some \$4,000 (£800) per year will be saved in labour cost in producing 1,000 tons of steel a month in a single-electrode doorless furnace.

Maintenance, Depreciation, and Interest Charges.—The three-electrode equipment is obviously more costly in maintenance and depreciation than the single-electrode equipment, especially if automatic regulators are employed with the former. As the single-electrode furnace can be operated at double the speed of the other, the original investment and interest on first cost are also less. With 1,000 tons output per month, the difference due to these items will reach \$6,000 (£1,200) per year. Summing up the various items in favour of the single-electrode furnace for the output assumed, the total saving will reach \$36,500 (£7,300) a year. As a well-designed furnace requires an energy input of about 800 kW. for an output of 1,000 tons of steel per month, this saving equals \$45 (£9) per year per kW., and this is a good return on the investment required to change the standard three-phase current distributed into either single-phase or direct current suitable for use in a one-electrode furnace.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The City Guilds' Lists of "Works of Reference."

We should like to be permitted to place it on record that success has at length crowned the repeated, and almost single-handed, efforts of Mr. Sidney Rentell, A.M.I.E.E. (editor of your contemporary *Electricity*), to bring about an improvement in the lists of Works of Reference relating to the electrical subjects.

For more years than would be believed, these lists (which are published in the Institute's Annual "Programme") have been in a state of suspended animation: excepting that for "Electrical Installation (late wiremen's) Work," which is of recent growth.

The waking-up of the City Guilds' authorities to the absurdity of recommending out-of-date and out-of-print books, and not including new ones, year after year, is, without doubt, mainly due to Mr. Rentell; and he has done a great service to students, to teachers, to authors, and to readers generally.

How has he done this good work? By repeatedly reprinting the lists, and showing what books were out of print, and, in some cases, for how long; by opening his columns to letters and articles of protest; and by a certain very direct method which, apparently, did not fail to have final effect.

No longer (or we had better say, not for some time) will the teacher, student, or other person interested in electrical engineering books be confronted with a list starting with a book that has been out of print for a quarter of a century; and including about 10 others that ceased to exist a varying number of years ago.

No longer will people run the risk of having an order for a book returned with the doubly-irritating information that the work is out of print, and that the publisher retired from business when he (the orderer) was a boy at school.

Some 17 books have been thrown out of the Electrical Engineering List, and about 30 new ones have been added. The value of the list is increased by dividing the 60 (or so) works into classes, but is considerably diminished again by omitting to give the publisher's name in nearly a score of cases.

We will not venture to criticise the new works of reference selected, but we notice that Mr. William Cramp is credited with "Continuous-Current Design," and that Mr. Aspinall Parr has become Aspinall & Parr.

The lists for "Telegraphy and Telephony" and for "Electro-Metallurgy" have not been subjected to such an extensive overhaul.

A. P. Lundberg & Sons.

Islington, August 29th, 1917.

Fault Localisation.

I have read with interest the articles on fault localisation by Mr. H. E. Blake and others in recent issues of the REVIEW. These articles show some ingenious methods of locating faults and overcoming all difficulties but the one which, in my experience, occurs most frequently—*i.e.*, the reduction in cross section of the copper conductor at the fault due to arcing or corrosion.

An instance of such corrosion is mentioned by Mr. D. M. W. Hutchison in his article on "V.B. Cable Breakdowns in the Tropics," and I have found this reduction in cross section in nearly all cases of faults on L.T. cables.

A sketch of a cable corroded or burnt is given in fig. 1, and it will be seen that the actual point at which the current leaves the faulty conductor may be at A, B, or C, or anywhere else on the corroded portion, a similar effect being produced by a loose ferrule due to the melting out of the solder when the fault occurs in a joint box.

The problem then is to find the fault under the conditions as drawn in fig. 2, where A, B, C, or D represent the unknown resistances of the corroded or burnt portion of the conductor at the fault, and r represents the fault resistance, which can be eliminated by use of a bridge method of testing.

If the resistances A, B, C, D are neglected, the probable result is that one is entirely misled as to the position of the fault particularly as the portion of the conductor between A and C, in fig. 1, may consist of carbonised insulation or globules of copper, iron, and lead, the resistance of which for a 1-in. length may be equal to some hundred yards of the copper conductor.

The induction method is of very little value as a check when lead-covered or armoured cables are concerned, as one may easily be led streets away by the pranks of the leakage current, which has been known on several occasions to affect a search coil strongly in a street where no cables were laid, the gas pipes providing an easy path back to the station earth-plate.

In the case of a short circuit between lead-covered single cables, the induction method may be used by means of a rectangular search coil laid over the cables, with its long sides parallel to the

FIG. 1.

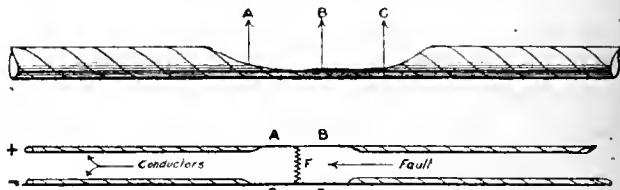


FIG. 2.

faulty cable; if there is an earth on as well as a short circuit it will be necessary to use an unearthed source of current for testing.

In the case of V.B. single cables the induction method is of great assistance in finding out earths or short circuits, the only difficulties being the presence of adjacent water or gas pipes, along which the leakage current tends to flow, and the fact that faults are often of high resistance, due to the self-sealing character of the insulation.

These high-resistance faults only allow a small testing current to be passed, but this can be made much more effective by connecting a condenser across the contacts at which the current is interrupted when D.C. is used.

I have also experimented with detectors used in wireless telegraphy, the fault being used as a spark gap fed from an induction coil, Hertzian waves being generated and used to affect the detector; this method may prove to be of assistance in finding open circuits, but one cannot now experiment owing to the restriction due to the war.

In conclusion, while the bridge and other methods of fault finding are useful, it is very gratifying when using those methods to be informed of a "hot flag" somewhere over the faulty cable.

W. Redmayne.

Electricity Works, Rotherham.

August 28th, 1917.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The Vislock Lock Nut.

The necessity of preventing nuts from slacking-off when once screwed up has long been recognised by engineers, and very many devices have been employed from time to time with a view to securing that result.

In recent years the extending use of mechanical road vehicles under conditions in which excessive vibration is necessarily present, has brought the matter into greater prominence, and as in the future adequate locking for nuts will probably be an

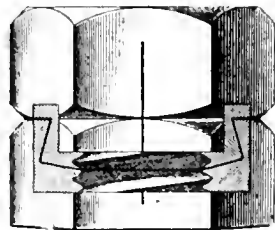


FIG. 1.—SECTIONAL VIEW OF THE VISLOCK NUT.

indispensable feature of machine design, especially where, as for instance, in certain classes of electrical machinery, there is a natural tendency to slacking-off through vibration, some interest attaches to the subject.

Of the various devices which have been introduced, probably the Vislock lock-nut is as well known as any; it is simple and self-contained, and indistinguishable in appearance from the ordinary lock-nut arrangement which has been the standard—though frequently ineffectual—practice for many years.

The makers of the Vislock nut have now had four years' experience with their products in daily use on a very extensive scale, which leaves little room for doubt as to the effectiveness of the device, which, our readers may remember, consists of two nuts, which are mechanically connected by an internal shank extending below the upper nut into a specially-shaped recess in the lower one.

and depends for its utility on the wedging action produced between the bolt and nut threads in this recessed portion, when the upper nut is rotated relatively to the lower one.

The Vislock nuts are made by VISLOCK, LTD., of 3, St. Bride's House, Salisbury Square, E.C., in British Standard Whitworth sizes from $\frac{1}{4}$ in. to 2 in. diameter, the bigger sizes ($1\frac{1}{4}$ in. to 2 in.) being specially made for heavy machinery; they are also made in B.S. fine-thread sizes from $\frac{1}{16}$ in. to $1\frac{1}{4}$ in. diameter; two depths are supplied, 1 and $1\frac{1}{2}$ times B.S.W. and B.S.F. standard.

New Armature Winding.

MR. PHILIP C. JONES, of 111, Woodstock Road, Belfast, sends us the following description of a new method of winding armatures, for which a patent has been applied for:

Fig. 2 shows the coils all assembled on the core, and it will be noticed that the stampings are built so that the slots run in an arc of a circle.

The coils are wound on a circular former made in two halves, and of simple construction. One side of the coil is fitted into the

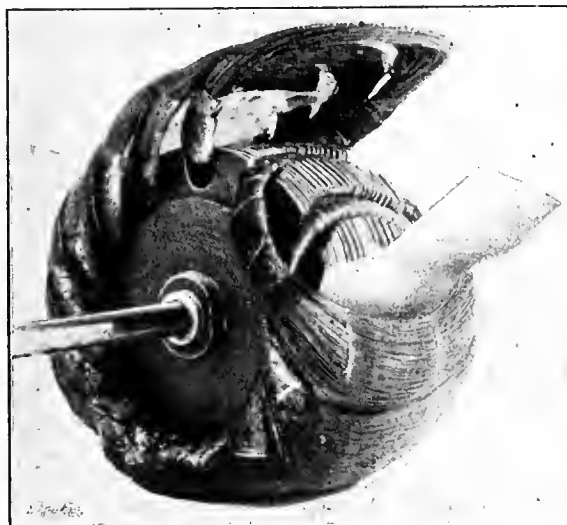


FIG. 2.—ASSEMBLING ARMATURE COILS.

slot, and requires no more forming, on account of the shape of the slot; a glance shows how insulation from core and between layers is effected.

The removing of a damaged coil without damaging others, and the making of the coils, are reduced in this winding to simple matters. The time required for winding the complete armature is greatly reduced, and a saving of copper is made through so little wire not being under the poles.

In the case of an armature of 6 in. diameter, with winding slots $\frac{3}{4}$ in. deep, with an ordinary winding $\frac{3}{4}$ in., would be required for bottom and top layers, but with the new winding $\frac{3}{4}$ in. slot depth only is required, the other side of coil being spread evenly over the periphery, thus reducing depth of winding from poles to $\frac{1}{8}$ in., with consequent advantages.

Fig. 3 is a view of a complete winding, showing the symmetrical appearance of armature. The winding is primarily intended for the smaller armatures.

Improved Method of Time Checking.

It is surprising how many employers there are who have up to the present failed to realise the great advantages to be gained by installing some system of departmental time checking for their workpeople, and it is still quite common to find large works where the employees deposit their time check when passing through one or more of the entrance offices, leading into the works, after which checking probably five minutes is lost by a fair proportion of them in reaching the particular part of the works where their employment lies. In these works it is to be noticed that the workpeople generally do not start actual work until the last of the "stragglers" has arrived. Firms who have installed departmental checking will substantiate the fact that all their workpeople being in their respective places when the works buzzer sounds, automatically start work almost directly. To meet the needs of works where a simple means is required of recording the actual presence of the employees in their respective departments at the allotted times at the various periods of the day, a system has been invented and patented by a large engineering firm in the Midlands, and whilst this was primarily designed to meet their own needs, the apparatus has proved so low in first cost, absolutely reliable in use, foolproof, and infallible in action, that it has been decided to manufacture the whole outfit and place it upon the market.

In this system a cabinet is placed in each department. On the front of the cabinet is an indicator showing for which time the checking is at the moment operating, a slot into which the workman places his check, and a metal scoop into which the check is returned to the workman should it be placed in the cabinet "after time." All the cabinets are simultaneously electrically controlled from one central point, the actual control being operated either from a clock or by the works time-keeper.

In the particular works for which this system was designed, the cabinets are opened at 5.45 each morning, and remain open until

6.5 a.m., the indicator during this period showing "Early." At 6.5 a.m. one of the electrical circuits being momentarily connected up the indicator then shows "6.30," and all checks are diverted into another part of the cabinet. At 6.30 a second electrical connection is made, after which the indicator shows blank, and checks dropped through the slot are returned to the workman through the front of the cabinet, the man having tangible proof that he is "too late."

The breakfast time being 8 a.m. to 8.30, the cabinet remains closed till 8.15, when the above process is repeated, and the cabinet remains open till 8.30. At dinner time, 12.30 to 1.30, the cabinets are opened at 1.15 and closed at 1.30.

The checks actually drop into a "transit" box, placed and locked inside the cabinet. This box has two compartments to receive the "early" and 6.30 checks, as it remains in the cabinet until the same is closed at the latter time. The transit box has a spring lock lid, and is made in such a manner that it is impossible to take it out of the cabinet without the lid being closed and locked. There is therefore no possibility of checks being inserted whilst the boxes are in transit between the cabinets and time office, where the boxes are

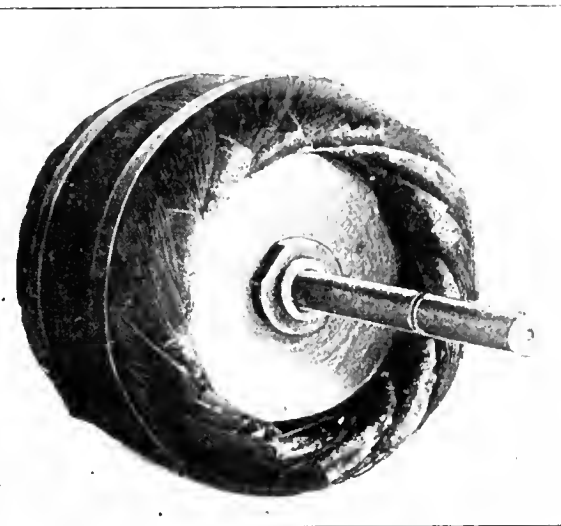


FIG. 3.—FINISHED ARMATURE WINDING.

emptied and the check numbers entered up on to the daily time sheets for payment. The system is adaptable for almost any conditions of working hours, as there are three distinct "times" or "blanks" available. The electricity consumption is negligible,

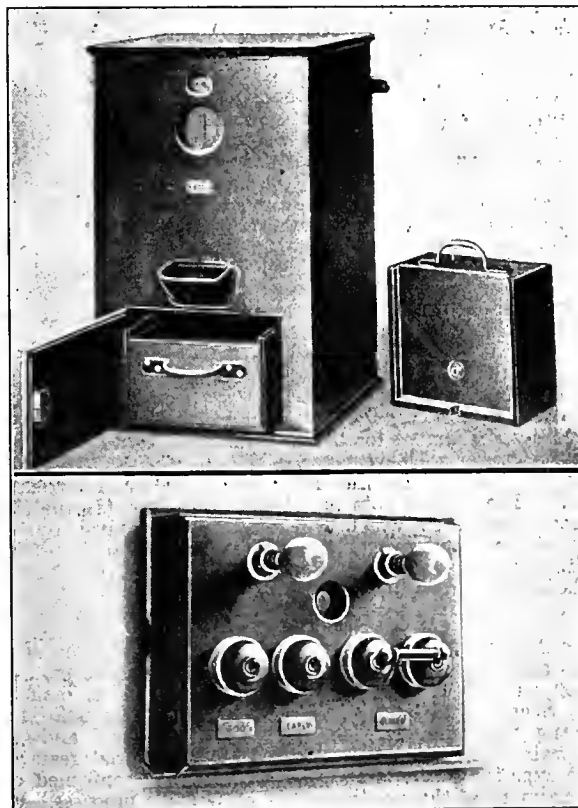


FIG. 4.—TIME-CHECKING CABINET, WITH SPARE TRANSIT BOX.

FIG. 5.—CONTROL PANEL FOR OPERATING CABINETS.

amounting to only a few pence in the whole year, as the current is only on momentarily at each operation. Further particulars may be obtained from Mr. G. E. Allin, 21, Dairy House Road, Derby.

SCIENTIFIC AND INDUSTRIAL RESEARCH.

THE following is an abstract of the report of the COMMITTEE OF THE PRIVY COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH, for the year 1916-17 (Cd. 8,718; price 3d. net):—

Since we last reported, Lord Crewe and Mr. Henderson have been added to our Committee under supplementary Orders in Council.

On December 1st last Lord Crewe, the Lord President of the Council, announced that the work of the Committee of Council for Scientific and Industrial Research had been established as a separate department, with offices in Great George Street. As the work of the Advisory Council developed and the industrial side of research grew in bulk and importance, it became clear that a separate organisation, having its own estimates, in charge of a minister responsible to Parliament, was a necessity. The foundation of the new department led to the creation of the Imperial Trust for the Encouragement of Scientific and Industrial Research. A donation of £1,000 made by Messrs. R. H. & R. Williamson, to be expended as to half its amount on research into some subject of mechanical engineering in conjunction with the Institution of Mechanical Engineers, and as to the other half on such research as the Committee of Council may determine, has been deposited with the Trust. It is also intended that the Trust shall hold on behalf of the Department the sum of one million sterling which Parliament has voted for the purposes of the Department, to be spent over a period of five or six years. Our Advisory Council have recommended that the money thus made available should be spent in the form of grants in aid of research undertaken by firms in any industry which may combine to conduct it on a co-operative basis. The best means to this end is the establishment under the Companies' Acts of associations for research limited by guarantee and trading without profit. The Board of Inland Revenue have decided that no objection shall be offered by their surveyor of taxes to the admission, as a working expense for income-tax allowance, of contributions by traders to industrial associations under Government supervision which may be formed for the sole purpose of scientific research for the benefit of the various trades, or specifically earmarked for the sole purpose of the research section of an adapted existing association.

During the past year we have concluded negotiations with the Royal Society for the transfer of the property of the National Physical Laboratory, together with the responsibility for its maintenance and development, to this Department. The scientific management of the laboratory will remain in the hands of the Executive Committee under the chairmanship of Lord Rayleigh, a member of our Advisory Council.

In order to deal effectively and systematically with the urgent problem of fuel economy, we have appointed a Fuel Research Board, with Sir George Beilby as Director, without remuneration. The other members of the Board, who are also unpaid in this capacity, are:—The Hon. Sir Charles A. Parsons, K.C.B., F.R.S.; Sir Richard Redmayne, K.C.B.; Mr. R. Threlfall, F.R.S. The Board will report to us through our Advisory Council, but it is our intention that it shall have executive powers within the limits of an annual budget approved by us. The Fuel Research Board has recently appointed an Irish Committee of Inquiry into peat as a source of power. The Committee will meet in Dublin under the chairmanship of Sir John Griffith.

We have considered and approved recommendations in respect of aid to 44 scientific investigations of industrial importance. We reported last year that we had approved grants to a number of individual students and research workers for the year 1916-17 to an amount not exceeding £6,000. In the event we have not expended more than £3,550 odd under this head upon 36 workers. Throughout our work has suffered in amount owing to the war, and we were unable to expend more than £14,521 out of the £40,000 placed at our disposal by Parliament for the financial year 1916-17. During the current year we have taken a sum of £38,050 in our estimates in addition to the fund of a million referred to above. The annual vote is intended to cover (a) the cost of those researches which will not be undertaken by the proposed research associations; (b) the grants to individual research workers, both students and others; and (c) the cost of administration.

REPORT OF THE ADVISORY COUNCIL.

In our report of last year we discussed the vital need of research at the universities, especially in pure science, and expressed our belief in co-operation between capital, management, science, and labour as the best means of financing and directing the extended laboratory investigations, and the large-scale experimentation required for industrial research.

The experience of another year of work has confirmed our first estimate of the position. We have made progress. But the progress must be slow, for the calls of war continually grow, and the numbers available for other work, however important, continually shrink.

We have addressed ourselves during this year in the main to the organisation of industrial research, first, because we felt the paramount importance of arousing and securing the interest of manufacturers in the application of science to

industry, and, secondly, because the influence of the war has created in industry an atmosphere conducive to the growth of new ideas, whereas it has unfortunately made the prosecution of work in pure science and in its organisation a matter of extreme difficulty.

Organisation.—The one question of policy, to which throughout the year we have continuously devoted our attention, is the working out, with all the care and advice we have been able to command, of the policy of co-operative industrial research foreshadowed in our last report. Association and combination are "in the air," and many trade associations have come into existence during the past year, some of which include research among their objects. The intention of the Government is to make a contribution to the assured income of such associations from the subscriptions of their members, varying in amount according to circumstances, and with a normal maximum of pound for pound, though in very exceptional cases this limit may be exceeded.

We proceeded to draft a model Memorandum of Association for companies limited by guarantee of nominal amount and working without profit, such as would fulfil the purposes we had in view, and at the same time be registered by the Board of Trade under the Companies' Acts without the use of the word "limited." We have also prepared notes for the guidance of those desiring to draft the articles of an association for research, and a short statement of the conditions under which the Department would make grants to such an association when founded. Further, the Department has issued a brief descriptive leaflet on "The Government Scheme for Industrial Research," which explains in non-technical language the manner in which the associations are expected to work.

As regards the constitution of the governing body or council of an association for research, it is obvious that capital, management, and science must have suitable representation. But we believe, further, that greater success and a wider scope of action will be attained if provision is made also for the inclusion of labour. In most cases only skilled labour will be concerned; The interim report just issued by the Sub-Committee of the Reconstruction Committee on Relations between Employers and Employed advocates the establishment of standing joint industrial councils. We believe that councils so constituted as to be able to discuss with knowledge questions affecting both employes and employer would, if they could be brought to work successfully, greatly help the formation and development of trade research associations.

Substantial progress has already been made towards the establishment of a National Research Association by the great staple industry of cotton. The woollen and worsted manufacturers of Great Britain have appointed a provisional committee to draft the constitution for a research association. The Irish flax spinners and weavers have decided to take the same steps. The Scottish shale oil industry and the photographic manufacturers have decided to establish associations immediately, the electrical engineering firms and the British Society of Aircraft Constructors, in conjunction with the Aeronautical Society, have the matter under consideration, the Scottish shipbuilding and steel industries are moving, and it may be possible to establish an association for research into the non-ferrous alloys in the near future. The British iron puddlers and the Diesel engine manufacturers have independently established research organisations for the benefit of their respective industries. The coal mining industry is interested, but it will necessarily take time to organise this huge industry on a national basis.

There will remain, however, important fields for industrial research which we can never hope to cover by means of research associations. Research into fuel is one of these. The Committee of Council have accordingly established the Fuel Research Board as a part of the Department. The researches we are conducting through the British Fire Prevention Committee and the Concrete Institute respectively into the fire-resisting and other properties of different kinds of concrete, are also cases which call for national action. The same considerations hold good for the scientific problems underlying illuminating engineering and cold storage.

By far the most fundamental work initiated during the year, so far as the industrial aspect of our labours is concerned, has been the appointment by the Committee of Council on our recommendation, of a Director of Fuel Research, with a Fuel Research Board to assist him in laying his plans.

The services of Prof. Bone, F.R.S., of the Imperial College, were retained, with the consent of the College Governors, as consultant to the Board. The British Association Committee on Fuel Economy is prepared to place the valuable information it has collected at the disposal of the Fuel Research Board, and the Director may anticipate the active help of its members either in their individual or corporate capacity as occasion may arise.

The Fuel Research Board have already presented their first report outlining their proposals for taking stock of the coal resources of each district, classifying according to their qualities the seams which are being worked or which might, in certain circumstances, be worked, and ascertaining broadly the industrial uses to which the different kinds of coal are being put. It is intended, with the help of the coalowners, to collect typical specimens of the coal seams of the various coal mining districts, and to examine and classify them by means of chemical and physical examination in the laboratory. On

the more theoretical side it is intended to conduct investigations into the nature and origin of the various types of coal, and into the chemical and physical behaviour of their constituents under the action of heat and other agents, beginning with the well-defined types of coal as they occur in commerce.

The work of the Fuel Research Board, like that of the Provisional Committee on Research into Cotton has been in the main preparatory. Neither body has yet done much in actual research, for they have been doing the careful thinking without which ideas are barren.

We have, however, recommended that grants should be made for three pieces of research which are related to the work of the Fuel Research Board. The first of these is being carried on at the Manchester Municipal School of Technology, and has for its objects the use of better methods of domestic heating, and improvement in the ventilation of dwelling rooms. A grant has also been given to the Institution of Heating and Ventilating Engineers to enable them (a) to tabulate and print the result of five researches on domestic heating carried out at University College, London, during the past three years, (b) to carry out a research with a view to establishing coefficients of heat transmission through standard building materials, and (c) to conduct an investigation on heat transmission from radiators.

The third grant will secure the continuance of the work begun in 1912 by the Committee for the Investigation of Atmospheric Pollution.

A grant made in November last to the Institution of Mining Engineers to enable them to investigate (a) the influence of hot and moist atmosphere on workers employed in mines, and (b) the methods to be employed for cooling and drying the atmosphere of mines, will lead, we hope, to an improvement in the circumstances in which a large number of miners work. Since the grant was made the principal coalowners have been considering the establishment of a National Association for Research, which could undertake this and other researches affecting the industry.

The Ministry of Munitions and the firms concerned have co-operated with the Department in a series of experiments intended to remove the difficulties experienced by English manufacturers of X-ray bulbs. We have retained Dr. Willocks, of the Sir John Cass Technical Institute, to direct the investigations. Certain results of value have already been obtained.

(To be concluded.)

WAR ITEMS.

When the Nights Draw In.—A correspondent with the Forces in France, writing under date August 23rd, says:—"Until I came out here, five months ago, I had not missed an issue of the REVIEW for years. We do not get very much time for reading, but now that the nights are drawing in we shall probably find the time hanging rather heavily, and a perusal of the REVIEW will be profitable and keep us abreast of the times. I am afraid we shall not be able to reply to any of the 'Situations Vacant,' however. I dare say you would be very amused if you knew of some of the jobs that we electrical men are called upon to do, but I was very pleased to hear a sergeant say one day that he liked to have electrical men in his section, because they were so adaptable! We get some very interesting jobs, and get over them in record time. Only a couple of weeks ago we installed a complete plant, engine, generator (bed for same), mains, and switchboard, after 6 o'clock in the evening. We are just keeping in training for all the extensions to plant after the war. I only hope that that happy time will soon be here."

Discharged Soldiers and Motor Work.—The Central Committee for the Employment of Discharged Soldiers and Sailors draws attention to the position of such men with respect to the motor industry. It is considered inadvisable for men who have not already trained as drivers to do so now. Among the reasons given are the cancellation of private petrol licences and the difficulty at present found in obtaining work for highly-skilled men of many years' experience. Thousands of unskilled men who were enlisted and are now, after training, coming back to civil life, will be anxious to remain at motor work. Although there is, generally speaking, an over-supply, the committee say there is a certain demand for men who are capable of undertaking work on commercial cars and on agricultural tractors, but in both cases the work is somewhat heavy, and therefore not suitable for men who have been badly injured.—*Times*.

British Westinghouse War Relief Fund.—A full statement of receipts and payments in connection with the British Westinghouse Employés' War Relief Fund was submitted to a meeting of delegates held on Friday last in the Women's Canteen at Trafford Park. The number of employés with the Forces to date is 2,702, and the casualties have been exceedingly high. The dependents who received allowances at June 30th, 1917, was 718. The accounts cover the period from August 24th, 1914, to June, 1917. The total receipts stand at £44,108, £29,103 of which was contributed by em-

ploies and £13,990 by the company, the remainder consisting of donations and interest. There has been paid out to dependents £25,836, £11,678 has been set aside for a Disablement and Dependents' Fund, and over £2,080 has been spent in donations to local and national funds, Christmas gifts, and payments to Red Cross workers.

Trading with the Enemy.—The "London Gazette" for August 31st contains a further list of persons and bodies in the following countries with whom trading is prohibited: Argentina, Paraguay, Uruguay, Brazil, Chile, Colombia, Greece, Netherlands East Indies, Norway, Peru, Spain, and Sweden, also particulars of a number of removals from previous lists.

German Industrial Census.—According to the "Hamburgischer Correspondent," a census was to be taken on August 15th of all industrial and trade establishments throughout the German Empire. The object of this census is stated to be the collection of statistical data considered necessary for the successful economic prosecution of the war and to facilitate the transition of the German economic system from war to peace conditions. The census was to include all Germans engaged in industry, whether as manufacturers, independent master craftsmen, tradesmen, or home industrial workers, and was to be carried out through municipal and communal authorities.—*Financier*.

Small Supplies of War Material.—According to the *Morning Advertiser*, at the West Ham Court, last week, Samuel Coster, 43, an electrical engineer, was charged, on remand, with entering into negotiation, without a permit, for the sale of 30½ lb. of alloy worth £16; and also with having under his control alloy required for the production of war material. Detective-Sergeant Mould said he had been to the Ministry of Munitions, and he was told that there was no intention to prosecute, it being held that the Act was not intended to apply to such small quantities. The accused was then discharged.

Reconstruction in France.—A law, promulgated on August 6th, authorises, *inter alia*, the Minister of Commerce, Industry, and Posts and Telegraphs to expend a sum not exceeding 250,000,000 frs. (about £10,000,000 at par) on the purchase of raw materials, plant, &c., necessary for the re-establishment of industry in the invaded districts of France. Plans for the purchase of material, &c., will be drawn up by three Commissioners acting under the direction of an Office of Industrial Reconstruction, consisting of eight representatives of the Government Departments concerned and eight representatives of commerce and industry (of whom four are to belong to the invaded districts). The Office is to be established at the Ministry of Commerce.—*Board of Trade Journal*.

Where Germany gets Copper.—The Serbian copper mines are now being intensively exploited by the Germans and Austrians, and good copper deposits are also said to have been found in Poland. Work has recently begun in the lead and copper deposits in the district of Kielec, and in the neighbourhood of Miedziana, Lysa Gora, and Olkuss the methodical exploitation of these ores has already been started. The existence of copper in this district has long been known, but under Russian rule the deposits were neglected, as the authorities devoted all their attention to the exploitation of the mines in the Urals.—*Ironmonger*.

Niagara Power and Munitions.—The "Times" correspondent at Toronto reports Mr. Lucas, Attorney-General of Ontario, as believing that a revision of the treaty between Great Britain and the United States regulating the use of the water of Niagara Falls may be necessary. "There has been an acute shortage of power in Ontario. Under the treaty the United States is allowed to use 20,000 cu. ft. a second and Canada 36,000 cu. ft. Recently the Ontario Hydro-Electric Commission secured an Order in Council authorising the expropriation of exported power in order to relieve the situation. But even this does not meet the domestic demand. If export is prohibited many American industries will be embarrassed. The increased use of power on both sides is largely due to the demand for the manufacture of munitions. It is suggested that the treaty be revised to allow both countries to divert more water from Niagara river."

Indiscriminate Granting of Trade Protection Cards.—At Bermondsey, Messrs. Sadler & Co., engineers, in applying for the further exemption of a turner and fitter, 37, passed for labour abroad, stated that they had applied for a trade protection certificate for the man, but had been told by the officers that they had better stick to the Tribunal as long as they could. Consequently they were not granted a certificate. The Military Representative (Lieutenant J. A. Davie) said this man was fully entitled to the protection certificate. These certificates were being issued to men not entitled to them, but men fully entitled to them could not get them. In one case he learnt that a boy of 19 had been granted a certificate, and on visiting the factory where he was employed he found that he had been granted a protection certificate for the stamping of cakes of soap. On the day of his visit a woman was doing his work, as the boy was away on holiday. In another case, a man, 26 years old, passed for general service, engaged by a firm of coal merchants doing odd jobs in their coal wharf, had obtained a protection certificate. The Tribunal had refused his appeal for exemption,

and he had lodged an appeal with the Appeal Tribunal, but whilst his case was pending he obtained the protection certificate. He thought the Tribunal ought to draw public attention to the way these protection certificates were being obtained. The Tribunal instructed the Town Clerk to communicate with the Government Department responsible for granting the protection certificates, drawing attention to the indiscriminate manner in which they were being issued. Applicant was granted two months' exemption.

At Camberwell, Mr. W. J. A. Westcott, 35, passed for general service, managing director of Messrs. Arthur Adams and Co., Ltd., tin box manufacturers, of Meeting House Lane, Peckham, appeared, at the request of the Military Representative, to show cause why his certificate of conditional exemption should not be withdrawn. He informed the Tribunal that he had been granted a card of exemption under the Protected Trades Schedule. The Military Representative said that this was not a business of national importance. Mr. J. Nisbett replied that evidently the Ministry of Munitions thought it was, for they had granted him an exemption certificate. Applicant said he held direct Government contracts for the manufacture of tin boxes. The Military Representative said there were many men in the borough holding these trade cards engaged in businesses which were not of national importance, and they did not know under what conditions they were obtained. He did not wish to reflect on this case, but he found that all sorts of dodges were being resorted to in order to get the cards. Tin box manufacturers were not included in the list of certified occupations, and he thought the man ought to join the Army. Sir Evan Spicer said the question for the Tribunal was whether this business was to be thrown away, even though it had grown out of the war. The Military Representative said if they were going to keep young men like this out of the Army, especially if they were fit, they might as well "throw up the sponge." It was decided to cancel the exemption granted by the Tribunal, which deprived the applicant of any further right to an appeal at the Tribunal should his card be withdrawn by the Ministry of Munitions.

Exemption Applications.—At Batley, three electrical engineers' certificates were reviewed. H. Hainsworth (37, in charge of a large engineering firm), who possessed an M.A.R.O. certificate, and had been working 90 hours a week on shell factories contract work, was given a renewal of conditional exemption. A. Brook (38), electrician, with M.A.R.O. certificate, was also given conditional exemption. H. Jagger (37) was told to apply for an M.A.R.D. certificate, and submit himself for medical examination.

At the Hull Tribunal, Mr. T. Holme, the Corporation telephone manager, applied for exemption certificates in the place of the existing blue cards granted by the Military Representative to 15 telephone employees. In reply to a question as to what was the position of the military in relation to these men, Captain Chapman said that they were already exempted, but the certificates granted were now out of date, and they required Tribunal certificates, to which the military offered no objection. The Humber Garrison and the York Command had told them what they had to do, and the telephone employees had to do it. As a matter of fact, he believed every one of the men would have to go under military control absolutely. In regard to replacing the A men, Mr. Holme said the 15 names were put forward in agreement with the local military authorities and themselves for substitution. They also communicated with the National Service Department, and gave details of the men they wanted. Only four had been substituted, and that was why he was making the application. It was not suggested that the whole of the 15 should be substituted, but only those under 31 years of age. Mr. Gibson asked if there was any objection to the men doing four hours per week dock guard duty, and in order that the decision of the military might be obtained, the issue of the new certificates, which was agreed to, was deferred.

At the Hull Tribunal, the Tramways Committee applied for three men engaged as armature winders. One was classified B1 and the other two C1. The staff had been before the Advisory Committee, who had taken all the A men. A representative of the department said that if these men were taken it would mean that the whole tramway system would be stopped. Conditional exemption was allowed.

At the South Yorkshire Military Appeals Court, on Saturday, 17 cases concerning employees of the Rotherham Corporation tramways were considered. According to the *Yorkshire Post*, in each case the Military Representative appealed against an exemption granted by the Local Tribunal. Fifteen drivers were among those concerned. The statement submitted on behalf of the Corporation was that they were doing their best to get substitutes, as shown by the fact that they had arranged to release six of the 17 men as soon as substitutes were efficient. They had 30 substitutes sent down, but only 10 remained. The traffic manager informed the Chairman that it was not desirable to utilise women as substitutes for motormen, as was done in Doncaster and elsewhere, as the gradients on some of the routes were dangerous. Two of the men were ordered to join up, and others were given until November 30th, but the Chairman said the Tribunal felt strongly that all the men should eventually find their way to the Colours. The exemption would not be made final,

and the management had better do all it could to find substitutes, women or otherwise, as the prospect was that the men concerned would have to go.

Renewed exemption to January 1st has been granted to A. A. Clements (36, C1), electrical engineer, Taunton.

At Surbiton, the Electricity Supply Co. appealed for a meter mechanic (27, C2), and three months were conceded.

At Oxford, the Military appealed against conditional exemption held since June 19th, 1916, by W. Bnsh (40, B1), scientific electrical instrument maker, engaged at the Electrical Laboratory, Parks Road. Prof. Townsend stated that Bush was engaged on the construction of wireless apparatus for the Royal Naval Air Service, under his direction, and Lieutenant Owen said that he ought to be protected by the Admiralty. The exemption was cancelled.

Bath Tribunal has granted three months' exemption to A. H. Leonard (29, C2), electrical engineer at the Grand Pump Room Hotel.

At Whitby, the electrical engineer to the U.D.C. (Mr. J. Piggott) appealed for a shift engineer (19, C1), and said that an efficient substitute, suggested by the Military, would require months of training before he could satisfactorily undertake the work and acquire local knowledge of the situation of cables, &c. The appeal was disallowed.

Before the Eton Rural Tribunal, exemption was sought for V. H. Froud (37, B2), electrician at the Stoke Park Golf Club. Three months were allowed, the case to be then reconsidered.

At Oxford, a review was made of exemptions, granted on the ground that they were necessary for the efficient running of the services, to H. Wyatt (31, general service) and F. L. Chatwin (33, general service), engaged with the Oxford Tramways Co. The company claimed that the men were indispensable, but the appeals were allowed, and a month's temporary exemption granted, with leave to appeal again.

IMPORT TRADE OF PERU.

THE following statement, showing the imports of electrical and allied goods into Peru during the year 1915, is extracted from the recently-issued trade statistics. The figures for 1914 are added for purposes of comparison, and notes of any increases or decreases are given:—

	1914.	1915.	Inc. or dec.
	£	£	£
<i>Electrical apparatus.</i> —			
From Germany ...	1,000	200	— 800
„ United States ...	1,500	2,000	+ 500
„ Great Britain ...	700	—	— 700
Total ...	3,200	2,200	— 1,000
<i>Copper wire and cable.</i> —			
From Germany ...	50	500	+ 450
„ United States ...	850	5,000	+ 4,150
„ Great Britain ...	—	1,500	+ 1,500
„ Other countries ...	250	500	+ 250
Total ...	1,150	7,500	+ 6,350
<i>Incandescent lamps.</i> —			
From Germany ...	3,000	1,300	— 1,700
„ United States ...	1,200	2,300	+ 1,100
„ Great Britain ...	200	500	+ 300
„ Other countries ...	—	1,400	+ 1,400
Total ...	4,400	5,500	+ 1,100
<i>Telephone apparatus.</i> —			
From Germany ...	400	100	— 300
„ United States ...	400	300	— 100
„ Other countries ...	200	100	— 100
Total ...	1,000	500	— 500
<i>Pumps.</i> —			
From Germany ...	200	500	+ 300
„ Belgium ...	300	500	+ 200
„ United States ...	11,500	8,000	— 3,500
„ Great Britain ...	1,500	500	— 1,000
Total ...	13,500	9,500	— 4,000
<i>Boilers.</i> —			
From Germany ...	1,000	500	— 500
„ Great Britain ...	4,500	800	— 3,700
„ United States ...	1,500	100	— 1,400
Total ...	7,000	1,400	— 5,600
<i>Spare parts for machinery.</i> —			
From United States ...	26,000	13,000	— 13,000
„ Great Britain ...	11,000	8,000	— 3,000
„ Other countries ...	5,000	2,000	— 3,000
Total ...	42,000	23,000	— 19,000

	1914. £	1915. £	Inc. or dec. £
Machinery (other than agricultural).—			
From Germany ...	40,000	9,000	- 31,000
.. United States ...	127,000	97,000	- 30,000
.. France ...	4,000	1,500	- 2,500
.. Great Britain ...	42,000	19,000	- 23,000
.. Italy ...	1,000	1,000	-
.. Other countries ...	5,000	2,500	- 2,500
Total ...	219,000	130,000	- 89,000
Railway and tramway cars.—			
From Germany ...	500	3,000	+ 2,500
.. United States ...	10,000	17,000	+ 7,000
.. Great Britain ...	3,000	1,000	- 2,000
.. Other countries ...	5,500*	1,000	- 4,500
Total ...	19,000	22,000	+ 3,000
* Belgium.			
Rails.—			
From United States ...	113,000	80,000	- 33,000
.. Germany ...	1,000	10,000	+ 9,000
.. Great Britain ...	9,000	—	- 9,000
.. Other countries ...	32,000*	2,000	- 30,000
Total ...	155,000	92,000	- 63,000
* Belgium £32,000.			

BUSINESS NOTES.

Book Notices.—"Theory of the Submarine Telegraph and Telephone Cable." By Dr. H. W. Malcolm. London: The Electrician P. and P. Co., Ltd. Price 18s. net.

"Engineering Directory." No. 64. July, 1917. London: Engineering, Ltd.

"Laws of Physical Science." By Dr. E. F. Northrup. London: J. B. Lippincott & Co. Price 8s. 6d. net.

Brazil.—The American Consul at Rio Grande, Rio Grande do Sul, states that the importation and distribution of foreign merchandise in the State of Rio Grande do Sul have been controlled chiefly by German houses, which endeavour to import everything possible from Germany. "In the electrical line this was particularly true, but, in spite of this handicap, several American electrical articles found their way to the market solely because of their superiority. There are some 45 electric light and power companies furnishing service in the various municipalities of this State, and there is a constant demand for plain lamps, fixtures, fans, small motors, and supplies. The trade is principally in the hands of the hardware dealers, all of whom carry some electrical equipment, and certain ones make a speciality of electrical goods. Certain electrical specialties are sold in drug stores and even by the larger general stores, but, as a rule, greater effort is put forth by the hardware dealers making a speciality of these lines. American electrical irons, toasters, warming pads, &c., could find an increased sale through intelligent sales methods, which would include correspondence with the dealers conducted in Portuguese, or at least in Spanish." Attractive literature should be sent at once, stating terms and giving data showing volume and weight of goods packed for export. "Three months are often required for a reply from this section of Brazil, and it is best to give at once all possible information. In the distribution of electrical goods generally, it is better for exporters to deal directly with the importers, and not place all chances of success or failure in the hands of a general agent."

For Sale.—The Stalybridge, Hyde, Mossley, and Dukinfield Tramways and Electricity Board has for disposal 90 Reason maximum-demand indicators. Particulars are given in our advertisement pages to-day.

THE ASSETS AUCTIONS Co. will sell by auction, on September 13th, at 129, Newington Causeway, the stock of an electrical factory. For further particulars see our advertisement pages to-day.

The Rochdale Corporation Electricity Committee has for disposal one Belliss-Morcom-B.T.H. 220-KW., three-phase, 3,000-volt steam alternator. For particulars see our advertisement pages to-day.

Kilmarnock Corporation has for sale one complete D.C. switch-board for lighting and traction. For particulars see our advertisement pages to-day.

Catalogues and Lists.—BRITISH THOMSON-HOUSTON Co., LTD., Rugby.—List No. 3,313 (20 pages) contains illustrated details of their truck type ironclad switchgear, type T, forms A and B for polyphase systems up to 11,000 volts. Half-tone illustrations, outline drawings, and diagrams of connections occupy a large amount of space.

THE BENJAMIN ELECTRIC Co., LTD., 1A, Rosebery Avenue, London, E.C.—Leaflet giving illustrated description and prices of their industrial signals or interior factory calling systems for fire alarms, air raid, and general service purposes.

MESSRS. L. ANDREW & Co., 2, Whitworth Street West, Deansgate, Manchester.—Net wholesale price circular of india-rubber gloves and gauntlets.

Fire.—Press reports state that the premises of Bradbury and Co., manufacturers of electric light fittings, of Woodcock Street, Birmingham, were gutted by fire on Tuesday morning.

Liquidation.—FIELD BROS. & Co., LTD.—The Controller, Mr. J. E. Percival, has applied for his release.

Trade Announcements.—MESSRS. QUEAD, LTD., have appointed the Western Electric Co., Ltd., of 49, West Campbell Street, Glasgow, as sole agents for the sale of their patent "Quead" fires in Scotland.

THE BRUSH ELECTRICAL ENGINEERING Co., LTD., have removed from No. 1, Kingsway, to Maxwell House, Arundel Street, Strand, London, W.C. 2.

LIGHTING AND POWER NOTES.

Aberdeen.—YEAR'S WORKING.—The annual report by the Corporation electrical engineer, Mr. J. A. Bell, states that the total income for the year to July 31st was £76,369, an increase of £496, while the total working expenses amounted to £47,215, an increase of £8,035. The gross profits amounted to £29,153, a decrease of £7,539. There was a deficit on the year's working, which was taken from the reserve fund, now standing at £39,304, of £315. Summer Time, early shop closing, and lighting restrictions have reduced the revenue by £1,076, and a reduction of 5 per cent. on the previous year's charges, has reduced the revenue £1,192 for lighting, £1,162 for power and heating, which reductions have been counterbalanced by the increase in sales for power. Mr. Bell explains that, owing to the war, the advance in power uses has been on a scale never experienced before.

Bolton.—The electrical engineer (Mr. W. J. H. Wood), at the request of the Coal Controller, is to co-operate with Mr. J. A. Robertson, as local representative for the South Lancashire and Cheshire districts with a view to securing economy in the consumption of coal.

Canada.—ONTARIO HYDRO-ELECTRIC PROPOSALS.—In a recent letter to the *Electrical World*, Mr. R. P. Bolton discusses the financial possibilities of the Ontario Hydro-Electric Commission's acquisition of the Ontario Power Co., which was rendered necessary by the proposed power development at Queenston by the Commissioners. The water which the Power Co. used provided a development of 180,000 H.P. on a fall of 160 ft., and the same volume of water at Queenston, with a head of 310 ft., will develop about 390,000 water H.P., or 300,000 electrical H.P., at an estimated cost of \$50 per electrical H.P. But the new development will still be burdened by the investment on the existing plant, and Mr. Bolton considers that the cost of the Queenston project added thereto will still leave the figure at \$126 per H.P., which is that of the Ontario Co.'s property. He calculates that the operating and fixed charges will amount to \$16.57 per H.P., which is greatly in excess of the price at which the Commission has hitherto purchased its service.

According to the *Financier*, the Imperial Privy Council has granted leave to the Electrical Development Co. to appeal against the decision of the Ontario Courts denying the company the right to proceed against the Attorney-General of the Province and the Hydro-Electric Commission with regard to the contemplated Chippewa development. The Electrical Development Co. contends that the original franchise given by the Government stipulated that it would never take water from the Niagara or Welland Rivers (Chippewa River) to compete against the company. It is suggested that if this covenant is binding, it would apply as much to the taking of water through the works of the Ontario Power Co. as in any other way. The Chippewa power plant would provide a development of 500,000 or 600,000 H.P., at a cost of about \$30,000,000.

Cardiff.—LINKING-UP.—The electrical engineer and manager has submitted a report on the question of linking-up the various power stations in the South Wales area, in connection with which a Committee has been formed, of which he has been appointed chairman. He asked for the authority of the Electricity Committee to go more closely into the question of details, including estimates of cost, &c., in order that the same might be submitted at a later date to this Committee for consideration, and at which time it is intended that the Committees of the various local undertakings should appoint representatives to meet together to finally discuss the matter. The Committee agreed to this, and will contribute to the united Committee similarly to other electrical undertakings on the basis of their annual revenue, the amount of the subscription for the Cardiff undertaking being £10.

Colne.—SALARIES.—The T.C. has decided to give the Corporation officials a war bonus of £25 per annum. When the war commenced it was decided to leave over the question of increases of salary, but it was felt that, as most workmen were now in receipt of more or less substantial war bonuses, the officials should also be granted a contribution towards the increased cost of living.

Continental.—FRANCE.—La Société des Forces Motrices de la Truyère is the name of a new company which has just been formed in Paris with a capital of £600,000, to establish a large hydro-electric plant to utilise the water power of the River

Truyère, the Société des Mines de Bruay, and the Société des Forges de Chatillon-Commentry-Neuves Maisons are interested in the new undertaking, the main object of which is to supply the electrical energy required for the new electric steel plant which is at present in course of construction by the Chatillon-Commentry Co. It is stated that the hydro-electric plant to be established will have a capacity of 36,000 H.P.

SPAIN.—Following the experiments at its Marie Luise Pits, it is reported that the Sociedad Metalurgica Duro-Felguera has decided to adopt underground electric traction in the whole of its collieries.

ITALY.—According to the American Consul, in the City of Venice there are over 1,200 users of electric light and over 1,000 users of electric power. Electricity is generated by water power, and as coal is scarce and high in price the number of power users is large everywhere in the Veneto, and is constantly increasing.

According to a paragraph in *L'Economista d'Italia* for August 25th, the Municipality of Turin has under consideration a large new hydro-electric station in Valle dell'Orco. The scheme will comprise (1) the construction of two barrages on Lakes Serru and Agnel, in the valley, capable of storing 7 million cubic metres of water, and a branch on the Ceresole plain, on the left slope, of an average capacity of 2,200 litres, with a minimum of 1,450 litres; (2) a barrage on the Telesio plain and Lakes Balma and Eugio, to form a basin of 15 million cubic metres; (3) a branch, from the Valle dell'Orco to the Valle della Centrale del Rossone, on the left bank, where all the water from higher up will be collected. According to estimates received, the new installation will give 20,000 KW., and will cost 40,740,000 lire (£1,629,600).

Dublin.—At a meeting of the Corporation, last week, objection was taken by Mr. Moran to certain extra payments to employés of the city electricity department. Mr. P. T. Daly said it was curious that two men were always mentioned as having done the overtime. Mr. Sherlock stated that some members thought the men referred to were favoured by the chief engineer because they were associated with him in other matters. Alderman Farrell declared that, in his opinion, Mr. Ruddle was not a free man; some of the officials even threatened him in his office. The paragraphs relating to overtime payments were deleted.

Dundalk.—The Urban Council has adopted a report of the Electricity Committee, in which it was stated that a satisfactory settlement had been arrived at in the arbitration on matters in dispute with Messrs. Brook, Hirst & Co., contractors for a new switchboard in connection with the supply meters at the Great Northern Railway (Ireland) sub-station. The contractors had agreed in each matter, and had, in addition, paid the arbitration expenses.

Fife.—**STEEL FURNACES.**—A 5,000-H.P. steam turbo-generating set has just been installed at the works of the National Steel Foundry (1914), Ltd., at Leven, to supply the current for the electric steel melting furnaces, and for other purposes. The company has at present two electric steel furnaces, one being of the Snyder, and the other of the Heroult type; a third furnace is, however, in course of erection, and is expected to be in operation at an early date.

Glasgow.—**YEAR'S WORKING.**—The twenty-fifth annual report of the Corporation electricity undertaking, for the year ended May 31st, 1917, shows a gross revenue amounting to £580,433, and working expenditure to £404,404, leaving a gross profit of £176,029; interest, £83,039, sinking fund, £76,049, and depreciation, £55,606, absorbed £214,695, leaving a deficit on the year's operations of £38,666, to meet which a sum has been transferred from the reserve fund account, which now stands at £19,172. The revenue account shows an increase of £49,713, but the working expenses have increased by £81,752, due apart from the larger output to the increased price of coal, materials and workmen's wages: £5,885 has been paid to dependents of employés on active service.

Capital expenditure during the year amounted to £255,353, and the total capital expenditure at the end of the year, less depreciation written off, stood at £2,835,297; the total depreciation written off the capital account to May 31st amounts to £766,915. The consumers at May 31st last numbered 31,724, as compared with 33,605 in the previous year. The total units generated were 162,398,668, including 5,139,217 purchased from the tramway department; the total units sold were 111,196,627, as compared with 112,794,461 in 1916. The units sold to private consumers were 140,513,680, an increase of 30,025,058, equal to 27.17 per cent.; of these, 20,474,183 units were for lighting, and 120,039,497 for power. The total number of motors connected was 12,101 of 97,733 H.P., and the units consumed amounted to 117,547,855, as compared with 11,172 motors of 84,744 H.P. and 88,596,457 units in the previous year. The total connected load was 123,180 KW., as compared with 109,370 KW.; and the maximum demand on December 21st last was 49,185 KW.

The report states that the foundation contract and river work of the new Dalnarnock works is now practically completed, and that plans and specifications were shortly to be issued for the buildings, boiler house, turbine room and switch house, and that permission has been obtained for orders being placed for two 15,000-KW. turbo-alternators and necessary boilers. It is hoped that a third 8,000-KW. turbine set will be ready for this winter at Port Dundas station, bringing up its capacity to 46,600 H.P.; a similar sized turbine has been supplied to Pollockshaws Road station, making the plant capacity 57,000 KW. The Govan and Partick plants represent 4,450 H.P. and 2,650 H.P. respectively.

Contracts have been entered into for the supply of coal for the coming year at practically the same price as in the year just closed.

The Committee recommends that the charges for electrical energy as from the date of last survey of the financial year 1916-17, and until further notice, be:—For private lighting in shops, warehouses, theatres, &c., 5d. and 1½d.; domestic lighting, 4½d.; for power, 2d. and 1d. per unit, 500,000 units and over, 1½d. for the first 250,000 units, and ¾d. for the second 250,000 units; special supply, 1d. and ¾d. per unit. Heating, other than domestic, 1½d. per unit; special rate to domestic consumers, 1d. per unit; where a special meter is to be installed for heating or cooking supply, 1½d. per unit; the KW. charge to be increased by 15 per cent. plus a running charge, which will vary with the price of coal.

Hebden Bridge.—**BULK SUPPLY.**—The U.D.C. has made an agreement with the Halifax Corporation for the supply of electricity in bulk to Hebden Bridge for a period of seven years from September 9th. The Corporation is to supply all mains, plant, and apparatus, and the Council is to carry out the laying of the cable between the Corporation's existing station and the Council's electricity works.

Hove.—**PRICE INCREASE.**—From September 30th the charges for current for power will be increased to 2d. per unit on the flat rate and by 10 per cent. on the indicator rates of charge.

Ireland.—The rising cost of illuminants is again drawing attention to the advantages of electricity and its cheapness when water power can be had on the spot. Few countries are more favoured with rivers and streams, and the wonder is that such power is left untapped in so many places, particularly in the south and west, where many towns and villages are built on rivers, &c. Another matter for wonder is that there is not more propaganda on the advantages of electrical lighting.

London.—**DEPTFORD.**—The General Purposes Committee reports that a letter has been received from the Clerk of the L.C.C. referring to the question of the electricity supply of London. The County Council now suggests that a further Conference should be held, and in this connection the Clerk states that he presumes that if a Committee exists, this Council would wish to be represented at the further Conference by such Committee, and not by individuals. As a matter of fact, the Councils not owning electricity undertakings have not appointed a representative Committee.

Maidstone.—**YEAR'S WORKING.**—The report of Mr. Hoadley, the borough electrical engineer, on the electricity undertaking for the year ended March 31st last, shows that the total revenue amounted to £22,736, the total costs to £14,463, and the gross profit to £8,273—these figures comparing with £19,771, £13,532, and £6,239 respectively in the previous year, while the net result after meeting capital charges was a profit of £1,186, as against a loss of £256 in 1916. The output sold was 3,236,741 units, as against 2,753,788 units in 1916; power supply absorbed 2,435,033 units, an increase of roughly 460,000, while heating and cooking supply more than doubled. With this respectable increase in the day load (the lighting load fell off at the same time), the load factor improved to 29.6 per cent., and the working conditions were further improved by the use of a Ljungstrom turbine plant, so that the total operating costs fell from 1.075d. to .995d. per unit (coal cost falling from .604d. to .589d.). Had not technical difficulties with a converter plant interfered with the continuous use of this turbine, the savings would have been much greater. The connected load was 117,780 equivalent 30-watt lamps and the maximum load 1,246 KW. The gross profit amounted to 13.6 per cent. on the outstanding capital.

Mexico.—**TAXES ON ELECTRIC LIGHT AND POWER.**—H.M. Chargé des Archives at Mexico City reports that as regards certain special stamp taxes imposed on, *inter alia*, electric lighting, a new arrangement has come into force, whereby the company supplying the service is responsible to the Government for a tax at the rate of 10 per cent. on the actual consumption, as shown on the bill of the consumer. This tax is to be collected by the company. Persons using not more than three lamps are exempt from the tax. No tax will be levied on signs and advertisements, special illuminations, charitable institutions and schools, public lighting, and federal and municipal buildings.

A tax on electric power has been fixed at 3 per cent. on the amount of the bill of the consumer. Exemptions from this tax are Government installations, power sold to other companies which are not consumers but who resell and distribute, and power supplied for irrigation and agricultural purposes.—*Board of Trade Journal*.

Newcastle-under-Lyme.—**YEAR'S WORKING.**—For the year ended March 31st the Corporation electricity department had a revenue amounting to £3,435; the working expenditure was £1,972, and, after providing for financial charges amounting to £1,715, a deficit of £253 resulted. The total units sold were 225,880, as against 257,216 in the previous year; the maximum load was 177 KW.

New Zealand.—The Christchurch City Council has decided, in view of the Public Works Department being unable to meet the Council's increased demands for electricity during the next two years, on account of its inability to obtain the necessary plant to extend the Lake Coleridge generating station, to install a producer-gas stand-by plant, at a cost of several thousand pounds. The Department has been asked to pay a share of the cost, seeing that the outlay is necessitated by its inability to fulfil its contract to supply power.—*Otago Weekly*.

Shipley.—The U.D.C. has approved the advances in wages recommended by the Association of Engineers to the engineers in the electricity department. After consideration of a letter from the General Labourers' Union with regard to the wages of fitters and switchboardmen, the Council agreed to alter the war-time payment of men employed 60 hours per week.

Stratford-on-Avon.—**PROPOSED PRICE INCREASE.**—The Electricity Co. has asked the T.C. for consent to a further increase in the price of current from 6d. to 6½d. per unit for the period of the war and 12 months after. The matter has been referred to a Special Committee for consideration.

Venezuela.—An American Consul states that the Maracaibo Electric Light Co., which started operation in 1888, is now furnishing electric power during the daytime. The capacity of the plant has been increased fourfold during the last two years. During the same time the company introduced the United States standard three-phase, 60-cycle system, with standard voltages. An American is the chief engineer for the plant. In view of the fact that electric power is now being furnished during the day, it appears there will be good opportunity for the sale of electric motors for industrial purposes. No large motors will, however, be required. Gradually, no doubt, there will be developed a demand for electric fans. Opportunities for the sale of electric heating and cleaning appliances do not appear favourable at present.

Wrexham.—**PRICE INCREASE.**—The T.C. has increased the charges for current for lighting and heating by another 15 per cent., making a total increase during the war of 25 per cent., and for power by 6½ per cent., making a total advance of 16½ per cent.

TRAMWAY AND RAILWAY NOTES.

Birkenhead.—**YEAR'S WORKING.**—The working of the Corporation tramways for the year ended March 31st last resulted in a total revenue of £80,748, an increase of £7,926 over the previous year; the working expenses amounted to £42,106, leaving a gross profit £38,641, and, after making provision for interest, sinking fund, and income-tax, &c., of £24,989, the net balance remaining is £13,652, an increase of £3,082 on 1916. The balance has been allocated as follows:—In aid of rates, £2,820; to reserve fund, £5,000; and to renewals fund, £5,832. The credit to reserve fund now stands at £8,192, and to renewals at £34,338. The car-mileage was 1,186,186, as against 1,176,951 in the previous year, and the passengers numbered 17,950,433, as against 16,676,022 in 1916.

Lancashire.—**TRAMWAY WAGES.**—The application of the Lancashire and Cheshire Tramway Workers for an advance in wages was considered at a conference in Manchester on Friday, August 31st, of the Lancashire and Cheshire Tramway Federation. It was decided to refer the question to the Committee on Production.

The Manchester Corporation and its employes have already agreed to a similar reference, and it is understood that a joint arbitration will be held for the whole of Lancashire and Cheshire.

Peru.—The Lima electric railway system is operated by the Empresas Electricas Asociadas, a company combining the three previous railway companies, which operated cars in Lima, between Lima and Chorillos (8 miles), and between Lima and Callao (9 miles); the old English line between Chorillos and Callao, *via* Lima, is worked for goods traffic. Altogether some 75 miles of single track, 135 passenger cars, and six electric locomotives are operated.—*Electric Railway Journal*.

Kingston-on-Thames.—**ACCIDENT.**—On Saturday morning, last week, a car belonging to the London United Tramways Co., while descending Kingston Hill, left the track and crossed the road, knocking down a tree and the iron standard supporting the overhead work. The collision with the standard caused the car to swing right round, the top being torn off and the body smashed; the only passenger, a lady, was injured about the head, and the driver was also hurt; the conductress was so seriously injured that she was detained at the Kingston Infirmary.

Preston.—**YEAR'S WORKING.**—The revenue account of the Corporation Tramways for the past year shows a gross working surplus of £21,746, as compared with £20,131 and £17,483 in the two preceding years. The traffic receipts have risen from £45,618 in 1913-14 to £57,683 last year, but working expenses, including allowances to employes on war service, show an increase of £6,444 over the year just quoted, whilst the increase during the past year has been £4,827. The power expenses alone are £1,950 greater than in the previous year.

Newcastle.—The City Council has approved of air raid warnings at night being given by interrupting the tramway supply for a minute, and after resuming supply, finally cutting it off. During the day, current will be cut off and a red flag displayed on each car.

YEAR'S WORKING.—At a meeting of the Corporation Tramways Committee, the annual financial statement of the undertaking was submitted. The total revenue of the tramways for the year ended March 31st last was £356,534, an increase on the previous year of £31,840; the total working expenses were £208,299, compared with £192,648.

Deducting working expenses, there was a sum available of £148,236, compared with £132,046 for the previous year; interest on investments, &c., brought the total available to £154,619, which was equivalent to 43 per cent. of the gross receipts. Out of the last-named sum the following charges had been met:—Allowances to the dependents of men on service, £15,939; special rents, £1,541; interest on capital, £26,776; redemption of debt, £46,009; interest on old horse tramway loans, £1,449; making a total of £91,716. The balance has been appropriated thus:—Income-tax, £15,815; contribution in aid of rates, £7,000; insurance (third party) reserve, £2,065; renewals fund, £37,992. The sum transferred to the renewals fund was £14,132 larger than in the previous year. Owing to the fact that labour and materials had been difficult to obtain, the repairs and renewals to the permanent way had not been carried on as in former years, consequently only the sum of £9,562 had been spent during the year, being £11,190 less than was spent in 1916.

Mr. R. Mayne, the chairman, in moving the adoption of the report, said it was satisfactory to note, in view of the heavy expenditure which would be required in the future, that there was now practically £106,000 in the reserve and renewals fund. The cost of renewals for some years to come would be considerably heavier than in pre-war times, and it would be advisable to appropriate the whole of the present year's surplus to that purpose. Every endeavour would be made to carry on the undertaking without having recourse to increasing the fares, and it was to be hoped that the traffic returns would be such as to avoid having to make any alteration to the existing fares and stages.

Rawtenstall.—**STRIKE.**—The employes of the Corporation tramways ceased work on Sunday and Monday last, owing to a dispute in regard to the war bonuses paid to women and boys, causing considerable inconvenience to local holiday makers.

Sydney.—**CITY RAILWAY.**—The N.S.W. Cabinet has decided to discontinue the work of constructing the city railway; all work is to be immediately closed down, except such as is necessary to remove the obstruction in Macquarie Street. In making this announcement, Mr. Fuller stated that whatever loan money might be available in the near future for the Railway Department would be devoted to the construction of rolling stock necessary duplications, and to carrying to completion such lines of a revenue-producing nature as had already been started.—*Sydney Daily Telegraph*.

According to the *Sydney Morning Herald*, in the first year of the war practically seven millions was expended on the project, in the second year over eight millions, and in the third, which ended on June 30th last, about seven millions.

Wolverhampton.—The temporary suspension from time to time of the Corporation tramways was explained by Mr. S. T. Allen, the borough electrical engineer, as due to increased demand for electricity on the part of the factories in the town and delay in obtaining the use of new plant which has been ordered and has not yet been completed. It is hoped, with economy on the part of the consumers, to keep the supply going until the first of the new generating sets now being completed is running.

TELEGRAPH AND TELEPHONE NOTES.

Italy.—A powerful wireless station is being erected with all speed at the instance of the Ministry of Marine in a spot in central Italy unnamed. The station, says *l'Elettrotecnica*, will be built and equipped on a new system, radically different from those constructed hitherto by the larger European wireless installation companies. The latest types of American transmitting and receiving apparatus will be installed, under the special supervision of the Minister of Marine. The opening of the station is expected to take place shortly, thus constituting a record for speed of construction.

Damage to Insulators.—At Blackburn County Police Court, on August 30th, three youths were summoned for unlawfully and maliciously breaking an insulator on a telegraph pole at Mellor. Cornelius Coward, of Preston, Inspector of Telegraphs, stated that in his area, which covered a radius of 18 miles from Preston, there had been considerable damage this year. No fewer than 3,000 insulators had been broken, representing about £520. On the road in question, which carried nothing but trunk wires, which were used for important war work, 178 insulators had been broken, representing over £31. Defendants, who denied the offence, were each fined 10s., and ordered to pay 4s. 6d. each expenses.

Denmark.—U.S. Consul-General Winslow reports that the total earnings of the State telegraph and telephone systems in 1916 were about \$1,800,000, the telegraphs accounting for \$1,175,000. Maintenance, salaries, &c., totalled \$1,170,000, leaving a net profit to the State of about 18 per cent. on the capital invested.

Norwegian Wireless Station.—A wireless station is in course of erection, with a view to opening communication with America. The station, which is near Stavanger, will have its receiving station at Narbo. The contractors are pledged to hand it over for working within the current year.—*Den Tekniske Forenings Tidsskrift*.

Portugal.—The postal and telegraph services have been temporarily deranged by a strike of officials. The Government has decreed that the entire staff of the departments is incorporated in the army, and that absentees will be treated as deserters, and the situation is now normal.

Spain.—By a Royal Decree, bearing date June 8th, all private existing and projected wireless stations transmitting and receiving, or receiving only, for whatever purpose used, are made subject to Government inspection. The inspection will be carried out by officials of the Telegraph Department, and its objects are to watch over public interests and order, to safeguard the State wireless system, and the fulfilment of the stipulations regarding material and the terms of concessions. Breaches of the regulations will be followed, in minor cases, by fines, or, in the graver cases, by the confiscation of the concession and plant and a heavy fine.—*La Energia Electrica*.

Sweden.—A Commission has been appointed to arrange for the erection of a wireless station at Karlsberg, which is to communicate with other international systems.

Telephone Directory.—Owing to the scarcity of paper and labour, it has been decided to defer the next issue of the Telephone Directory for three months, until January, 1918, and to publish two subsequent issues at nine-month intervals, in October, 1918, and July, 1919.

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—MELBOURNE.—October 10th. Department of the Navy. Pumping plant and equipment for the Commonwealth Naval Dockyard, Cockatoo Island, Sydney. Specifications from the Director of Navy Contracts, Melbourne.

Dublin.—September 11th. Electricity Supply Committee. Twelve months' supply of cables, troughing, bends, section pillars, service boxes, &c. See "Official Notices" August 31st.

London.—BERMONDSEY.—Sept. 7th. B.C. 500-KW. rotary converter. See "Official Notices" August 3rd.

Manchester.—September 17th. B. of G. Installation of a telephone system at the offices, All Saints. Particulars from Mr. J. Macdonald, Clerk.

Spain.—The municipal authorities of Castrillo de Villavego (Province of Palencia) have lately invited tenders for the concession for the electric lighting of the town during a period of six years.

Stockton-on-Tees.—September 10th. District Fund Gas and Electricity Committees. Stores, &c., for six months. See "Official Notices" August 31st.

CLOSED.

Cootehill (Co. Cavan).—Urban Council. Generator (35 lights), £40: Mr. Robert Coyle.

Manchester.—Electricity Committee. Accepted tenders: Superheater tubes, &c.—Babcock & Wilcox, Ltd. Lea recorders.—Lea Recorder Co., Ltd.

Salford.—T.C. Accepted tenders:—

Edison's Electric Accumulators, Ltd.—Two-ton electric vehicle with automatic tipping body, £1,125.

W. T. Glover & Co.—Low tension, paper-insulated, lead-covered cable, £177.

British Westinghouse Co.—One 300-kw. rotary converter set, £1,535; switchgear, £551.

Fernanti, Ltd.—One 250-k.v.a., three-phase, oil-cooled power transformer, £274.

FORTHCOMING EVENTS.

Birmingham and District Electric Club.—Saturday, September 8th. At 7 p.m. At the Swan Hotel, New Street. Paper on "The Manufacture of Commutators for Electrical Machinery," by Mr. A. P. Green.

Salford Technical and Engineering Association.—Saturday, September 8th. At 7 p.m. At the Royal Technical Institute, Peel Park. Paper on "Transmission of Power by Chains," by Mr. H. T. Hildage.

NOTES.

Legal.—PRICE v. HOOK.—In the City of London Court, on Tuesday, before his Honour Judge Atherley-Jones, K.C., a claim was made by Mr. Charles E. Price, accountant's clerk, against Mr. Charles Hook, trading as the Times Electric Co., Ltd., electrical manufacturers, Godliman Street, E.C., to recover the sum of £32 for balance of salary and for services as a book-keeper and secretary of the company, as well as a claim for a bonus. Mr. Griffiths appeared for the plaintiff, and Mr. Valetta for the defendants. Mr. Griffiths said that the defendant was the owner of a one-man company. There was nobody in it except the defendant and his wife. Mr. Valetta said that the plaintiff had no business to have sued the defendant. It was the Times Electric Co., Ltd., which employed the plaintiff, and not Mr. Hook.

The plaintiff, in his evidence, stated that he had been in the employment of the defendant for five or six years as book-keeper. Then Mr. Hook turned his business into a limited company. He was paid £3 monthly as book-keeper, having other employment elsewhere, and retained the position of book-keeper until August, 1916, when one of the two directors was called up for military service. The other director had been secretary, and witness took the post of secretary at £1 a week, in addition to his remuneration, as book-keeper. There was now £32 due to him as the balance for the service which he had rendered. It was distinctly agreed that he was to be paid a bonus at the end of each financial year as might be decided by the directors, but the figure was not to be fixed until it had been seen what the profits were. The company made a very large profit this year, but last year there was a loss. He was not claiming for a floating bonus, but only for the minimum bonus which was agreed between them. In cross-examination, witness said Mr. Hook held 998 shares out of 1,000 which had been issued. He certainly had no intention of making Mr. Hook personally liable, except that Mr. Hook was the company.

Mr. Valetta urged that the action could not succeed against the defendant personally, and the company was not before the Court. The company had sued the plaintiff in another action to be heard in a fortnight's time for the return of books belonging to the company and £5 lent to the plaintiff. Judge Atherley-Jones suggested that the proper thing to do was to amend the summons by adding the company. Mr. Valetta objected to that, and said there was no justification whatever for the present action. Judge Atherley-Jones, K.C., was afraid plaintiff could not proceed, but he thought the defendants had misled the plaintiff in applying for particulars, and so treating the action as properly brought against Mr. Hook. There must be judgment for the defendant, but without costs, which he thought he was justified in doing, having regard to the course pursued by the defendants.

Gas Topics.—The *Times* recently drew attention to the drastic German restrictions on gas consumption. All over Germany this reduction was to equal 10 per cent. of the monthly consumption a year ago, but in Berlin new orders have been issued which, it is estimated, will reduce ordinary domestic gas consumption by a half. In view of the coming winter, this restriction, together with the reduction in coal heating, has raised a strong public protest.

The Taunton Gas Co. attributes to the lighting restrictions and the Summer Time Act a decrease in consumption of five million cubic feet during the year.

At one of the Sheffield gas works an explosion recently occurred, in which 20 persons were injured. The explosion originated in a meter house where repairs were being made and set fire to a gas-holder, which was burnt out, while a second holder was wrecked by flying fragments.

Educational Notes.—HACKNEY INSTITUTE (L.C.C.).—The new session opens on September 17th, with evening lecture and laboratory courses in electrical engineering subjects, including electrical measurements, dynamos and motors. An announcement appears in our advertisement pages to-day.

UNIVERSITY COLLEGE, LONDON.—The programme for the new session in the Faculty of Engineering has been issued, giving particulars of the courses of study, scholarships, fees, &c. Prof. J. A. Fleming is head of the Department of Electrical Engineering.

Appointments Vacant.—Overhead lineman (40s. +), for the Colne Corporation Light Railways; electrical fitter, for the South Lancashire Tramways Co.; junior assistant to shift engineer (£91), for the Worcester Corporation electricity works; electrical staff for the ordnance depôts, aerodromes, and military camps in the Southern Command; draughtsman, for the Borough of Hornsey electricity works; two engineers to take charge of shifts (55s.), for the City of Hereford electricity works. See our advertisement pages to-day.

Profit-Sharing.—In the September number of the *Financial Review of Reviews*, Mr. J. B. C. Kershaw has an article on "The Promotion of Industrial Efficiency," in which he discusses the question of profit-sharing as a means of bettering the position of the workers and increasing productivity. He expresses the opinion, which has frequently been stated by ourselves, that the amount of the bonus requires to be substantial in order to be of any practical help in satisfying demands. A bonus of 5·5 per cent. on wages can have little effect in raising the worker's efficiency or increasing his devotion to his employer's interests. A German firm found nothing under 10 per cent. to be of any value; the Lever maximum is 20 per cent., but the author is of opinion that 30 per cent. or 40 per cent. on standard wages would, in many

Theft.—On a charge of stealing a quantity of electrical appliances, fittings, and tools, valued at £100, Jesse Taylor (17), electrical test assistant, employed by the Chloride Electrical Storage Co., Clifton Junction, was bound over at the Manchester Police Court on Friday last.

cases, be justified by the results. He discusses the investment of the bonus, and, briefly, the subject of welfare work. Profit-sharing is more easily applicable and more readily accepted as part of a scheme of industrial partnership in which the general welfare of the workers is also reasonably and fairly provided for.

Institution and Lecture Notes.—The Institute of Metals.—The annual autumn meeting will be held on Wednesday, September 19th, at Burlington House, Piccadilly. At the opening session (4 p.m. to 6.30 p.m.) the following communications will be presented:—

- "Experiments on the Fatigue of Brasses." By B. Parker Haigh, D.Sc.
- "Hardness and Hardening." By Prof. T. Turner, M.Sc.
- "The Effects of Heat at Various Temperatures on the Rate of Softening of Cold-rolled Aluminium Sheet." By Prof. H. C. H. Carpenter, M.A., Ph.D., and L. Taverner.
- Note on "A Comparison Screen for Brass." By O. W. Ellis, M.Sc.

At the evening session (from 8 p.m. to 10 p.m.) the proceedings will include:—

- "Further Notes on a High-temperature Thermostat." By J. L. Haughton, M.Sc., and D. Hanson, M.Sc.
- "Principles and Methods of a New System of Gas Firing." By A. C. Ionides.
- "Fuel Economy Possibilities in Brass-melting Furnaces." By L. C. Harvey.
- "The Effect of Great Hydrostatic Pressure on the Physical Properties of Metals." By Professor Zay Jefferies, B.Sc.
- Note on "The Use of Chromic Acid and Hydrogen Peroxide as an Etching Agent." By S. W. Miller.

In connection with Mr. Ionides's paper, a demonstration of a new system of furnace heating will be given, and it is expected that this paper will give rise to an animated discussion on metal melting.

Invitations to be present at the meeting can be obtained by non-members of the Institute of Metals on application being made to Mr. G. Shaw Scott, M.Sc., secretary and editor, 36, Victoria Street, S.W. 1, from whom also particulars of the forthcoming ballot for the election of new members can be obtained. So great is the present interest in metallurgical matters, that the membership of the Institute has increased, we are informed, since January 1st last by over 30 per cent.

Junior Institution of Engineers.—This Institution has instituted a "Cadet Associate Membership," whereby engineering pupils in works or college (day or evening students) may be registered for a nominal yearly fee of 5s. It is open to youths of 15 years and over who are still undergoing training, and who, as certified by a principal of a technical college or head of department of an engineering works, are making satisfactory progress in the development of their abilities as engineer pupils. The registration as a Cadet Associate Member of the J.I.E. is for one year only, and renewals can only be accepted when satisfactory progress and development is vouched for by a responsible authority under whom the applicant is serving. The Institution undertakes certain duties in regard to these Cadets, which are set forth in a pamphlet which may be obtained upon application to the Secretary, Junior Institution of Engineers, 39, Victoria Street, Westminster, S.W. 1. The project is commendable, and will, doubtless, meet with the success it deserves. There is little doubt that much valuable *personnel* is now wasted for the lack of a wider organisation such as the Juniors can furnish, and the constitution of the Council is such that the new scheme will be pushed with vigour and enthusiasm in the interests of the profession and of patriotism. Many youths feel that they wish to become engineers, but drift into other professions where they are round pegs in square holes, simply because there is no one from whom they can claim assistance and advice in the furtherance of their desires. Many apprentices, too, remain unacquainted till too late with openings which might lead to their advancement in public or private services either at home or abroad. Managers of engineering shops throughout the country are frequently in need of youths possessing certain elementary qualifications which local conditions cannot provide. Technical instructors, too, desire to become acquainted with openings in works, so that their pupils may gain a good start in life, and not be entirely dependent upon the blind god "chance," which has detrimentally affected the careers of numerous promising youths.

For Government Purposes.—A Scottish correspondent writes:—"Recently five houses in Buckingham Terrace, Edinburgh, were leased for a department of the National Insurance Commission, and alterations, including substitution of electric light fittings for gas, were carried out. Then in a short time the premises were vacated, and had to be put back to their original condition and the electric light fittings removed, at a cost of £3,000. Now, it is stated, the premises have been once more requisitioned for Government purposes, but it is explained that a stricter economy will now be observed."

Royal Mint Report.—The production of Imperial coins, viz., 203 millions, for the year 1915, exceeded by 16 millions that of any previous year, and precluded any but a comparatively small coinage (3 million pieces) being undertaken for Colonial use. Of the Imperial coinage 22 million pieces were gold, 105 million silver, and 76 million bronze. The Deputy Master, Sir Thomas Elliott, states that the silver issues were more than double that of any previous year, and were due to large demands consequent on the withdrawal of gold coin from active circulation. The profit on the year's working was £4,710,000. During the year, Sir Edward Rigg, Superintendent of the Operative Department, reports that 2,130 tons of metal were converted into coinage bars, this figure being approximately double the average of the previous 10 years. In the machinery branch the staff was considerably augmented and engaged on special work undertaken by the Mint. To meet the generally increased demands a 200-kw. Siemens-Belliss generating

set was installed, and the main switchboard extended and re-arranged. The monthly output of the Mint generators averaged 12,269 units, an increase of 2,000 on the figure for 1911. The number of motors in use rose from 106 to 125, their gross H.P. being now 974. The extended use of high-power incandescent lamps has raised the total of such from 8 to 22, and the number of arc and flame lamps has been correspondingly reduced. Incandescent lamps in the official premises show an increase of 32, their total being 1,330, and those in the private residences number 135. In the Inland Revenue Department, 1 copper, 88 nickel, and 55 steel-faced electros were grown in connection with the preparation of adhesive, postcard and embossed plates and dies for postage and other stamps.

The Assayer of the Ottawa Branch Mint, Mr. R. Pearson, refers to experiments made with a view to the increase of the amount of gold electrolytically refined in a given time. Sufficient data were obtained to show that a current density of 7,250 amperes per sq. metre could be used, and a combination, at Ottawa, of the Miller's chlorination process and the electrolytic deposition of gold has been adopted with satisfactory results. Rough gold deposits which are reasonably "clean" (approximately 75 per cent. gold, 20 per cent. silver, and 5 per cent. base) may be raised to 9800–9900 fineness, cast into anodes, and the refining finished by the electrolytic process in 18 hours, all platinum and such metals being recovered from the electrolyte. The slimes are practically eliminated, the electrolyte does not become "foul," and need not be renewed for very long periods.

Volunteer Notes.—COUNTY OF LONDON VOLUNTEER ENGINEERS (FIELD COMPANIES).—Headquarters, Balderton Street, Oxford Street, W. 1.

Orders for the week, by Lieut.-Colonel C. B. Clay, V.D., commanding:—

Officer for the Week.—Second Lieut. P. Bowden.

Monday, September 10th.—Technical instruction (searchlight) for No. 3 Company, Right Half Company, at Regency Street. Drill, No. 3 Company, Left Half Company. Signalling Class, 6.30. Recruits' Drill, 6.30.

Tuesday, September 11th.—Physical drill and bayonet fighting.

Wednesday, September 12th.—Drill and elementary bridge construction for No. 1 Company, Right Half Company.

Thursday, September 13th.—Drill and elementary bridge construction for No. 2 Company, Right Half Company. Signalling Class, 6.30. Ambulance Class, 6.30.

Friday, September 14th.—Technical instruction (searchlight) for No. 3 Company, Left Half Company, at Regency Street. Drill, No. 3 Company, Right Half Company. Recruits' Drill, 6.30.

Saturday, September 15th.—Commandant's Parade for route march and drill. Parade, Golder's Green Station, 2.45 p.m. Uniform. A and B men are reminded that one route march per month is compulsory. Recruits' drill, 2.30.

Uniform.—A and B men are warned to attend Headquarters on Tuesday, September 11th, to be measured by the regimental tailor for the Service Uniform.

(By order) MACLEOD YEARSLEY.

Power Sources of American Electric Railways.—A recent issue of the *Electric Railway Journal* contained a table showing that of 1,108 electric street railways and interurban lines, 51.3 per cent. generated their own power and the remainder purchased it, also that 70.6 per cent. of the cars are operated on generated power and 29.4 per cent. on purchased power. Many of the companies have power and lighting businesses in addition.

A further table giving a similar classification of railroads operating electrical divisions is as follows:—

Name and division.	Pur- chase power.	Gener- ate power.	Motor cars.	Loco- motives.	Miles.
Balto. and Ohio Belt Division	P	—	—	9	8.4
Boston and Maine, in New Hampshire ...	—	G	37	—	30.72
Boston and Maine, in Mass. ...	P	—	—	5	22
Bush Terminal R.R. ...	P	—	2	3	6
Chicago, Milwaukee, & St. Paul	P	—	—	14	140.6
Erie R.R., Rochester Division	P	—	8	—	40
Grand Trunk, St. Clair Tunnel	—	G	—	6	12
Great Northern Railway, Cascade Tunnel ...	P	—	—	4	10
Long I. R.R. Electric Division	P	—	591	—	217.2
N.Y., N.H., and H., all elec- trified divisions ...	P	G	{ 25 14* }	100	570
N.Y.C. and H.R. Elec. Div....	—	G	{ 192* 19* }	63	254.6
Norfolk Southern R.R. Va. Beach Division ...	—	G	{ 25 17* }	1	47
Norfolk and Western Railway	—	G	12	—	88.8
Penn. R.R., Paoli Division ...	P	—	93	—	96.6
Penn. Tunnel and Terminal Co.	—	G	68	66	95.5
West Jersey and Seashore R.R.	—	G	109	—	150.3

* Trailers.

A Tramway Conundrum.—A driver writes to us that he recently had occasion to use the electric brake (on a car fitted with a B.T.H. controller), and when on the third brake notch, the circuit-breaker tripped out and at the same time the car started again, as if working on the power notch, though the handle was still on the third brake notch. This was repeated several times, and our correspondent (who does not say what type of brake he was using) is anxious to obtain some explanation of the matter.

Prohibited Exports.—The Supplement to the *Board of Trade Journal* of September 6th contains complete lists of articles which, according to the latest information received by the Board of Trade, are prohibited to be exported from Norway, Portugal, Russia, Spain, Sweden and Switzerland. The Supplement also contains a reprint of the United Kingdom Contraband List in its present form.

Improved Motor Ambulances.—Two new types of motor ambulance specially designed to carry serious cases have been designed by the Motor Ambulance Department of the Joint War Committee of the British Red Cross Society.

One of the new vehicles is a single-bed ambulance. The body is light and airy with folding rear doors, and an electric radiant heater is used to maintain the necessary temperature.

The other vehicle is a special two-bed ambulance, built with duplex panels, between which is an insulating material. Heating is provided by electric footwarmers, the current for which is supplied by the regular lighting system on the car, and by pipes through which the whole of the exhaust of the engine can be taken. The car is scientifically ventilated and is lit by electricity.

—*Times*.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station and Tramway Officials.—MR. THOS. COPE, permanent way foreman for the Peterborough Electric Traction Co., has been appointed permanent way inspector of the Cape Town Electric Tramways.

General.—MR. R. COLLINS, who is at present on the Belfast staff of the Edison Swan Electric Co., Ltd., has been appointed engineer and manager of the Galway Electric Supply Co., in succession to Mr. L. E. Rayner, who is taking up an appointment in England.

LORD RHONDA has appointed MR. JOHN WARDLE, commercial manager of the Metropolitan Railway, to control the cold air storage and inland transport of food.

LIEUT. JOS. MARTIN, Northumberland Fusiliers, has been promoted to a Captaincy. When the war broke out he was an electrician at Newburn Steel Works, and enlisted as a private in the Fighting Fifth.

The *Times* states that the President of the Board of Trade has granted to SIR E. WYLDBORE SMITH, Director of the Commission Internationale de Ravitaillement, the rank of an Assistant Secretary to the Board of Trade so long as he holds his present appointment.

COUNCILLOR PETER HIGSON has been elected chairman of the Bolton Tramways Committee, in succession to the late Alderman Miles. COUNCILLOR J. R. HORROCKS has been appointed vice-chairman.

Roll of Honour.—CAPTAIN WILLIAM GREGORY TERRY, Lancashire Fusiliers, died of wounds in France on August 27th. He was educated at Shrewsbury School, and afterwards served his apprenticeship with Messrs. Browett, Lindley & Co., Ltd., Patricroft, going through the whole of the departments and completing his course in the drawing office. He afterwards joined the staff of the Salford Corporation electricity works, but after a few years he re-joined Messrs. Browett, Lindley & Co., Ltd., being appointed to their staff as outside representative of their Northern Section. Captain Terry was well known in engineering and colliery circles, and his genial manner won him many friends and respect everywhere.

PRIVATE C. POLLITT, Manchester Regiment, who has died in hospital, aged 47, was formerly employed by Messrs. Charles Macintosh & Co., Ltd., Manchester.

PRIVATE J. KINSEY, of the K.O. Royal Lancaster Regiment, who has been killed in action, was employed at the Blackpool Corporation electricity works.

CORPORAL W. SAVAGE, Lancashire Fusiliers, killed in action, was employed by Messrs. Chas. Macintosh & Co., Ltd., of Manchester.

SECOND LIEUT. FREDERICK VICTOR CLAREMONT, R.G.A., late shift engineer at Islington electricity works, was killed in France on 14th ult.; GUNNER G. PARKER, R.F.A., who was previously employed at the same works as a boiler-house hand, was killed in action on July 14th.

PRIVATE F. WAYWELL, Lancashire Fusiliers, killed in action, was employed by Messrs. Charles Macintosh & Co., Ltd., electric wire and cable manufacturers, Manchester.

CORPORAL G. LOCK, Manchester Regiment, killed in action, was employed by the British Westinghouse Co., Ltd., Trafford Park.

GUNNER R. W. AERSTALL, R.F.A., who is in hospital at Boulogne, after gassing, was employed by Messrs. Bottomley and Frampton, electrical engineers, Blackpool.

LANCE-CORPORAL R. RUTTY, N. Staffs. Regiment, whose death in action is reported, was before the war engaged at Siemens Bros. Dynamo Works at Stafford.

PRIVATE H. THORP, 23rd French Mortar Battery, who has died of wounds, enlisted whilst second in charge of the dispatch department of the Ediswan Works, Ponder's End, where he was engaged for 25 years.

STAFF-SERGEANT A. HARDCASTLE, R.F.A., who was an electrician with Mr. T. Durrant, of Sheffield, has died in India from sunstroke.

PRIVATE S. WALTON, Royal Scots Fusiliers, who has died of wounds, was an employé of Taylor, Tunnicliffe & Co., Hanley.

PRIVATE WM. TODGOOD, Gloucestershire Regiment, who has died in hospital at Bristol, was for three years on the staff at the Bath E.L. Works. In October, 1914, he was taken prisoner of war by the Germans, and some time ago he was repatriated, after enduring great hardship.

RIFLEMAN F. CASWELL, Rifle Brigade, who has fallen in action, was engaged at the Southwark Electricity Works.

PRIVATE E. WALLIS, Queen's Royal West Surrey Regiment, who was with Crompton & Co., Ltd., Chelmsford, has been killed in action.

RIFLEMAN A. FRICKER, London Irish Rifles, who has fallen in action, was with the Telegraph Construction and Maintenance Co.

LIEUT. L. A. WALKER, Army Service Corps, whose death at the Front is announced, was resident engineer at Southgate for the Metropolitan Electric Power Co., Ltd. He had been recommended for the Military Cross.

PRIVATE W. L. BUCKLEY, Royal Welsh Fusiliers, who has been killed in action, was on the staff at the generating station of the Leeds Tramways Department.

SAPPER T. GRANTHAM, of Blackpool, who is in hospital wounded for the fifth time, was an electrician at Blackpool Tower.

SECOND LIEUT. E. B. GREENHOUSE, of Bishops Castle, who has been killed in action, was an engineer and electrician.

PRIVATE J. H. OLIVER, R.E., who has been wounded, was apprenticed with Messrs. Lockart & McNab, electrical engineers, Upper Craigs.

PRIVATE R. C. E. KERR, an employé of the Glasgow Corporation Electricity Department, has died from wounds, aged 35.

CORPORAL H. E. F. GOUGH, R.G.A., employed at the electricity works, Chester Street, Birmingham, has been killed in action.

PRIVATE T. MOODY, an electrical engineer, of Knaresborough, was killed in action on August 10th.

CORPORAL WILLIAM DUDLEY, Manchester Regiment, formerly reported wounded and missing, and now presumed to have been killed, was employed by the Record Electrical Co., of Manchester.

Obituary.—MR. WALTER DAVENPORT.—We regret to note that there passed away at Egham, on August 28th, at the age of 73 years, Mr. Walter Davenport, who will be remembered by many in the electrical trade as the first secretary of the National Electrical Manufacturers' Association. Mr. Davenport, whom we always found a most genial and approachable man, was experienced in trade association matters by reason of his secretaryship of the Mineral Water and Vinegar Brewers' Association, and his experience proved very useful to the electrical industry when it was at the beginning of its organising efforts which preceded the larger operations of the B.E.A.M.A. Later he was, by virtue of his office in the N.E.M.A., prominently identified with electrical exhibitions held at Olympia and Manchester, and with the Electrical Trades Benevolent Institution. In recent years he had not been associated with electrical affairs.

MR. J. G. LORRAIN.—The *Times* "Deaths" column contains a notice of the death of Mr. James Grieve Lorrain, patent agent, of 9, John Street, Adelphi, W.C., which occurred at East Wittering suddenly on August 23rd. In the earlier years of his career he was closely connected with telephone developments in different parts of the British Isles. For considerably more than 30 years he had practised in London as a consulting engineer for electric lighting and telephone work, but more particularly as a patent agent. Mr. Lorrain was a member of the Institution of Electrical Engineers, a member of the Institution of Mechanical Engineers, and a Fellow of the Chartered Institute of Patent Agents. He was also a member of the Council of the Dynamicals. The deceased gentleman was well known in the electrical world, and his unassuming and kindly presence will be much missed in electrical and certain other Masonic circles in London, in which he was a prominent figure.

ALDERMAN GEORGE SALTER.—On August 31st there passed away suddenly, at the age of 61, at Stourbridge, Mr. George Salter, chairman of George Salter & Co., Ltd., steam gauge and spring makers, West Bromwich.

The death has taken place, at the age of 63 years, at Walton-on-the-Naze, of MR. ARCHIBALD WHITE, for many years chief engineer of the *Buccaneer*, owned by the India-Rubber, Gutta-Percha, and Telegraph Works Co., Ltd., Silvertown. He joined the company in 1898. Mr. White had never recovered from privations caused through being shipwrecked off the coast of Madagascar, about three years ago.

NEW COMPANIES REGISTERED.

Clements, Jeakes & Co., Ltd. (148,312).—Private company. Registered August 25th. Capital, £25,000 in 3,000 5 per cent. cum. pref. shares of £5 each and 10,000 ord. shares of £1 each. To take over the business carried on at 51, Great Russell Street, W.C., and at Marklin Street, Drury Lane, W.C., as Clements, Jeakes & Co., and to carry on the business of domestic, electrical, and general engineers, electricians, iron and brass founders, &c. The subscribers are: J. H. Clements, The Cottage, Repton Road, Watford, engineer; G. B. Clements, 26, Regent Square, W.C.1, engineer. The first directors are: J. H. Clements and G. B. Clements. Registered office: 51, Great Russell Street, W.C.

Watercraft Detachable Power Installations, Ltd. (118,345).—Private company. Registered August 29th. Capital, £20,000 in 41 shares (12,500 pref.). Builders of and dealers in engines and power plant for the propulsion of watercraft of all kinds, electrical and general engineers, &c. The subscribers (each with one share) are: T. F. de Saulles, 25, Houghton Road, Birchfield, Birmingham, coal factor's manager; F. W. Huxfield, 18, Frances Road, Handsworth, Birmingham, coal factor's cashier. The first directors are: E. W. Reid, T. H. Coggins, and A. E. Hooke. Solicitors: Shakespeare & Vernons, 83, Colmore Row, Birmingham.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Lancashire Electrical Engineering Co., Ltd.—Memorandum of satisfaction in full on July 27th, 1917, of charge dated March 20th, 1917, securing the sums owing on company's account with Union Bank of Manchester.

A. J. Wakelin, Ltd.—Memorandum of satisfaction in full on August 29th, 1917, of debentures dated May 22nd, 1914, and July 31st, 1915, securing £500, has been filed.

British Thomson-Houston Co., Ltd. (47,982).—Capital, £800,000 in £10 shares (40,000 ord. and 40,000 pref.). Return dated August 13th, 1917. All shares taken up. £725,310 paid; £74,690 considered as paid. Mortgages and charges: £173,495.

Burt, Escaré & Denelle, Ltd.—Capital, £10,000 in 25,000 ord. and 15,000 pref. shares of £1 each. Return dated May 8th, 1917. 19,332 ord. and 10,400 pref. shares taken up. £29,732 paid. Mortgages and charges: £7,500.

Bray, Markham & Reiss, Ltd. (74,871).—Capital, £20,000 in £1 shares. Return dated July 23rd, 1917. 9,650 shares taken up. £8,800 paid; £800 considered as paid. Mortgages and charges: Nil.

Anchor Cable Co., Ltd. (69,073).—Capital, £250,000 in £10 shares. Return dated June 14th, 1917. 6,500 shares taken up. £61,000 paid; £4,000 considered as paid. Mortgages and charges: £50,000.

United Electric Tramways of Monte Video, Ltd. (80,456).—Capital, £1,000,000 in 100,000 pref. and 100,000 ord. shares of £5 each. Return dated July 9th, 1917. All shares taken up. £235,105 paid on 26,221 pref. and 32,800 ord.; £704,895 considered as paid on 73,779 pref. and 67,200 ord. Mortgages and charges: £971,547.

United River Plate Telephone Co., Ltd. (23,654).—Capital, £2,000,000 in £5 shares (324,000 ord., 40,000 pref., and 36,000 unissued). Return dated June 26th. 324,000 ord. and 40,000 pref. shares taken up. £1,740,000 paid on 308,000 ord. and 40,000 pref.; £80,000 considered as paid on 16,000 ord. Mortgages and charges: £300,000.

Western Electric Co., Ltd.—Capital, £500,000 in £5 shares. Return dated May 29th, 1917. 68,805 shares taken up. £25 paid; £325,000 considered as paid. Mortgages and charges: Nil.

Walter's Electrical Manufacturing Co., Ltd. (94,300).—Capital, £13,000 in £1 shares. Return dated July 18th, 1917. 11,250 shares taken up. £1,250 paid; £10,000 considered as paid. Mortgages and charges: Nil.

Westinghouse Metal Filament Lamp Co., Ltd. (89,948).—Capital, £10,000 in £1 shares. Return dated May 10th (filed July 4th), 1917. All shares taken up. £7 paid; £9,993 considered as paid. Mortgages and charges: Nil.

CITY NOTES.

Tyneside Tramways and Tramroads Co.

At the half-yearly meeting, held at Newcastle-on-Tyne on August 28th, Mr. G. E. HENDERSON presided in the absence of Dr. J. T. Merz, the chairman, through ill-health. He said that the traffic receipts had increased by £5,538, compared with the corresponding period of last year, and, as might be expected, the costs also had increased. The amount available for allocation, after paying interest on mortgages, &c., showed an increase of £3,400. The directors proposed to pay a dividend at the rate of 4 per cent., compared with 1½ per cent. for the corresponding half of 1916. They were also increasing the amount placed to reserve and special reserve by £1,061, and the carry forward they had increased by £774. The directors considered the present times abnormal, and any increased receipts which might be due to increased railway fares and reduced railway facilities should be also regarded as abnormal, and not as part of the ordinary progress of the company. They, therefore, thought it better to place a larger sum to the reserve fund. That latter account, with the additions made in the report, would now stand at £27,412, and their investments and loans at £26,134. The traffic receipts were continuing to increase, and for the seven weeks ending August 15th there was an increase of £1,532.

German Companies.

The Elektra A.G., of Dresden, reports for 1916-17 a loss of £6,000, as compared with a deficiency of £5,000 in the previous year. As in 1915-16, the loss for last year is to be met out of the special reserve fund.

The directors of the *Wolfram Lampen A.G., of Augsburg,* report net profits of £7,400 in 1916-17, as compared with £7,100 in the preceding year, and including the balance forward a total of £14,100 and £14,000 in the two years respectively. It is not proposed, however, to make any distribution, but to enter into voluntary liquidation on account of the destruction of the works by fire last May, the impossibility of erecting and equipping a new building, and the withdrawal of customers as a consequence of the recent judgment of the Imperial Court on the matter of the patents relating to wire-filament lamps.

The report of *Brown, Boreri & Co., of Mannheim,* characterises the year 1916-17 as a period of continued great activity and a maximum utilisation of the plant and machinery. The cost of labour and raw materials, however, increased so largely that it was impossible to take them fully into consideration on the acceptance of contracts. After setting aside £44,000 for depreciation, as against £46,000 in 1915-16, the accounts show net profits of £73,000, as contrasted with

£58,000. It is proposed to pay a dividend of 12 per cent., this rate comparing with 10 per cent., 5 per cent., and 5 per cent. in the three preceding years respectively.

The Continentale Ges. für Elektrische Unternehmungen, of Nuremberg, which is a financial organisation of the Schuckert group, reports that the many years of the company's activity in the construction and working of electricity supply works and tramways in Italy was brought to a standstill in the year ended with March 31st, 1917. It was possible to realise these investments on suitable terms, and the money thereby realised was applied partly to the repayment of credits granted by the Schuckert Co. and partly to the purchase of German loans. The entrance of Rumania into the war had cut off connections with the Jassy electricity works, and no information was available as to the situation of that undertaking. The traffic on the secondary railways and tramways in which the company is interested was more active than in the preceding year, but the working expenses experienced a large increase, and the financial results were again unfavourable. Including the balance brought forward, the net profits in 1916-17 are returned at £44,000, as in the previous year, and the dividend is at the rate of 2½ per cent. on capital of £1,556,000, being the same as in 1915-16.

The Deutsch Sudamerikanische Telegraphen Gesellschaft, of Cologne, states that since the issue of the report for 1915 no alterations in the condition of the company's cables, so far as could be seen from the results of tests available to the company, had taken place, and working was at a standstill. It could not be foreseen what the consequences would be of the rupture of diplomatic relations between Brazil and Liberia in regard to the stations at Pernambuco and Monrovia and the other property there. The receipts in 1916 amounted to £205,000, as compared with £182,000 in the preceding year, and the net profits are returned at £54,000, as against £41,000. A dividend has been declared at the rate of 5 per cent. as compared with 6 per cent. in 1915, on ordinary share capital of £625,000. The report also mentions that the accounts for 1916 of the *Compania Telegrafico-Telefonica del Plata* had not reached the company, but as the financial position of this Argentine company led to the assumption that it would not be able to pay any dividend for last year, the Cologne company had set aside £19,000 as reserve for its investment in that company.

Russian Companies.

The Petrograd Electric Lighting Co. of 1886 records net profits of £809,000 for 1916, as contrasted with £680,000 in the previous year. Apart from the dividend of 10 per cent. on the preference capital, the ordinary shares are to receive 7 per cent., but the distribution of the profits, as a year ago, is deferred to a future occasion.

The Russian A.E.G. is reported to have earned gross profits amounting to £625,000 in 1916, and net profits of £280,000, as compared with £223,000 in the previous year. It is proposed to pay a dividend of 10 per cent. on ordinary share capital of £1,200,000, as in 1915, the new shares for £1,200,000 not participating in the distribution for 1916. The undertaking is being continued as a Russian concern by a new company under the title of the *General Electricity Co.*, with a capital of £2,400,000.

The Russian Siemens & Halske Co. reports gross profits of £336,000 for 1916, of which £125,000 has been devoted to depreciation, £16,000 placed to the reserve fund, and £91,000 applied to the payment of taxes on war profits. The balance permits of the payment of a dividend of 12½ per cent. on the old shares and 7½ per cent. on the new shares, the total share capital being £700,000. The company's undertaking and that of the *Russian Siemens-Schuckert Works* are now being taken over by a Russian company with a share capital of £2,500,000.

City of London Electric Lighting Co., Ltd.—Dividends announced on account of the distribution for the year ending December 31st, 1917:—On the preference shares 6s. per share, on the ordinary shares 6s. per share, both subject to the deduction of income-tax.

Brazilian Traction, Light & Power Co., Ltd.—Quarterly dividend of 1½ per cent. on the fully-paid cumulative preference shares.

Clyde Valley Electrical Power, Ltd.—Interim dividend, 1½ per cent. actual on the ordinary shares, free of tax.

Newcastle-upon-Tyne Electric Supply Co.—An interim dividend of 2½ per cent. on the ordinary shares, less tax, is announced.

London Electric Supply Corporation, Ltd.—The directors, for reasons entirely attributable to the war, have deemed it advisable not to distribute a dividend on the preference shares, but to carry forward the profit earned in the half-year ended June 30th last.—*Financial Times.*

Davis & Timmins, Ltd.—Interim dividend, 6 per cent. per annum, free of income-tax, on ordinary shares for the half-year.

Madras Electric Tramways, Ltd.—Interim dividend on ordinary shares for the half-year ended June 30th, 8 per cent. per annum.

Canadian General Electric Co., Ltd.—Quarterly dividend of 2 per cent. for the three months to September 30th on the common stock, and a half-yearly dividend of 3½ per cent. for six months (at the rate of 7 per cent. per annum) on the preference stock.

Reduction of Capital.—*Pollock & Macnab.*—A petition for confirming a resolution reducing the capital from £60,000 to £50,000 has been presented to the Court.

Marconi International Marine Communication Co., Ltd.—The directors have been offering to the shareholders 250,000 new shares of £1 each at the price of £1 15s. per share.

STOCKS AND SHARES.

TUESDAY EVENING.

THERE is little diminution of the strength of markets as a whole, and the news from Riga failed to depress materially any Stock Exchange prices, with the exception of those immediately concerned. A considerable amount of buying has taken place amongst the industrial groups; and, as an instance of the way in which prices respond to any little attention which may be drawn to them, the case of Edison Swan shares is appropriate. The consideration advanced that, having regard to the splitting of the shares which will take place before the end of the year, last week's quotation of 19s. was tempting to the buyer, evidently attracted a good deal of notice, because the price ran up to 23s. in a couple of days, reacting as the profit-takers came in to 21s. 6d. Other members of the manufacturing group are also being inquired for, and the £5 shares in the Edison Company have themselves risen from 30s. a fortnight ago to 35s. now. As a speculation, they are probably worth buying to-day, though the qualification requires emphasis.

Substantial recoveries have occurred amongst the stocks in the Underground Railway group. Revision of the fares came into force on the tube and bus systems last Saturday, and this is held to constitute a strong bull point in favour of Metropolitans, Districts, and, of course, the issues of the Underground Electric Railways Company itself. The Income Bonds of the last-named have risen to 84½, *ex* the £2 net dividend deducted on Monday. The £10 shares are better at 35s., and the shilling shares have come in for a little notice on a slightly improved basis. Metropolitans have risen 1½ to 24½, Districts the same amount to 16½. They have the market to themselves, these Undergrounds, because the rest of the Home Railway market is dull, heavy, and listless, thanks to the incessant demands made by this or the other section of railway men.

Further progress has been made in the upward direction by electric lighting shares. Interim dividends are now being declared, and two or three prices have advanced notably, though the rest are left unchanged. Buyers, however, find that their orders are extremely difficult to fill, and that their stockbrokers report shortage of shares in nearly all the group. It is being assumed that the electric lighting companies have now got down to a level of dividend which is likely to prove bedrock, so far as the war-time is concerned; while, afterwards, there is more than a fair prospect of the pre-war standard being attained.

There is a feeling—it can scarcely be described as a rumour—in the air that closer unity will yet be established between the various electric supply undertakers, and that any move in this direction is bound to have the effect of benefiting the companies through the saving of expenditure which would inevitably follow. This idea does not confine itself entirely to London companies. Those in the provinces are also expected to be affected. As we have just remarked, however, it is no more than an impression at present, although it adds to the strength of the market as a whole.

The cable market is good, with improvements in Eastern Telegraph ordinary stock and two or three of the others. A very fair volume of business is being transacted here, but, as before, shares are in short supply. Something of a feature is the firmness of International Marconi Marine shares, which have risen sharply on the company's announcement of a new issue of shares at a price which will give existing holders a profit of about 17s. 6d. per new share.

Proprietors are invited to apply at 35s. for as many shares as they like; and as it is uncertain what proportion they will be allotted, the Stock Exchange has been unable to fix any definite price as the value of the rights, although Marines are quoted this week *ex* rights. After touching 2½, the price reacted to 2½. The shares in the parent company are practically unchanged at 3½, most of the interest centring upon Marines for the time being. Canadians and Americans remain at 2s. 6d. and 16s. 3d. respectively.

Mexicans move in somewhat bewildering fashion. After a bout of most unusual strength, the markets concerned in Mexico have halted; and in several cases holders of the stocks and bonds have taken advantage of the big rise in prices in order to realise their securities. Mexico Trams got up to 10, but reacted to 3½, and Mexican Light and Power Common from 30 came back to 24. Yet the Preferred shares in the latter company have moved up another 3 points, and the bonds are steady. Brazilian Tractions further eased off to 47, another drop of a point, though the Preferred improved to 93.

The Anglo-Argentine Tramway group is very firm. Proposals are now before the Argentine Government with a view to enabling the railway companies to raise their fares; and it is more than half expected that, if these are allowed, the Tramway Company will also follow suit. Rio Tramway and San Paulo Tramway Bonds are both better.

Amongst miscellaneous shares, British Aluminium Ordinary and Edison Swan's have divided most of the attention. The former jumped to 33s. 3d., while Edisons, as mentioned before, rose from 19s. to 23s. before reacting to 21s. 6d. The £5 fully-paid shares at 35s. are 5s. higher, following upon their rise of 2s. 6d. last week. No change has occurred in the Debenture stocks. British Insulated at 14 have another 10s. to their credit. India-Rubbers and Telegraph Constructions are both strong. Babcock & Wilcox have been wanted in the North of England up to 63s. 6d., and the price in London reflects this demand.

There is no particular change in Callenders. Henleys have recovered the dividend of 5s. It is thought that British Westinghouse Preference at 2½ possess more than a sporting chance of improvement. They are 1½ per cent. shares, and received dividends in the last two years of 7½ per cent. per annum, so that the yield at the present price is about 5½ per cent. on the money. It may be only the optimism permeating the industrial market as a whole which points the anticipation of a rise in Westinghouse Preference, but the shares will be interesting to watch, at all events, for the next few weeks.

The Rubber Market is good, thanks to a rise in the raw stuff to 2s. 9½d. per lb. An explosive rise in most of the powder companies' shares is another of the features in the Industrial Market; and just lately some of the Mining sections have begun to wake up, the improvements including a good many of the shares in the companies of the base metal group.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.					
	Dividend		Price	Rise or fall this week.	Yield p.c.
	1916.	1916.	Sept. 4, 1917.		
Brompton Ordinary	10	9	6½	—	£7 4 0
Charing Cross Ordinary ..	5	5	8½	—	6 9 0
do. do. do. 4½ Pref..	4½	4½	8½	—	6 13 4
Chelsea	4	3	2½	—	5 4 4
City of London	8	8	13½	+ ½	6 0 9
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
County of London	7	7	11½	—	6 8 1
do. do. 6 per cent. Pref.	6	6	10½	—	6 17 1
Kensington Ordinary	7	6	5½	—	6 14 8
London Electric	8	8	1	—	Nil
do. do. 6 per cent. Pref.	6	4	8½	—	5 6 8
Metropolitan	8	8	8	—	5 0 0
do. do. 4½ per cent. Pref.	4½	4½	8½	—	7 4 4
St. James' and Pall Mall ..	8	8	7	—	5 14 6
South London	5	5	2½	—	7 5 6
South Metropolitan Pref.	7	7	21½	—	6 10 3
Westminster Ordinary	7	7	6½	+ ½	5 7 8
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	8	6	98	—	6 2 5
do. Def.	8½	1½	22½	—	6 16 4
Chile Telephone	8	8	7½	—	6 11 4
Cuba Sub. Ord.	6	5	8½	+ ½	6 14 3
Eastern Extension	8	8	14½	—	5 9 4
Eastern Tel. Ord.	8	8	147½	+ 1½	5 8 4
Globe Tel. and T. Ord. ..	7	7	12½	—	5 9 10
do. Pref.	6	6	10½	—	5 15 8
Great Northern Tel.	22	24	86	—	6 13 4
Indo-European	18	18	54½	—	5 19 3
Marconi	10	15	3½	—	4 15 10
Oriental Telephone Ord. ..	10	10	8½	+ ½	3 1 6
United R. Plate Tel.	8	8	8½	—	5 15 4
West India and Pan.	6d.	6d.	1½	—	1 12 0
Western Telegraph	8	8	14½	—	5 10 4
HOME RAIL.					
Central London, Ord. Assented	4	4	61½	+1	6 10 1
Metropolitan	1	1	24½	+1½	4 2 6
do. District	Nil	Nil	10½	+ ½	Nil
Underground Electric Ordinary	Nil	Nil	12	+1	Nil
do. do. "A"	Nil	Nil	5½	—	Nil
do. do. Income	6	4	84½	+3½	4 14 6
FOREIGN TRAMS, &c.					
	Dividend				
	1915.	1916.			
Adelaide Sup. 6 per cent. Pref.	6	6	47½	—	6 8 1
Anglo-Arg. Trams, First Pref.	5½	6½	8	+ ½	9 3 4
do. do. 2nd Pref. ..	5½	—	2½	—	—
do. do. 5 Deb. ..	5	5	67	—	7 9 8
Brazil Tractions	4	4	47	—1	—
Bombay Electric Pref.	6	6	98	—	8 4 8
British Columbia Elec. Rly. Pico.	5	6	45½	—2	10 19 10
do. do. Preferred Nil	Nil	Nil	81	—	Nil
do. do. Deferred Nil	Nil	Nil	29	—	Nil
do. do. Deb. ..	4½	4½	55	—	7 14 7
Mexico Trams 5 per cent. Bonds	Nil	Nil	50½	+1	Nil
do. do. 6 per cent. Bonds	Nil	Nil	37½	+4	Nil
Mexican Light Common	Nil	Nil	25	—6	Nil
do. Pref.	Nil	Nil	35½	+3	Nil
do. 1st Bonds	Nil	Nil	50	—	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	8½	—	4 15 10
British Aluminium Ord. ..	7	10	14½	—	6 1 8
British Insulated Ord.	17½	20	14	+ ½	7 2 10
British Westinghouse Pref.	7½	7½	2½	—	5 4 1
Callenders	20	20	14½	—	7 0 6
do. 5 Pref.	5	5	4½	—	6 1 8
Castner-Kellner	22	22	8½	—	6 6 0
Edison Swan, fully paid ..	—	—	1½	+ ½	Nil
do. do. 4 percent. Deb.	4	4	71	—	6 12 0
Electric Construction	7½	7½	1½	—	8 0 0
Gen. Elec. Pref.	6	6	10½	—	5 17 1
do. Ord.	10	10	16	—	8 5 0
Henley	25	25	16½	+ ½	7 16 3
do. 4½ Pref.	4½	4½	4	—	5 12 8
India-Rubber	10	10	18½	—	5 7 6 10
Telegraph Con.	20	20	8½	—	5 6 2

* Dividends paid free of income-tax.

V.B. CABLE BREAKDOWNS IN THE TROPICS.

By C. J. BEAVER, M.I.E.E.

THE article on this subject in the ELECTRICAL REVIEW of August 24th, 1917, by Mr. D. M. W. Hutchison, Chief Electrical Inspector of Mines in the F.M.S., does not constitute so serious an indictment on V.B. cables under tropical conditions as might at first sight appear. From the opening paragraph it might be inferred that the cause of failure under tropical conditions had not been investigated by the cable makers, and that the latter are content to account for it by assuming that the conductors have been overloaded, and that the resultant overheating has allowed decentralisation to occur.

This entirely ignores a recent detailed account of an investigation of the subject in the Tropics given in an I.E.E. paper on "Cables" by the present writer (see ELECTRICAL REVIEW, December 4th and 11th, 1914, pages 770 and 802, and *Journal I.E.E.*, Vol. LIII, 1914, page 74 *et seq.*). It will be presumed in the following notes that readers sufficiently interested will be more or less cognisant of these references, in which it was conclusively shown that such trouble as has occurred in V.B. insulated cables in the Tropics has not been due—as might appear from Mr. Hutchison's references to overload, sun temperature, &c.—solely to tropical temperature conditions. Heat was found by the present writer to be only one of the factors in the case, and one which would not alone produce the trouble. In the investigation above referred to, the factors determined by very comprehensive survey and diagnosis of the results of minute examination of cables and their surroundings, confirmed by further investigation on the spot (comprising both positive and negative evidence), and subsequently corroborated by experimental reproduction of the effects, were heat, moisture, leakage current and time.

The first stage leading to failure is usually a physical change whereby the V.B. is softened. It was previously known to the writer that such softening might be of a character distinct from that which occurs quite locally in the vicinity of a fault on a negative V.B. cable, commonly known to be due to a saponification effect on the V.B. following on the local production of alkaline substances by the electrolytic action of the fault current. Its occurrence was also known to be distinct, not being confined to negative cables, but arising on positive, negative, and neutral cables indiscriminately. It also occurred on cables carrying alternating current.

Softening due to heat and moisture under exaggerated temperature conditions was known by the manufacturer to occur in the process of vulcanisation of the bitumen, but being accountable for by local retardation of vulcanisation due to the presence of moisture, its real significance was not appreciated until these factors were determined by the investigation referred to. This type of softening (in the absence of alkaline material) was shown to be considerably facilitated by the action of current from a source external to the part acted upon, moisture being an essential factor in forming paths for such current.

When the V.B. becomes sufficiently softened to become displaced and to allow leakage from the affected part, the effect of current tends to predominate, and softening proceeds rapidly, although the defect may not, and usually does not, for reasons which will be considered later, constitute a fault which will definitely declare itself.

Another feature, to which due significance had not previously been attached, was that the softening and consequent breakdown effects were local and not general.

The writer had, prior to his investigation in the Tropics, frequently asked for information on this point, and invariably received the answer that it was general.

The misleading character of this reply is doubtless due to the fact that little is seen of the cables in the ordinary course by those in charge of them, except at parts where trouble occurs; and in such cases the urgency of affairs connected with supply is such that other questions are considerably subordinated thereto. Even if a sample and a fairly lucid description is sent home, it is not only difficult

to correctly diagnose the original cause of breakdown, owing to the impossibility of distinguishing symptoms of effect from those relating to cause, but the question of the condition of surroundings and adjacent parts has practically no light shed upon it. Not only the microscope, but the field glass is necessary when fundamental questions are involved.

Mr. Hutchison says, when describing the character of certain faults in a V.B. distribution network, "the bitumen sheathing for several feet on each side of the fault was soft and sticky," but he does not mention the important point as to whether this state continued or ceased. It is clear that if it did cease, as in the writer's experience it frequently would, Mr. Hutchison's opinion that "V.B. cables are quite unsuitable for tropical countries" only applies to part of the cable. This variation leads to the obvious suggestion that extraneous and not inherent causes are responsible for the effects.

The writer has frequently seen normal and considerably deteriorated cables side by side in the same bitumen-filled trough, as well as transitions from one stage to another within a few inches in the same cable.

Some remarkable cases of the latter are described in the paper above referred to, where in the case of armoured service cables laid direct in the ground, a sharp line of demarcation existed between parts above and parts under the ground, the former being quite normal and the latter appreciably affected. Again, in feeder pillar cables, variations in the physical state of the V.B. coincided with local leakage circuits, due to damage of the insulation where the cables entered the pillars, and defective trims at terminal lugs. These coincidental variations were not accidental occurrences, the number of instances checked for confirmation, and the consistent character of the results of examination putting this beyond doubt.

As temperatures above ground were in these cases considerably in excess of the temperatures below ground, and as cables which had been stored for years showed no evidence of deterioration, it was quite clear that tropical conditions, *per se*, were not the cause of trouble.

To summarise the matter, the conclusions above referred to were drawn from such a mass of evidence as to render them practically incontrovertible.

Apart from the experimental reproduction of the effects which was subsequently successfully carried out, a number of opportunities have been taken of checking the conclusions in various cases which have since been submitted for the writer's examination.

Such additional evidence as has been gained has been almost invariably confirmatory in character. For instance, with regard to the factor of current, confirmation of its passage through apparently solid masses of trough filling bitumen has been afforded by examination of globules of water enclosed in such masses. They have been found in some cases strongly alkaline and in others distinctly acid, according to the polarity of the cable to which they were in close proximity, though not in contact. It may be added that in these cases the cause of the leakage was damage due to subsidence of ground.

In most cases the value of the leakage current concerned is probably of a minute order, and, from this point of view, non-metallic sheathed cables are certainly at a disadvantage, because, in the first place, insulation resistance tests give very indefinite results, which do not indicate the intrinsic soundness of the dielectric proper (this being usually in series with other insulating materials, such as trough-filling bitumen, &c.), and, secondly, for the same reason, faults do not readily breakdown on account of the high resistance of their path to earth. This maintenance difficulty is, in the writer's opinion, the key of the whole trouble so far as distribution networks of V.B. cables are concerned. The effects of the factor of current are cumulative—local leakage circuits producing softening and, in turn, other leakage circuits, which go on reacting with each other—so that a considerable amount of deterioration occurs before any electrical indication of it is available. It must be remembered, although it is frequently overlooked, that in such systems it is only the balance of fault current which returns *via* earth to the station, and therefore ideas as to the total amount of leakage in a network may be very

erroneous. It will therefore be seen that, so far as distribution networks are concerned, the whole matter turns on efficient installation and rigid and minutely-organised maintenance.

With regard to the three-core solid V.B. double-wire armoured cables supplying the pumps in a tin mine in the F.M.S. referred to by Mr. Hutchison, the writer has seen samples which probably came from this installation.

The general description of the installation bears a remarkable similarity, although the description of the mechanism of failure does not correspond to the description which Mr. Hutchison gives of "the cores coming together and short-circuiting." This, however, may have been assumption on his part.

In the shaft and adit samples examined by the writer neither of the faults were between phases. In the former, the cores had locally—at a bend where the cable turned from the vertical to the horizontal at the shaft bottom—approached the armour at the inner radials of the bend. The original thickness of dielectric between the cores was, however, fully maintained throughout the faulty part, and, moreover, they returned *en masse* to their central position within 2 ft. to 3 ft. of the fault. The atmospheric conditions were said to be steamy, or foggy with moisture, at a temperature of 110° F. These conditions presumably allowed, or produced, sufficient weakening of the exterior part of the V.B. to allow the internal mechanical stress due to the bend to overcome its resistance, but it is significant that the inner part between cores, which was presumably hotter because of the current carried by the conductors, did not yield. There was some softening of the outer part of the V.B.—probably commenced by the two factors of heat and moisture, and subsequently accentuated by leakage current—but the inner parts were quite normal. Generally, therefore, there was nothing mysterious about the failure, nor anything at variance with previous knowledge.

In the case of the adit cable, the fault appeared to be primarily due to a mechanical trouble. So far from the cores coming together, they had uniformly splayed out until they locally approached the armour. This being quite opposed to the normal tendency, it seemed clear that a mechanical stress had been set up during installation which tended to untwist the cores, and the writer's conclusion was that a certain amount of bending or kinking had occurred when the cable was being carried into the adit by the Chinese coolies, and that the mechanical stress referred to was the result of efforts to straighten the cable.

It may be added that instances similar to this are not unknown at home when cables are carried in-bye in coal mines on the shoulders of labourers.

With regard to a remedy for the non-mechanical causes of breakdown, the investigation described in the paper above referred to, the subsequent reproduction of the effects, and the study of the chemical and physical aspects of the subject led to the conclusion that the primary stage—the softening process—might be averted by the physico-chemical expedient of incorporating with the V.B. some colloidal substance, incapable of decomposition by hydrolytic action, and exerting a maximum protective effect when present in small proportion.

Experiments in this direction ultimately showed that high-grade vulcanised rubber could be so treated that it would fulfil these requirements,* and that a very small proportion of the admixture afforded a surprising degree of protection. In fact, the combination had properties not possessed by its components.

It has been shown above that what appears to the casual observer to be a combination of mechanical weakness (permitting decentralisation) and chemical change (softening) is primary and not ultimate in character, and having provided against this primary or fundamental source of the trouble, the mechanical aspect of the matter may fairly safely be left to take care of itself under normal conditions of laying or fixing.

It may be, as Mr. Hutchison suggests, that paper lead-covered cables would give good results in the hands of trained Oriental jointers, but consulting engineers at home do not yet appear to be convinced that the instruction im-

parted by European jointers, in the East has sufficiently leavened the lump.

The relative carrying capacities of paper lead-covered and V.B. insulated cables are not so widely different as is often supposed; in fact, under some conditions of installation there is no difference in this respect. The non-hygroscopic character of V.B. which prevents a local damage causing the ruin of a long length of cable, will always constitute a strong argument in its favour as compared with hygroscopic insulating material—such as paper and varnished cambric. The fact that these latter materials are dependent for the preservation of their insulating properties on the provision of a lead covering and on its maintenance intact, is a particular disadvantage in mining installations, where the fixing conditions are invariably awkward and the risks of damage considerable.

It is on account of these considerations that the solid type of wire-armoured V.B. cable has had such a vogue in mining work at home.

THE MANUFACTURE OF NITRATE OF AMMONIA BY ELECTRIC POWER AT COKE OVEN PLANTS.

By E. KILBURN SCOTT, A.M.I.C.E., M.I.E.E.

(Abstract of paper read before the COKE OVEN MANAGERS' ASSOCIATION.)

WHENEVER reference is made in papers or articles to by-products of coal, the utilisation of the ammonia is always assumed to be as sulphate of ammonia.

In order to make this, compound sulphuric acid has to be purchased at prices which are fixed by the acid associations, and, further, it has often to be carried to considerable distances, which adds to the expense. In peace time there is usually plenty of acid, but since the war it has been very scarce.

This paper proposes to show that manufacturers of coke can easily turn their ammonia by-product into nitrate by means of acid of their own manufacture; also that by making their own acid they become entirely independent of the acid associations, which have for so long controlled the supplies in this country.

The nitric acid required for nitrate of ammonia may be very dilute—of, say, 25 per cent. to 33 per cent. strength—and it is easily and cheaply made from the air by electric power.

When ammonia is obtained as a by-product of the distillation of coal, the cost may be, as in the case of most by-products, only a little above the interest charge on the recovery plant plus the cost of operating the same.

A battery of 50 regenerative ovens of, say, medium size Coppée type, will coke 360 tons of coal per day. Taking coal of average quality, containing 10,000 cu. ft. of gas per ton, and assuming 50 per cent. as being surplus gas, there would be 1,800,000 cu. ft. of surplus gas per day. Large gas engines working on such gas have been found to use about 21 cu. ft. per brake-horse-power per hour, so this quantity of surplus gas should develop about 3,500 h.p., which, with modern electric generators, is equivalent to about 2,500 kw.

Power may also be obtained from waste-heat ovens by using the steam in high-pressure steam turbines.

A battery of 50 waste-heat ovens of, say, medium size Coppée type, will furnish enough waste heat to raise about 350 tons of steam per day in high-pressure boilers. If the steam is superheated, and used in modern steam turbines, a consumption of about 11 lb. of steam per horse-power per hour is attainable, and the power should therefore be about 3,000 h.p., which, with modern electric generators, is equivalent to about 2,000 kw.

I understand that beehive ovens are kept in use, partly because the coke is supposed to be more suitable for making crucible steel than any other kind. This appears to be a fallacy, but in any case electric steel furnaces which do not require any coke are rapidly coming into use.

I propose to give figures for a power plant capable of generating 1,000 kw. continuously, and an electrochemical factory to utilise that amount of energy. Readers must remember, however, that the larger the plant the lower the first cost per kw. installed.

The following is the approximate cost of power-house plant for utilising coke-oven gas in direct coupled gas engines:—

Three 500-kw. vertical type gas engines direct coupled to three-phase alternators, complete with two motor-driven circulating water pumps for the engine jackets, compressed air starting equipment, also piping and valves. Gas mains from ovens to purifiers and thence to gas engines, also the purifiers to rid gas of sulphur before passing it to the gas

* Patent No. 9,554/1914.

engines, £28,000. Under normal conditions this should be sufficient to cover buildings, foundations, and all incidental expenditure.

The following is the approximate cost of power-house plant for utilising waste heat to raise steam for turbines:—

Three 500-kw. steam turbo-alternators of Westinghouse or other good type, each complete with condenser, motor-driven extraction pump, valves and fittings, £20,000; also steam-raising equipment for above, consisting of boilers and super-heaters, economiser, steel chimney, feed pump, steam and water piping, and gas mains from ovens to boilers, £9,000; total, £29,000.

It will be seen that for the size of power-house, the price is about the same for each kind of plant. For larger sizes the cost of a steam plant is lower than a gas-engine plant, also the limiting size of a gas-engine unit is about 1,000 kw. Steam turbine units can be built for practically any output, and the larger they are the better they work, and the lower the steam consumption.

Gas engines give high thermal efficiency, but unless precautions are taken they do not work well with coke-oven gas, because of the snappy action due to high percentage hydrogen.

Leaving a fair margin of profit, electrical energy ought to be supplied from such a power-house at ½d. per unit. At this figure, 1,000 kw. for 8,000 hours a year would bring a return of £4,166.

From this must be deducted the standing charges, labour, and stores, and also any figure that the coke-oven proprietor feels justified in charging for the gas or waste heat. As he is selling to himself, it is merely a matter of book-keeping, and profit can be shown in steps or on the finished product only.

The plant required to fix atmospheric nitrogen as nitric acid partly consists of electrical apparatus and partly of chemical, the latter being by far the largest and most expensive part, and taking up most space.

The plant consists of:—Electric furnaces and boilers; switchgear and instruments; fans for air supply and circulation of gases; apparatus for cooling and oxidation of the gases; &c. Also the acid and alkali absorption towers or chambers, complete with acid elevators or *montejus* and distributors, &c.; reservoirs and mixing tanks; crystallising and drying plant, &c.

The furnace is that which I have specially developed for the purpose. It differs from those in use abroad in that it is a self-contained three-phase unit, and as such it has various advantages.

The recognised method of measuring the yield of the furnace is to find the output of dilute nitric acid which it gives in a given time for a given amount of electric energy. The acid is resolved into the equivalent amount of pure nitric acid of 100 per cent. strength.

Usual yields for single-phase furnaces are about 50 grammes per kw.-hour with 60 as a maximum. Careful tests carried out over a considerable period with my three-phase furnace have shown considerably higher yields.

To make nitrogen peroxide gas into acid, it has to be brought into contact with water, and a convenient way of doing this is to have several absorption towers filled with acid-proof tiles arranged so that the liquor and the gases pass in contraflow direction. The acid is drawn off at 25 to 33 per cent. strength, which is strong enough for making ammonium and calcium nitrates.

At the end of the acid-absorption towers there is a further tower also filled with tiles, down which caustic soda trickles. This has a stronger affinity for the gas than has water, and the small amount which passes over from the acid towers is thus quickly absorbed, and forms a mixture of sodium nitrate-nitrite, which is used in the aniline dye manufacture.

Another form of absorption tower than can be employed gives acid up to 50 per cent. strength.

The manufacture of nitrate of ammonia is carried out by running the dilute nitric acid from the absorption plant into a closed iron tank containing ammonia solution, in which the ammonia is at about 25 per cent. strength. Acid is slowly added to a large volume of liquor, and an agitator mixes them together, the heat of combination being carried off by cooling coils as well as by circulation of air.

The addition of acid continues until nearly all the ammonia is taken up, leaving a slightly alkaline reaction.

The ammonium nitrate solution is then run through a filter into vacuum pans, where evaporation is effected by steam coils at a pressure of 20 mm. of mercury.

When nearly all the water has been evaporated the solution passes into long troughs slightly inclined, and subjected to a rocking motion. The nitrate forms into small crystals with no enclosure of liquor, and after the crystals have been dried in a hydro-extractor they are placed in bags or barrels ready for market. The nitrate is absolutely pure.

We will assume that the electrochemical plant is of such size as to utilise 1,000 kw., the round figure above mentioned, while the power house will supply continuously.

For the electrochemical plant £8 per kw. is a fair price, so the total is £8,000.

The price of electrical energy is assumed at ½d. per unit, which is fair, because electrochemical factories in this country have been supplied with electrical energy at under that figure for many years.

The number of working hours in a year—namely, 8,000—

is convenient because it leaves a balance of 700 hours for overhaul time, &c., and thus less spare plant is required. It also allows for intermittent running off the peak in winter, if found necessary.

Depreciation on the electro-chemical plant may be taken at 10 per cent., this being sufficient to pay for a new plant in about seven years. A large proportion of the capital cost is required for absorption plant, which is of robust construction, like a chimney, the depreciation for which is usually taken at 2½ per cent.

The yield of acid is reckoned at 1½ tons of 33 per cent. nitric acid per kw.-year—that is to say, 1,500 tons from a plant utilising 1,000 kw. This is based on a yield of 66 grammes of concentrated acid, or 200 grammes of 33 per cent. acid per kw.-hour. As a matter of fact, greater yields are obtainable, but the above figure is sufficient for the purpose.

Assuming the electrochemical plant to cost £8,000, and to utilise 1,000 kw. for 8,000 hours per annum at ½d. per unit, the expenses are:—

Electrical energy	... ..	£4,166
Depreciation, 10 per cent. on £8,000	... ..	800
Salaries, wages, stores, royalty, &c.	... ..	1,790
		£6,756

This, for an output of 1,500 tons, gives £4½ per ton of 33 per cent. nitric acid, or the equivalent rate for pure acid is £13 10s.

For a plant to utilise 10 times the amount of energy, or 10,000 kw., the cost should be well under £4, even taking the above figures for the yield.

The amount of ammonium nitrate that can be made by such a plant is 135 tons of pure ammonia plus 1,500 tons of 33 per cent. nitric acid, giving 635 tons of pure ammonium nitrate.

As to the value of ammonia from the coke-oven gas, I intend to take the figure of £30 a ton, or 3½d. a lb. The cost per ton may now be set out as follows:—

1,500 tons of 33 per cent. nitric acid at £4½	... ..	£6,750
125 tons of pure ammonia at £30	... ..	3,750
		£10,500

As this produces 635 tons of ammonium nitrate, the cost is £16½ per ton.

In addition to ammonium nitrate, there is also the sodium nitrate-nitrite. This may be assumed at one-tenth of a ton per kw.-year, and it is readily saleable. It should be worth £1,500 a year.

There is a margin between the above calculated cost and the normal selling price of 100 per cent. I leave it to readers to whittle this down as they think fit to allow for inefficiency of reaction and other contingencies. When that is done there will still be a large margin.

Before the war, nitrate of ammonia made by the electrical process in Norway was sold in large quantities at £28 to £30 a ton. Properly speaking, there is no quotation now, because all the make is taken by the Government for explosives. Its minimum price may, however, be fairly taken at double the above figure.

What will happen after the war we cannot tell, but one thing is certain—namely, that the price per unit of contained nitrogen will be higher for nitrate of ammonia than any other nitrogen compound. This has always been so, because the combined nitrogen is 35 per cent.

Usual percentages of combined nitrogen are given in the following table:—

Name.	How obtained.	Usual percent. of nitrogen
Sodium nitrate	From Chile	15½
Sulphate of ammonia	By-product of coal	18
Calcium nitrate	Made by electric power	18
Calcium cyanamide		13
Nitrate of ammonia		35

As a means of transporting combined nitrogen from one part of the world to another, nitrate of ammonia is better than any other medium, so it is likely always to hold the field in the export market.

Nitrate of ammonia is the principal ingredient of most safety mining explosives, the word "safety" being a relative term expressing the fact that they are safer than dynamite, &c.

The British and certain other Governments have passed regulations insisting on only safety or permitted explosives being used in mines. The more this idea extends the more nitrate of ammonia will be required.

The present demand for nitrate of ammonia for making up burster charges for shells is tremendous, and it is no exaggeration to say that we are now using more in a week than before the war we used in two years.

Under the trade name of "ammonal" (a mining explosive used before the war), nitrate of ammonia mixed with powdered aluminium and certain other ingredients is used as the burster charge for hand and rifle grenades.

Explosives are likely to be used to a much greater extent after the war than was the case before, because soldiers who have been accustomed to handling them will have no hesitation in using explosives for agriculture when they go back to the land.

For breaking up soil and making holes for fruit trees explosives are already much used, because the soil is thoroughly loosened, and this enables the roots to grow easily, and moisture to get to them. For breaking up the underlying "hard-pan" of soils of hot countries, explosives are also very useful.

As the safest form of explosives nitrate of ammonia should be much used for this work; indeed, it is likely that Government regulations similar to those for mines may be drafted for agriculture.

I believe that after the war nitrate of ammonia will come into use as a fertiliser. The expert gardeners of France and Belgium have used it for intensive cultivation for some years. Nitrate of ammonia is an all-round fertiliser. Also, it has the advantage that when it gives up its nitrogen to plants only the constituents of water are left behind.

The principal objection to nitrate of ammonia is that it is deliquescent, but this is likely to be overcome, and careful experiments to this end are now being conducted.

Before the war practically all the nitrate of ammonia used in this country for making safety explosives for mining, &c., was imported from Norway, which, considering the necessity for nitrate of ammonia, is another instance of the absurdity of allowing foreigners to control businesses important to the nation.

Before the war Germany was the largest purchaser of Chile nitrate, taking twice as much as the next consumer, the United States, and over six times as much as this country. Now Germany does not require any Chilean product, because immense plants to make nitrates from the air have been established.

It will easily be seen that by making nitrates from air the Germans are at a great economic advantage, for our complete dependence on Chile nitrate means we have to pay large sums for the nitrate and for transport, insurance, &c. Also, there is part of the immense national charge for protecting the sea routes by which we get it here. Large sums are also required for the pyrites, sulphur, and for the plants to manufacture sulphuric acid with which to treat the nitrate.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

SWITZERLAND.—A Federal Decree, dated June 30th, consolidates and extends the prohibitions of export formerly in force. The effect of the measure is to prohibit the exportation as from July 7th of goods of all kinds with the exception of those specified; export licences may, however, be granted by the Department of Public Economy in so far as national interests permit. Among the goods excepted are china insulators, dynamo-electric machines, and electrical transformers, induction coils, high-tension coils for dynamos, and electric arc lamps.

Another Decree contains provisions respecting the particulars which are required to be entered in import and export declarations, the collection of the statistical tax—*vide* the ELECTRICAL REVIEW of May 18th—and the exemption from this tax accorded to certain classes of traffic, &c., &c. The text of the Decree may be consulted at the Department of Commercial Intelligence, 73, Basinghall Street, E.C. 2.

TUNIS.—By a Beylical Decree, dated May 16th, lead and lead ores exported to foreign countries are subject to an export duty of 2 per cent. of the value f.o.b. port of shipment.

FRENCH WEST AFRICA.—For the purpose of assessing export duty, the valuation of rubber exported from April 1st to October 1st has been fixed at 500 francs per 100 kilograms, for shipments from Senegal, French Guinea, Ivory Coast, and Dahomey. Export duty is leviable at the rate of 7 per cent. on the valuation.

BRITISH INDIA.—An official announcement has been issued by the Department of Commerce and Industry that all qualities and sizes of ruby block mica, both of Government and trade descriptions, may be shipped freely to London without any restriction whatever. The British Government, however, reserve the right to requisition any consignments on arrival if required for military munitions.

EAST AFRICA AND UGANDA PROTECTORATES.—The Customs Departments of East Africa and Uganda have been amalgamated, and are now under the control of the Chief of Customs of East Africa. The East Africa Customs Regulations will apply generally to the amalgamated Department. Road and wharfage dues have been abolished by the Government of Uganda.

JAMAICA.—The increased import duties imposed last year on certain goods—see ELECTRICAL REVIEW of August 18th, 1916—have been re-imposed for the year ending March 31st, 1918.

UNITED STATES OF AMERICA.—The War Revenue Bill, as passed by the House of Representatives, provides for an additional Customs duty of 10 per cent. *ad val.* on goods which are dutiable under the United States Tariff Act, and

a duty of 10 per cent. *ad val.* on goods which are free of duty under that Act. The measure has yet to be passed by the Senate, who, it is understood, are proposing various amendments.

NETHERLANDS.—Under a recent Customs decision, sheets of mica, even if cut in special sizes, will be admitted free of duty.

GRENADA.—The importation by steamer of electrical apparatus, among other goods, is prohibited by Proclamation, as from May 25th.

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

- 11,909. "Electric signalling systems for mines." AUTOMATIC TELEPHONE MANUFACTURING CO. & H. GREEN. August 20th.
- 11,927. "Electric switches." J. M. NAUL. August 20th. (U.S.A., May 10th, 1916.)
- 11,983. "Electric transforming and converting apparatus." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). August 21st.
- 11,990. "Means for uniform distribution of current to direct-current units connected parallel." AKT. GES. BROWN, BOVERI ET CIE. August 21st. (Germany, August 21st, 1916.)
- 11,993. "Ignition dynamos." E. C. R. MARKS & SPLITDORF ELECTRICAL CO. August 21st.
- 11,996. "Electric ignition apparatus for internal-combustion engines." F. HIRD & H. W. F. IRELAND. August 21st.
- 12,016. "Telephone systems." AUTOMATIC ELECTRIC CO. & AUTOMATIC TELEPHONE MANUFACTURING CO. August 21st.
- 12,035. "Switchgear for starting and controlling electric motors." J. A. HIRST. August 22nd.
- 12,054. "Machine switching telephone systems." WESTERN ELECTRIC CO. August 22nd.
- 12,074. "Contact devices." IGRANIC ELECTRIC CO. (Cutler-Hammer Manufacturing Co., U.S.A.). August 22nd.
- 12,077. "Direct-current electric motors." F.I.A.T. FARRICA ITALIANA AUTOMOBILI TORINO SOC. ANON. & J. Y. JOHNSON. August 22nd.
- 12,104. "Electrical point detectors for railways." A. E. HUDD & G. H. WION. August 23rd.
- 12,105. "Supports for electric fans, &c." F. C. W. THOMPSON. August 23rd.
- 12,114. "Cooling appliances or sparking plugs and other details of internal-combustion engine cylinders." J. POMEROV. August 23rd.
- 12,125. "Ignition apparatus for internal-combustion engines." RENVY ELECTRIC CO. & A. E. WHITE. August 23rd.
- 12,127. "Incandescent electric lampholders." P. M. R. SALLES. August 23rd.
- 12,129. "Magneto-electric generator." F. L. HOLLISTER. August 23rd.
- 12,132. "Magnetic compasses." M. B. FIELD. August 23rd.
- 12,149. "Electric heating, &c., apparatus." H. BURGESS & A. H. TAYLOR. August 24th.
- 12,158. "Cord grip for electric lampholders." J. P. KAVANAGH & F. H. R. NEVILLE. August 24th. (New Zealand, November 11th, 1916.)
- 12,165. "Electrically-operated mechanism for driving clockwork trains, &c." F. HOLDEN. August 24th.
- 12,191. "System for protection of three-phase alternating-current systems." R. J. JENSEN. August 24th.
- 12,199. "Electric signalling systems for mines, &c." AUTOMATIC TELEPHONE MANUFACTURING CO. & C. REMINGTON. August 25th.

PUBLISHED SPECIFICATIONS.

1916.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

- 6,517. SYSTEMS OF TELEGRAPHY. C. E. HAY. May 5th, 1916. (108,330.)
- 10,950. ELECTRIC SWITCHES. G. O. DONOVAN & W. DONOVAN. August 3rd, 1916. (108,357.)
- 10,999. DETECTORS FOR WIRELESS TELEGRAPHY. W. CROSS (Svenska Aktiebolaget Gasaccumulator). August 3rd, 1916. (108,361.)
- 11,348. STARTERS FOR ELECTRIC MOTORS. Switchgear & Cowans and G. H. NEEP. August 11th, 1916. (108,366.)
- 11,972. MINE SIGNALLING KEYS. Sterling Telephone & Electric Co., F. G. ROLL & W. C. DAVEY. August 23rd, 1916. (108,373.)
- 12,020. METHOD OF PREPARING RADIO-ACTIVE MINERAL WATERS CONTAINING RADIUM-PRECIIPITATING ACIDS. August 24th, 1915. (101,295.)
- 12,091. WIRE-DRAWING MACHINES. R. D. CONNER. October 22nd, 1915. (101,963.)
- 12,441. ELECTRIC MEASURING INSTRUMENTS. British Thomson-Houston Co. (General Electric Co., U.S.A.). September 2nd, 1916. (108,379.)
- 12,758. "Shoes or sockets for electric cable terminals." W. T. HENLEY'S TELEGRAPH WORKS CO. & W. S. WAREFIELD. September 8th, 1916. (108,381.)
- 13,798. THERAPEUTIC ARC LAMPS. F. FORBES & F. W. COLLETT. September 28th, 1916. (108,392.)
- 13,954. SIGNALLING APPLIANCES FOR COLLIERIES AND THE LIKE. J. SAMSON. October 2nd, 1916. (108,397.)
- 14,930. METHOD AND APPARATUS FOR CONTROLLING ELECTRIC ARCS. D. F. COMSTOCK. October 20th, 1915. (101,885.)
- 15,007. ELECTRIC MOTOR CONTROLLERS AND LIKE APPARATUS. G. ELLISON & J. ANDERSON. October 21st, 1916. (108,403.)
- 15,053. ELECTRIC CANDLE FITTINGS. H. GARDE. October 23rd, 1916. (108,406.)
- 18,503. ELECTRIC SIGNALLING LAMPS. H. LUCAS & C. L. BREEDEN. December 27th, 1916. (108,424.)

1917.

- 1,347. AUTOMATIC TELEPHONE SYSTEMS. Automatic Telephone Manufacturing Co. February 14th, 1916. (104,171.)
- 1,754. ELECTRIC MOTOR CONTROL AND APPARATUS THEREFOR. British Thomson-Houston Co. & H. C. HASTINGS. February 3rd, 1917. (109,430.)
- 4,588. ELECTRODES FOR ELECTRIC ARCS AND FOR MEDICAL AND OTHER PURPOSES. J. C. ROUND. March 23th, 1917. (108,437.)

THE ELECTRICAL REVIEW.

Vol. LXXXI.

SEPTEMBER 14, 1917.

No. 2,077

ELECTRICAL REVIEW.

Vol. LXXXI.]

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THE RUSSIAN GOVERNMENT AND ELECTRICAL INDUSTRY.

It is of great interest to learn from a Russian Government organ that while our Ally is groping its way along the dangerous pathway that leads to Freedom, trying to bring organisation out of revolutionary chaos, there is proceeding in the background a development which in principle is of the utmost importance industrially.

It has been resolved that the Russian Government shall itself participate in a number of large electrical share companies. In April last there were approved the statutes of the General Electrical Co. with a capital of 24,000,000 roubles; and in the following month the statutes of the Russian Siemens Co. (capital 25,000,000 roubles) were also approved. The founder of both companies was the Treasury itself, in the person of the Ministry of Trade and Industry, which took 35 per cent. of the shares of each company. In the former of these is included the General Electrical Co.; which was closed by order in June, 1915, and in the latter the Siemens and Halske, and Siemens & Schuckert concerns, which were closed down under the same order.

The idea of the direct participation of the Government in the electrical industry took form in May last year in connection with the effort to save the Russian electrical industry from the dominating influence of German capital and of German electro-technical control. The investigations carried out by the Ministry of Trade and Industry disclosed the very close dependence of the most important Russian electrotechnical concerns on Germany. The German A.E.G. was the founder of the Russian General Electrical Co., and continued to be its technical controller till war broke out. About three-fourths of all the shares in the Russian company were in German hands. Similarly, in the Siemens and Halske and the Siemens-Schuckert concerns the technical control was held in the hands of German firms of similar name. It is true that in the first of these the block of real German shares hardly exceeded 10 per cent. of the total, but in the Siemens-Schuckert concerns about three-fourths of the shares were in German hands.

The manner in which German electrical authorities and organisers secured the virtual subjection of the electrical industry of other countries to their influence is well known, and it is not new to learn that in Russia, too, the most important electrical concerns proved to be members of these German electrical trusts, at the head of which stand the firms named. But it was the technical and financial completeness of the German electrical measures that brought the Russian governing power face to face with the necessity for inquiring what was the best method for suppressing the connections between the Russian and the German electrical industries. The usual sale of the concerns in Russian hands, or the purchase of the German shares for their further distribution on the private market, appeared to be impracticable, for it would have been impossible to guarantee against the purchase of such shares by the same German firms after the war. Their schemes for the domination of electrical affairs in other countries left no doubt at all that after the war they would imme-

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Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 8d.; Canada, £1 8s. 10d. (\$5.80). To all other countries, £1 10s.

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diately endeavour to resume their lost position in Russia.

Meantime, the electrical industry acquired quite exceptional importance, not only for national defence, but for all other industries, because of the rapidly growing electrification of such industries. It is recognised that they who hold in their hands the keys of the electrical and electrotechnical concerns have the ability to compel other branches of industry to listen to them, and the more the electrical industry is organised, and the more it is syndicated the greater becomes its power over the consumer. From this point of view, the dependence of the large Russian electrotechnical concerns on the German trusts appeared to the Russian authorities to be particularly dangerous, and to merit complete and final suppression.

It was under the influence of such considerations that the idea originated of securing the direct participation of the Government in the electrotechnical industry. The struggle with German influence was only the starting point in the development of this idea. The deciding factor, at least after the revolution, was an effort to subject the electrical industry to the real and essential, and not only to the apparent and formal, control of the Government. The Government as shareholder in the business, and as joint-owner of the concern, felt more capable of achieving its ends in the world of the electrical industry than would a Government in the person of its superintending agencies.

But the Ministry of Trade and Industry never sought to obtain a predominating position in these concerns, and to subject them entirely to its will. The Ministry preferred to retain for itself in both concerns only 35 per cent. of the shares; for the control of a third of the total capital, which involves due influence in the whole business, at the same time, does not deprive the concern of its private commercial character, or make it a Treasury concern. In the General Electrical Co. the Ministry found it convenient for a time to reserve, besides the 35 per cent., a further 15 per cent. to 20 per cent. of the shares which, for sundry reasons, were left unallotted, partly in view of the changeable situation and the desire of the Ministry not to set free blocks of shares without the guarantee of the standing of those who might acquire them. But this temporary retention in the *portefeuille* of the Treasury of a supplementary packet of shares by no means indicates a variation of its original decision to limit its participation to one-third of the capital, as on the first suitable occasion such shares will be handed over to private control.

On June 30th, 1917, the constituent meeting of the General Electrical Co. was held, and the first test of this particular form of private-cum-Treasury enterprise may be considered accomplished. The complete formation of the Siemens Co. has been somewhat delayed, but this delay can hardly extend beyond the autumn.

The situation is a very interesting one. Of course, there is little in common between Russian electrical affairs and such affairs nearer home. The question has been asked in regard to our own country, and in regard to the Colonies, what safeguards we shall adopt to prevent a return to German ownership now eliminated, after the war. Russia seeks to secure that end by a measure of financial control. Strong hands and strong measures are both necessary in order that success may be assured. It is to be hoped that the participation of the Government may attain the ends in view, and that those who become the representatives of the Treasury in these concerns will prove to be firm and reliable protectors, not only of purely Treasury interests, but also of the interests of Russian industry as a whole. At this moment of exceptional crisis through which Russian industry is passing, the latter consideration is incumbent on them no less than the former.

Traffic Congestion in Manchester.

THE report of the Traffic Congestion Special Committee of the Manchester City Council, of which an abstract appears in our columns this week, will be of considerable interest to the ruling authorities of many of our large cities, who will sooner or later have to face problems of their own, which, if not identical, will involve very similar principles.

The report is comprehensive in that it discusses the combined effects of all classes of vehicular traffic on street congestion, and further explores the possible steps to be taken in the future, with a view to securing a continuous and well-defined policy in regard to these matters.

The more immediate proposals relate to the construction of several tramway termini round a portion of the inner city area, thus short-circuiting the cars at selected points and eliminating the bulk of them from the streets of the inner area. We note, however, that the Watch Committee made a more drastic suggestion, namely, that the cars should be considerably reduced in number or *entirely excluded* from the central area between the hours of 10 a.m. and 5 p.m., and that, in the latter case, motor buses should be employed to deal with cross passenger traffic. There is nothing the passenger dislikes so much as changing from one vehicle to another unnecessarily, and we imagine these passengers would be very cross indeed. It should, moreover, be noted that the street congestion in the vicinity of the terminals will be seriously increased at certain hours due to foot passenger traffic.

One suggestion of the Watch Committee, which deserves commendation, is that improved and efficient methods of handling goods from vehicles standing in the street should be made compulsory. There is no comparison between the private individual or firm, which conducts its business in such a way as to interfere with the public use of the street, and the possible obstructions caused by a tramway, which is a public undertaking, operating for the benefit of the people as a whole.

The Tramway Committee's arguments against the employment of motor buses on already congested routes are, of course, unanswerable, but the suggestion that the financial benefits to the city in respect of rates on track and maintenance of roads would in such a case disappear, is somewhat beside the point. In any case, the buses would, no doubt, contribute on a mileage basis to the maintenance of the roads which they regularly used. The report, as a whole, leads one to the conclusion that the time is rapidly drawing near when any form of street passenger transportation will be inadequate to deal with the traffic on certain routes, and that the problem of underground transport will have to be faced at any early date.

Publicity and Trade Development.

WITH regard to the question of the organisation of our publicity services, concerning which Mr. D. Ross Kennedy writes on another page of this issue, we would suggest that British manufacturers and traders look into this department of their operations without delay. We make the suggestion with a full knowledge of what has happened in the past, when some of our manufacturers have failed to appreciate the importance of efficient publicity service in the technical Press, and with a varied experience of the high place which such activity holds in the esteem of Continental manufacturers. The British manufacturer who is doing important work which it would profit himself and the electrical world gener-

ally to know about, makes a lamentable mistake when he adopts the policy of hiding his light under a bushel. Suspicion of his competitors and the desire to suppress information concerning the contracts that he is securing, and the machinery, apparatus, and installation work that he is supplying, or has supplied, may do him a certain immediate service by depriving his rivals of information for a short time, but it may prevent the great purchasing world from putting business his way. Safeguards of a reasonable kind can always be employed without depriving the public of valuable information. But it is not only suspicion that has prevented this matter from receiving the attention that it deserves. There have been cases without number where firms have been too busy to attend to such things, or have not thought it worth while to furnish interesting material when the Press has asked for it. Our experience proves that one of the things required by the reader who counts from the purchasing power point of view, is such information as we have mentioned, and if its preparation is only done in a haphazard sort of way, or is nobody's business in particular, the Press is deprived of an opportunity for service that it desires to render. Of course, much depends upon the kind of information that is imparted and the manner in which it is served up. There are right and wrong methods in publicity—we have had experience of both. There is superficial publicity matter which tells nothing; there is a publicity zeal (sometimes childlike and bland, at others bold as a lion) that an editor finds it necessary to humour or to moderate; and there is that unnameable monstrosity which brazenly exposes itself as a conditional appendage of an advertisement. These are objectionable features which experience removes—in some cases. There is no question that after the war the electrical and engineering manufacturer will need as part of his trade-development department a reasonably and efficiently conducted publicity service, and it will be well if the matter be fully considered now.

Prospects in Majesty's Trade Commissioner in New Zealand. New Zealand, Mr. R. W. Dalton,

dwells upon the bright prospects in store for British trade after the war. Some points in this report worthy of special consideration on the part of engineering firms are summarised on another page. Mr. Dalton's remarks are, however, all well worth study by anyone interested in export trade, and it is safe to say that had the report been made by a German Consular representative, it would have been held up as a pattern of what our Trade Commissioners ought to endeavour to compile. Mr. Dalton puts forward the plea, which has been heard before from Dominion markets, that British manufacturers should take their customers more into their confidence on the subject of present difficulties of delivery. Were they to do so they would find New Zealand purchasers sympathetic, and ready to abstain from trade with foreign countries as much as they possibly could, and to revert to British sources of supply after the war. This attitude of patriotic support is not, however, unconditional. Our manufacturers, again, are exhorted to give more study to the market's requirements, to advertise more widely, to treat their agents with greater liberality, and to realise that, although intrinsic merit is a great factor in capturing business, a greater factor still is price. If they will do all this, splendid opportunities await them for participating in the development of trade and industry in New Zealand, which is sure to come sooner or later after the conclusion of Peace.

ENGINEERING PUBLICITY.

BY D. ROSS KENNEDY.

THE contemplated publicity campaign by electricity supply undertakings has raised numerous suggestions and theories on the publicity methods which could be employed with some prospects of success.

The proposals have been more or less repetitions of old-established methods of advertising, from which it would seem that publicity and advertising are synonymous, whereas advertising is but a comparatively small branch of publicity.

The interest shown, however, augurs well for the future of publicity and, let us hope, commercial affairs generally amongst engineers, whose habitual attitude in the past has been one of indifference, if not of antagonism, to anything related to the commercial side of their profession. With a deeper interest in these matters, the fact will be revealed to engineers that a properly-organised publicity department can render them valuable service, whether their work be in the design office or the factory.

Under war conditions the organisation of British engineering establishments has been greatly improved. The increased outputs obtained, although not altogether due to the reorganisation, are nevertheless proofs of the necessity which existed for it.

These improvements have been confined principally to production, as under the circumstances there was no inducement to interfere with the commercial organisation, but the improvements which were found to be so necessary in the methods of manufacture, may be taken as an indication of the urgent need for reorganising engineering commercial methods as well when normal business conditions are restored.

This applies more especially to the publicity and sales organisations. The neglect of organised and systematic methods for the sale of engineering products has been often commented upon, without much beneficial effect, but if the results of war organisation have been appreciated, the *status quo ante bellum* will not be resumed.

The awakening interest of engineers has brought into prominence the advantages associated with the employment of the "selling engineer" in place of the "commercial traveller." The adoption of this system would be a material aid to the commercial progress of the engineering industry.

The average commercial traveller invariably has to "refer to head office" for information on technical points, which could be satisfactorily dealt with on the spot by the sales engineer, who also is more competent to use, and with much greater effect to apply, the technical information and data conveyed to him from the designers and producers, through the publicity department. He is also in a position, by reason of his technical training, to appreciate the value of acquiring data for the use of the factory technical staffs, the importance of which would not appeal to the commercial mind.

The systematic collection, analysis, compilation, and distribution of technical data form part of the duties of a publicity department. There is also the preparation and distribution of publications, in which technical and scientific data are reduced to a form of commercial value. An efficient publicity department is, therefore, an absolute necessity in modern factory organisations, and particularly so if the employment of selling engineers is to be a success, and the accompanying advantages are to be profitably utilised.

The publicity department is indispensable to the selling department, whilst to the technical staff it is a valuable aid to efficiency. Through the medium of the publicity department harmonious relations are established and maintained between the commercial and technical staffs, so that commercial and technical data and information are freely contributed with beneficial results to the whole factory organisation.

The modern publicity department embraces five sections:

1. Publication.
2. Records and data.
3. Advertising.
4. Photographic.
5. Distribution.

These five sections are centralised under the supreme control of a publicity superintendent, so that they can be worked together systematically, and, as a consequence, concentration of effort can be more readily obtained, a result of no little importance in publicity operations. Each section is organised on lines to suit its particular work, under the head of a specialist with competent assistants. The more important members of each section must have a good general technical experience in addition to their specialised training.

1. The publication section prepares technical and commercial literary matter in several forms of publications treating of the products of the factory, the publications being compiled, arranged, illustrated, and printed according to their use and destination, which may be broadly classified as for (1) public distribution (home), (2) public distribution (abroad), (3) private circulation.

2. The records and data section receives all the information and data relating to the products of the factory, which other departments, commercial and technical, inside and outside the factory, contribute to the publicity department, including prints of all photos. taken by the photographic section. All this material is analysed, indexed, and filed in the record section in a condition easily available for use by the publication and advertising sections. Applications by other departments of the factory for unpublished data, tests, reports, &c., are therefore made to the publicity department, thus obviating a certain amount of duplication which would otherwise occur.

3. The advertising section prepares and issues advertisements for insertion in periodicals, trade journals, directories, and other advertising media. This section is also responsible for the design and composition of supplementary advertisements, consisting of posters, wall cards, calendars, blotters, diaries, and other devices forming more or less permanent advertisements. This class of advertising yields most efficient results, when the device is presented in an attractive, educational, or useful form of personal value to the recipient, and is one which could be cultivated to a greater extent, with much advantage, by engineering advertisers.

4. The photographic section secures photographic records of the factory products in course of manufacture, when completed and in actual use, and also the methods and processes used during manufacture and construction. Photographs selected by the publication section for illustrations in publications are prepared for blockmaking by the photographic section, which is also responsible for obtaining satisfactory blocks from the approved retouched prints.

5. The distribution section receives and stores all completed publications, and is responsible for correctly addressing and dispatching them. The work of this section is important, and invites the use of ingenious systems of classification and indexing, so as to modify the work of circularising, which is apt to become involved.

The above only briefly outlines the work of a modern publicity department, but will serve to indicate to some extent its sphere of operations. The class of work dealt with in the factory dominates, more or less, the extent of the activities of the publicity department, but there is no organisation embracing either the manufacture or sale of electrical or mechanical engineering products which would not benefit from a publicity department organised on sound lines to suit the surrounding conditions.

For the purpose of electricity supply undertakings the work of the publicity and selling departments will differ in some ways from that of these departments in a manufacturing concern, but their organisation will be substantially the same. It has been suggested that the methods employed in the American "Do It Electrically" campaign should be adopted in this country.

This campaign was organised by a coalition of electricity supply companies, manufacturers of, and dealers in, electrical apparatus, who formed a "Society for Electrical Development," which had for its object the "electrical" education of the people, whereby they would become familiar with the uses to which electricity could be put, and with the attendant advantages and costs of electrical appliances. All publicity efforts are more or less educational in effect, but an appeal with "electricity" in the

foreground as the subject of study would not produce results commensurate with the work and expense entailed. This applies more so to this country, the people of which, on the whole, are not inclined to devote time and mental exertion to the study of a subject which will ultimately become an outlay of money. But as the most fertile field for increasing the demand for electricity supply will be found in the homes of the people, indirect and more subtle methods than the American scheme could be adopted, with much greater prospects of rousing the interest of the average man and woman, to whom the word "electricity" conveys an impression of something beyond their ken, involving vague risks in its control when that demands a closer intimacy than the operation of a tumbler switch.

The commercial value of co-operation is now recognised; and, in the first place, co-operation will be required between supply authorities and the dealers in and manufacturers of apparatus, and also with wiring contractors. The cost of appliances and apparatus must be spread over a period of time, so that electrical heating, cooking, and cleaning appliances may be installed in houses on terms of hire or purchase by instalments.

The introductory publicity operations should consist of the preparation and distribution of pamphlets or booklets of an attractive form, treating, in a concise and interesting manner, of the work and operations on which the apparatus would be employed, giving hints and instructions, not in conjunction with any particular apparatus but on the best methods of carrying out the work irrespectively of the type of appliance or apparatus employed. The electrical apparatus would be eventually brought forward and effectively shown to be the cheapest, most efficient, and most suitable for the purpose, and to provide, at the same time, the ideal conditions under which the work was described as being carried out. Practical demonstrations of the working and operation of the apparatus would be given under conditions familiar to the probable customer. These demonstrations would be organised by the selling department, assisted by the advertising section of the publicity department.

In such manner as outlined above, householders could be drawn into a familiar and appreciative attitude towards electrical appliances, not because of the electrical attributes of these appliances, but for reason of their utility and inherent advantages, and, no doubt, in due course, with the use of amplified publicity methods, the electrical factor would come to be regarded just as indispensable to home life as it now is to industry.

Another fruitful field for central supply authorities to cultivate is the use of electric vehicles in cities and larger towns. This, the most economical and reliable means for short transport service with frequent stops, has made little progress, due in great measure to lack of facilities for charging and repairing batteries at reasonable cost. Supply undertakings could develop the neglected commercial possibilities of this field by organising traction battery charging, repairing and testing departments at the central stations.

Again, by co-operation manufacturers and dealers would place on the market vehicles without batteries. Charged batteries would be hired and exchanged at the electricity supply station just as simply as the motor-vehicle owner obtains petrol supplies from a garage or petrol store. The low prices of the vehicles and the small operating costs provided by this system would guarantee its success, and its popularity could immediately be achieved by the modern publicity department. Apart from its commercial value, this system would also provide a variable load under the control of the central station, and afford a means for filling, to some extent, the valleys in the load line.

Export Facilities to the Continent.—Manufacturers or merchants wishing to deliver goods safely and expeditiously in Italy, France, or Spain, may be interested to know that the Lep-Transport and Depository, Ltd., of Castle Street, Long Acre, W.C. 2, has a well-organised system of transport to these countries by way of the Channel ports of Northern France. During the last few weeks they have carried thousands of tons to Italy by way of France.

ELECTRODES FOR ELECTRIC FURNACES: THEIR MANUFACTURE, PROPERTIES, AND UTILISATION.

THE physical and chemical nature of furnace electrodes, their position in the furnace, and their electrical and mechanical properties all exercise great influence on the quality of the product and the efficiency of the furnace. The electrodes must be refractory, in order to withstand a working temperature of about 3,000° C. They must be good conductors of electricity at all temperatures, poor conductors of heat, and exert no injurious chemical effect on the desired reaction in the furnace. Metals, alloys, and certain mixtures are used for electrodes in some furnaces, but carbon (either amorphous or graphitic) is by far the most generally useful material fulfilling the above desiderata.

The raw materials used in making amorphous carbon electrodes are gas-retort coke, anthracite, and tar coke or petroleum coke. The base of manufacture is material rich in carbon and with a minimum of ash and volatile matter. The agglomerant is dry tar. The permissible limits of impurities are silica 0.5 per cent. and iron oxide 0.2 per cent. Silica is particularly objectionable where the electrodes are to be used in making aluminium. Various chemical and physical processes are employed in order to reduce the percentage of ash and of volatile matter in the raw material.* Petroleum coke is the raw material most used; according to its origin, it yields from $\frac{1}{2}$ to 2 per cent. of ash, $1\frac{1}{2}$ to $1\frac{1}{2}$ per cent. of sulphur, and 12 to 15 per cent. of volatile matter. After treatment the coke contains about 0.5 per cent. of silica, 0.15 per cent. of iron oxide and alumina, and 0.05 per cent. of soluble soda salts. As for graphite, artificial material (produced by "graphitising" the electrodes) is generally employed in preference to natural graphite.

Whatever the variety of carbon, it is ground until 40 per cent. passes a No. 100 screen; 15 per cent. passes No. 60; 20 per cent., No. 30; 15 per cent., No. 16; and 10 per cent., No. 8. A minimum proportion of tar should be used as agglomerant, and 10 to 12 per cent. is sufficient when electrodes are squirted mechanically under very high pressure. Tar for fixed electrodes (soles, &c.) may contain 60 per cent. of volatile matter; but for rod electrodes it should contain no more than 40 to 45 per cent. After being mixed thoroughly the compound is squirted through dies, or pressed in moulds, at about 2 tons per sq. in. The baking process, which eliminates volatile material, converts the tar to carbon, renders the electrodes hard and compact, and increases their electrical conductivity, is effected in continuous furnaces with a maximum temperature of about 1,300° C. Other types of furnaces are used in special cases. The heating, baking proper, and very slow cooling occupy altogether eight to ten days. The finished amorphous carbon electrode has a density of 1.6 to 1.65 and a porosity of 18 to 20 per cent.

Graphitic Electrodes.—The manufacture of these, based on the conversion of amorphous carbon to graphite at high temperature, may be effected by the Girard and Street (Le Carbone) process or by the Acheson process. In the Carbone process the rod of raw paste is passed continuously through a small chamber in a carbon block, where it is exposed to the intense heat of an arc between carbon electrodes set at right angles to the rod under treatment.

The Acheson process consists simply in heating, by the electrical resistance of the charge itself, a mixture of coke and oxide (alumina, iron or manganese oxide or silica), or simply an anthracite with a high percentage of ash. The first product is carbide, which then dissociates into graphite and the original oxide. The impurity plays simply a catalytic part until graphitising is completed, and is then volatilised. From anthracite yielding 6 per cent. of ash, Acheson obtains graphitic electrodes yielding only 0.033 per cent. of ash. According to Jean Escard (*loc. cit.*) the price of these electrodes (about £80 per ton in France) is the chief reason against their use in French works, especially in aluminium manufacture, where (owing to liberation of oxygen at the anode) the life of graphite electrodes is not much longer than that of amorphous electrodes. In electrometallurgy, on the other hand, the surfaces in contact are smaller, and the resistance to oxidation of graphitic electrodes is so much greater that their consumption does not exceed 40 per cent. that of amorphous electrodes. It is probable that a number of French electrometallurgists will make their own graphitic electrodes in future. Where water power is available, a stock of electrodes can be made economically during periods of high water, to utilise power only temporarily available, and hence not capable of economical use in the main furnace equipment.

Properties and Utilisation.—The physical properties on which depend the performance of electrodes in service are:—Their specific gravity, mechanical strength, sonorosity, hardness, density, and conductivity to electricity and heat. Their industrial value depends, above all, on the purity of the raw materials, the fineness to which the latter are ground, the proportion of agglomerant, the pressure of moulding or squirting, the baking process, and the composition and percentage of ash and volatile matter.

Density, Hardness, State of Surface.—The density of electrodes ranges from 1.45 to 1.6, and its apparent value (without allowing for interstices) is obtained very easily by dividing the weight by the volume of the electrode, as calculated from its dimensions. The apparent density gives a good measure of the degree of disintegration in service. The true density (requiring a vacuum pump for its determination) is a useful guide to the purity of the electrode, and varies inversely with the hydrogen content.

Good electrodes are generally very hard, so much so that they should be moulded to the desired details of form before baking. Their surface should be as smooth as possible, in order to secure good contact with the terminals. Improvements in manufacture have reduced the risk of breakage with sudden variations in temperature. Formerly such breakages were common (especially at screwed joints), and caused serious delays. The best way to detect and locate breakages is to thrust a bar into the furnace and on to the electrode; if a sonorous sound is emitted when the end of the bar is struck by a hammer, the electrode is still sound. Graphite electrodes, though weaker in tension than amorphous ones, are less brittle. This is due largely to the high temperature at which they are made and to the species of annealing which they receive in cooling. The annealing renders the structure more homogeneous and improves the thermal conductivity of the graphite.

Chemical Properties and Effects.—Carbon being a powerful reducing agent, one has sometimes to use metal electrodes of the same metal as is being treated, in refining furnaces. Generally, however, the oxidising effect of a slag can be adjusted to overcome the carburising effect of the electrodes to any desired extent. Of the impurities in electrodes, sulphur is particularly injurious in steel manufacture. There may be 1 per cent. or more of sulphur in electrodes sold as "first quality," and this may introduce 0.005 to 0.006 per cent. of sulphur in the molten metal. Even after prolonged baking, electrodes contain 0.25 to 0.4 per cent. of hydrogen over and above the amount corresponding to moisture absorbed after cooling; the proportion of such water is generally between 0.25 and 0.35 per cent.

Conductivity.—Carbon electrodes conduct heat less readily than metals, so that a temperature difference of, say, 1,500° C. may be maintained between the ends of an 18-in. electrode. Several writers, including Herring, state that the thermal conductivity of graphite diminishes rapidly with rising temperature, whereas that of amorphous carbon increases. For electrodes working at 1,400° C. in the furnace and with one end water cooled, the relative conductivities (copper = 1) are:—Acheson graphite electrodes, 0.34; amorphous carbon, 0.17.

Carbon is a worse conductor than metals, but improves with rising temperature, so that the current density can be increased without causing excessive heating. The resistance increases with the proportion of agglomerant or binder, but decreases with higher pressure of moulding and temperature of baking. The resistance in ohms per metre \times sq. mm. of various electrode carbons is as follows:—

Ohms per metre \times sq. mm.	Cold.	Hot.
Acheson graphite	37.45	14.06
"Retort coke"	21.90	15.56
"Ceylon graphite"	54.73	56.88
	56.84	6.09 (?)

The high conductivity of graphite electrodes permits smaller sizes to be used for a given current. This means initial saving in material, and also smaller electrode surface exposed to the oxidising action of the furnace products.

The electrical resistance of electrodes may be measured simply by the fall of potential in a measured length of electrode through which a measured current is passed. A double Thomson bridge gives more accurate results. In either case, the test current must not heat the specimen appreciably. Contact resistance may be eliminated by drilling small cups in the ends of the test pieces and filling these with mercury. Axial strips or bars of metal are sometimes included in the construction of electrodes to reduce the electrical resistance, and increase the mechanical strength (see "Compound Electrodes" later).

The mechanical pressure used in forming electrodes varies the electrical resistance within wide limits by pressing the particles of carbon more or less tightly together; consequently, it affects also the permissible current density. A usual allowance for mean current density is 3 to 4 amperes per sq. cm. of section (19 to 26 amperes per sq. in.). If special cooling facilities be provided the current may be increased to 10 amperes per sq. cm. (64½ amperes per sq. in.) as an absolute maximum in amorphous electrodes. Graphite electrodes may carry 20 amperes per sq. cm. (130 amperes per sq. in.), which is a great help where the highest temperatures have to be attained by expending great power in small space.

Form, Dimensions, and Arrangement in Furnace.—The shape and length of electrodes vary according to the application. At the Ugine works (Savoie), round electrodes are 28 to 35 cm. diameter and square electrodes 25 to 33 cm. side, the length being 1.6 to 1.8 metres for both patterns. Large section simplifies working and reduces the number of electrodes required; the strength of the electrodes is, however, reduced, and their individual weight becomes serious. Also, in the event of breakage, it may be difficult to remove the large fragments before the charge is lost by cooling or by carbonisation. The simultaneous use of several small electrodes offers the advantage of being able to increase the current density, but since a certain space must be maintained between electrodes, the total section of the latter must be reduced, and with it the daily output. The electrodes may be arranged in several rows; for instance, four rows of eight or nine electrodes (each 8 to 10 cm. diameter) may be used in aluminium manufacture, the total current carrying section of the 32 or 36 electrodes being 0.256 to 0.288 sq. metres. The square carbons (25 cm. side) are arranged in two rows of five.

In the two-phase iron smelting furnaces at Trollhattan, four square electrodes are used, each 66 cm. square and built up from four 33 \times 33 cm. electrodes. The complete electrode is 2 metres long, weighs 1,300 kg., and is set at 65° to the horizontal. About 25 cm.

* Details of these processes are to be found in *Le Génie Civil*, Vol. LXXI, pp. 65 et seq., whence the present notes are derived.

length is wasted by the arrangement used to secure perfect connection with the supply leads. In the Stassano three-phase furnace, three or six 8-cm. round electrodes are used in the 500 and 1,000 H.P. sizes respectively. These are set radially through the furnace walls at about 15° with the horizontal. The advantage of round electrodes is that they can be utilised completely by screwing new lengths into the back of stumps.

It is now usual to employ four, eight, or twelve 25-cm. sq. electrodes (1.75 to 1.9 m. long, and working at 4 amperes per sq. cm.) in furnaces for ferro-alloys. This gives a high conductivity arrangement, and if one of the electrodes breaks its renewal involves less loss of time and material than the replacement of a large electrode equivalent to all or some of the smaller ones.

Sole-electrodes *M* (fig. 1) may be built up of a number of prismatic electrodes clamped closely together and generally placed on a strong iron plate *f* connected to the supply leads. The crown

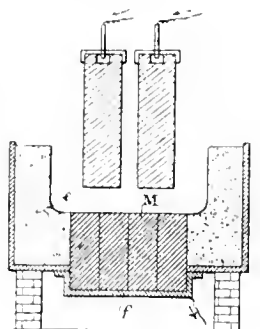


FIG. 1.

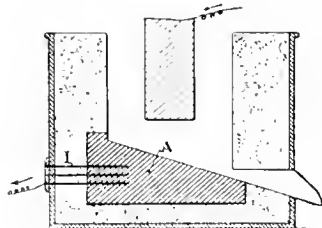


FIG. 2.

of the electrodes forms the bottom of the furnace, and all around them is packed carbon *pisé* *e* to ensure tight joints. This arrangement is used in several aluminium works. Sometimes the sole-electrode is formed in a single block *A*, fig. 2 (showing a furnace for electrometallurgy), which is moulded in place, the whole basin being then placed in a baking furnace before use. Leading-in conductors, *I*, are generally embedded in the base block in such a case.

Horizontal electrodes in one or several units are used in furnaces for making carborundum or graphitic carbon. Circular electrodes are used in certain melting furnaces and for the manufacture of alloys. In the Girod furnace, which utilises peripheral resistance, the electrodes are blocks of carbon *AA'*, *BB'* (fig. 3), grouped two

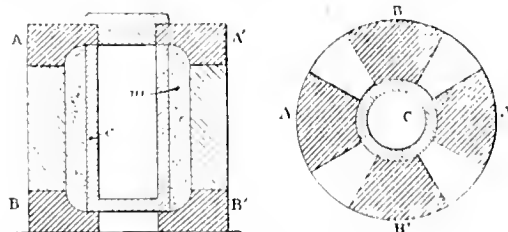


FIG. 3.—GIROD PERIPHERAL ELECTRODES: VERTICAL AND HORIZONTAL SECTION.

by two in parallel, and leading current to a semi-conducting mass *m* surrounding the melting pot *C*. This furnace is particularly useful in the manufacture of ferro-vanadium by direct union of the elements.

In the Conley furnace (fig. 4) electrodes *EE'* are embedded in the masonry, and consist of four sectors *e*, connected by refractory, con-

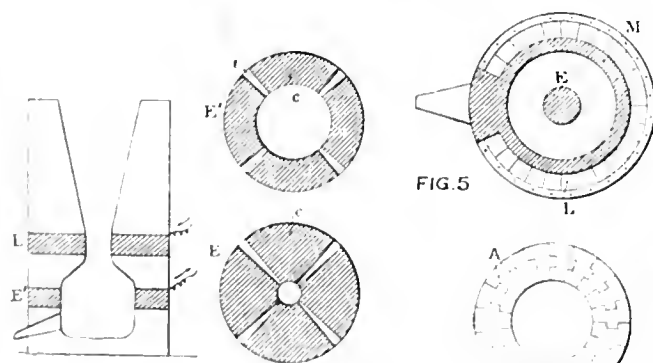


FIG. 4.

FIGS. 5 AND 6.

ducting masses *e* of graphite *pisé* (rammed). A circular electrode *M* (fig. 5), protected externally by refractory brickwork, is used in conjunction with a movable vertical electrode *L*, in one of the Heroult furnaces for reducing iron ore. The electrode *M* forms

also a crucible, but is kept so low that current is forced to travel through the charge. Hollow electrodes built up from a number of interlocking blocks *A* (fig. 6) serve to carry current, and admit materials into the furnace; they have been used for some time in the manufacture of calcium carbide. So-called "fluid" electrodes are used in certain furnaces, where the fuel forms one electrode which flows as the reaction proceeds; as a matter of fact, there are two fixed electrodes, but it is the reducing-carbon which transmits current to the mineral under treatment.

Length of Electrodes.—Longer electrodes mean less loss of material in the shape of stumps, but greater loss of energy by Joule effect. For each individual case there is a certain "most economical" length of electrodes, which may be calculated from Lou's formula:—Economic length = $l + \sqrt{(2,000 \cdot s^2 \cdot l \cdot d \cdot k \cdot b) / (r \cdot i^2)}$; where *l* = mean length of stump when replacing electrode (cm.); *s* = section of electrode (sq. cm.); *d* = density; *k* = average consumption (cm. length per hour); *b* = difference between price of electrodes and value of stumps (fr. per kg.); *u* = cost of energy (fr. per kw-hour); *r* = resistivity of electrode; and *i* = current. For example, the most economical length of a 400 sq. cm. electrode, carrying 2,000 amperes, and used to a stump length of 50 cm., is found to be 1.91 metres (6¼ ft.), if *u* = 0.01 fr. (0.1d.); *r* = 0.006 ohm; *k* = 0.5 cm./hour; *d* = 1.5; and *b* = 0.004 fr.

(To be continued.)

METROPOLITAN POWER-STATION ENGINEERS.

WE are informed by Mr. W. J. Webb, of the London District Committee of the Electrical Trades Union, that a Conference, at which Sir George Askwith presided, was held, on September 5th, at Montague House, Whitehall, between representatives of the Associated Municipal Electrical Engineers and the Electrical Trades Union, concerning rates of wages, war awards, and conditions of employment of power-station and sub-station engineers. The Conference lasted nearly three hours, and was of a perfectly amicable character throughout, and Mr. Webb suggests that it will not be long ere the green card issued by the Electrical Trades Union as working rules and conditions for station engineers is a settled thing. The following are the short notes of the Conference issued by Sir George Askwith:—

At a Conference held on September 5th, 1917, under the chairmanship of Sir George Askwith, in regard to claims reported by the National Electrical Trades Union (with the National Union of General Workers), it was agreed that the secretary of the Associated Municipal Electrical Engineers should ascertain from the Borough Councils in the list given below of the boroughs included in their Association whether the Associated Municipal Electrical Engineers, with such members of the Councils as may be desired by each Council, can be authorised:—

(a) To treat with: 1. The Electrical Trades Union in respect of uniform payment and conditions for electricians at power stations on the basis of the Union trade card and in respect of the settlement of the war wages to be added to the wages which may be agreed.

2. The National Union of General Workers (and possibly the Bricklayers' Union and the Workers' Union) for consideration of the wages of the semi-skilled and unskilled men employed at power stations controlled by Borough Councils in the Greater Metropolitan Area, having special regard to the possible principle of uniform payment; and (b) to have power to refer points, failing agreement, to conciliation or arbitration.

LIST OF BOROUGHES.

St. Pancras.	St. Marylebone.	Fulham.
Hammersmith.	Walthamstow.	Epsom.
Battersea.	Bexley.	Barking.
Hackney.	Stepney.	Southwark.
Croydon.	Hampstead.	Heston and Isleworth.
Bermondsey.	West Ham.	Ilford.
Islington.	Willesden.	Hornsey.
Stoke Newington.	Poplar.	Beckenham.
Woolwich.	Finchley.	East Ham.
Gravesend.	Barnes.	Watford.

(Signed) G. R. ASKWITH.

A Conference of members of the engineering staffs of electricity supply stations of London was held at St. Bride's Institute, Fleet Street, E.C., on September 5th, with the object of discussing the question of the organisation of central-station engineers in the London area. Mr. Chalmers Kearney was the chairman, and the A.E.S.E. was represented by Mr. W. Arthur Jones, A.M.I.E.E., President of the A.E.S.E.

After a few introductory remarks by the chairman, Mr. H. W. Healey proposed that an Association be formed for the shift engineers of London electricity supply stations. Another speaker suggested the advisability of joining the Chief Technical Assistants' Association.

An amendment was moved by Mr. W. A. Jones in the following terms: "That this meeting of engineering representatives of electricity supply stations in the metropolitan area, considering the

need for their collective organisation to be imperative, do hereby resolve to ally themselves with the London Branch of the ASSOCIATION OF ELECTRICAL STATION ENGINEERS."

The speaker, in moving the amendment, reviewed briefly the history of the A.E.S.E., the objects of its existence, its accomplishments in the past, and its work for the future.

After a brisk discussion, the matter was put to the vote, and the amendment declared carried.

Similar conferences are about to be held in most of the important electrical centres in the provinces. Next week the station engineers of the Birmingham district will meet to discuss the question of their organisation. The lead given by their London confrères will, no doubt, influence their decision. All particulars of the A.E.S.E. can be obtained from the Hon. Secretary, Mr. W. J. Ebben, 26, Little Park Gardens, Enfield.

NEW ELECTRICAL DEVICES, FITTINGS,
AND PLANT.

Readers are invited to submit particulars of new or improved
devices and apparatus, which will be published if considered of
sufficient interest.

Electrically-Driven 20-in. Bar Mill.

In a new extension of Messrs. Johnson's Iron and Steel Works, West Bromwich, there has recently been laid down a 20-in. two-high bar mill, which embodies the latest improvements in the



FIG. 1.—300-H.P. "WITTON" MOTOR DRIVING THE MILL.

electric driving of rolling mills. The mill consists at present of one stand of rolls for dealing with ball furnace iron and steel blooms, and is driven direct by a continuous-current "Witton" motor (fig. 1); a fly-wheel is interposed between the motor and the mill. This motor has an output of 300 H.P. on continuous rating at 52 R.P.M., and has an overload capacity of 100 per cent. for short periods. It is designed for speed adjustment by shunt regulation from normal speed up to 100 R.P.M. on light load, and is compound-wound in order to give a drop in speed of about 20 per cent. between light load and full load, thereby enabling the fly-wheel to take a share of the load during heavy passes. In order to accommodate the motor to the particular requirements of various classes of work, a diverter is provided on the switch panel, enabling the amount of compounding to be easily varied. In this way the drop in speed of the motor can be adjusted, and the fly-wheel can be called upon for a heavier or lighter amount of work.

The flywheel is 18 ft. in dia., and weighs about 20 tons; it is equipped with a band-brake operating on the lower half, by means of which the mill can be brought rapidly to rest. The mill is driven from the flywheel shaft by means of a wobbler and disconnecting coupling.

A motor house encloses the motor, switchgear, flywheel with its bearings, and overhead travelling crane, the crane rails being continued so that the crane can also travel outside over the mill housings, for which purpose the portion of the steel partition at the crane level is arranged to swing open. Two doors completely enclose the electrical plant from the dust of the mill.

The motor is controlled by a switch panel fitted with expanded metal sides and door (fig. 2). This panel comprises a double-pole main switch, circuit-breaker, ammeter, voltmeter, watt-hour meter, speed regulator, diverter for carrying the compounding, and multiple-switch starter with grid resistances. The apparatus is interlocked by means of the special G.E.C. arrangement for rolling mills, which ensures the motor being started with full field and the switches operated in the correct sequence. By the same device the circuit-breaker is prevented from being closed should the starter have been left in the running position.

The power for driving the motor is supplied by the West Bromwich Corporation electricity department.

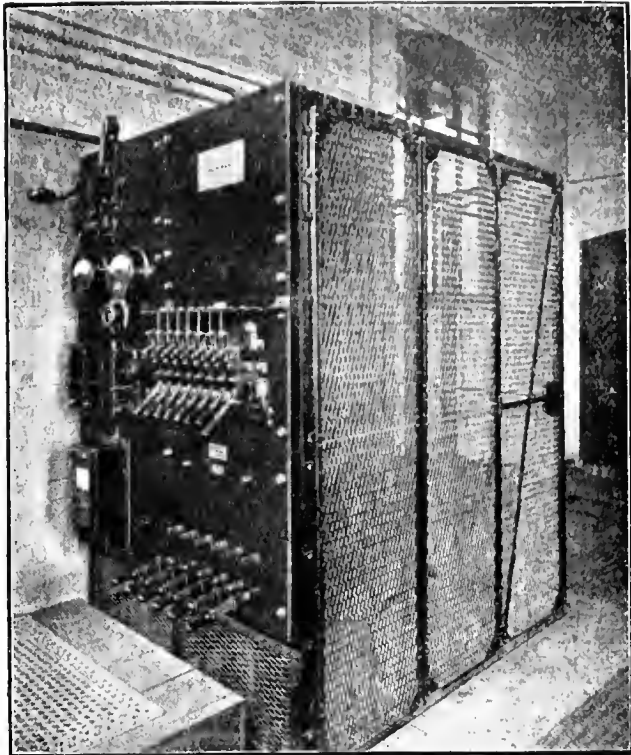


FIG. 2.—"WITTON" SWITCHGEAR CONTROLLING THE INSTALLATION.

The electrical plant and flywheel were supplied by the GENERAL ELECTRIC CO., London, to the specification of Messrs. Walter Dixon & Co., the consulting engineers.

Benjamin Industrial Signals.

The BENJAMIN ELECTRIC, LTD., of Rosebery Avenue, London, E.C. 1, have introduced a range of industrial signals primarily designed for use in connection with interior calling or fire-alarm systems, to supersede the use of bells, buzzers and gongs. Modern business and manufacturing requirements have demonstrated the absolute necessity of instant and unrestricted communication between departments and responsible officers of the organisation. The intercommunication telephone system fails to meet these requirements, inasmuch as it is only effective when the individual required is in his own office to receive the call. But there is frequent necessity for communicating with those officials whose duties require their moving about the plant or premises. The time wasted in locating them is liable to become a considerable item of expense, whereas by a prearranged signal sounded simultaneously in all departments, the individual is located in a few seconds, and the message delivered.

The ordinary bell or gong signals are inefficient in many cases owing to the lack of sound volume and tone quality necessary to enable them to be instantly heard above the roar of machinery. Under these conditions, the Benjamin industrial signals meet the case, their volume of sound being equal to that of four or five gongs and the tone quality such that there is no possibility of their harmonising with the usual noises of industry.

The signals involve no up-keep expense, operate on an exceedingly low electric current consumption, and are instantly responsive to either button or switch.

The design of the signals is such that the adjustment mechanisms are proof against careless attempts at adjustment. In the D.C. signals this point has had careful attention, while in the A.C. signals adjustments are not necessary. In the D.C. signals pure silver contacts are employed of sufficient area to take care of 50 to 70 per cent. overload. The windings in both types are of highest grade black enamelled copper wire, the whole being treated with plastic insulating varnish and baked, rendering them waterproof.

The D.C. signals operate in parallel, and a spark-killing device is connected across the magnet winding to eliminate erosion of the vibrator contacts; the A.C. signals work either in series or in



FIG. 3.—BENJAMIN D.C. SIGNAL.

parallel, and need no contacts. Both types are made for various voltages.

A master relay panel, illustrated in fig. 4, is made for use in conjunction with Benjamin industrial signals to allow of their operation on high-voltage circuits. By the use of the master relay, the signals may be operated by current from the lighting circuit and the signal given by switch-button as on ordinary bell circuits, this being especially useful where code signalling is required.

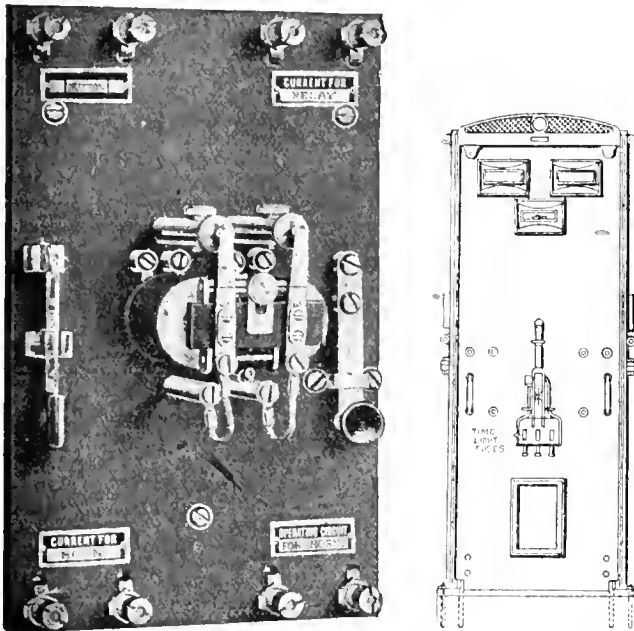


FIG. 4.—MASTER RELAY PANEL.

An ordinary telegraph key is recommended. The primary or push-button circuit is operated by three to six dry cells in series. By depressing one of the push-buttons, or keys, the low-voltage battery circuit is closed through the master relay coil, which in turn closes the relay contacts governing the high-voltage current supply to the signals.

The relay parts are mounted on a slate panel. The contacts are adjustable, so as to take care of any possible deterioration due to arcing. The primary or button circuit is in series with a knife switch, which allows the circuit to be temporarily opened if difficulty occurs in the push-button or its wiring. A test button is also furnished, in order that the entire system may be tested from the master relay panel. The entire panel is encased in a heavy sheet-steel box with hinged cover and lock. The relays have a capacity of 12 A.C. or 10 D.C. signals.

B.T.H. Truck-type Switchgear.

The BRITISH THOMSON-HOUSTON CO., LTD., of Rugby, has recently issued a new descriptive list relating to its truck-type ironclad switchgear for polyphase systems up to 11,000 volts. Such gear

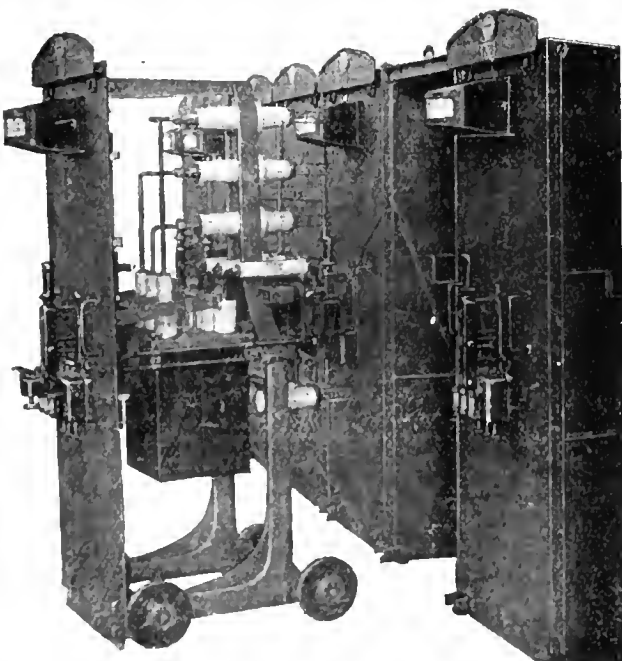


FIG. 5. B.T.H. 6,600-VOLT SWITCHGEAR.

has been developed for use where "safety" in handling by unskilled labour and ease of carrying out extensions and alterations, with a minimum of interruption to supply, are essential requirements; it

constitutes a logical development on "safety first" lines, and the truck arrangement facilitates and simplifies labour operations.

Fig. 5 is a view of some 6,600-volt panels, with one truck removed: fig. 6 shows the general arrangement of a three-phase panel of this type. All the H.T. bus-bars and cable connections are carried on insulators mounted in frame castings which are built up to form the cell structure. The bus-bars are entirely enclosed in a continuous chamber at the back, and when the structure is against a wall access is obtained through handholes. Protecting covers for padlocking on to live cable and bus-bar terminals can be supplied, also portable cell-doors for closing a cell from which the truck has been removed.

The whole of the apparatus for each circuit equipment, including the oil switch, instruments, transformers, &c., is mounted on the

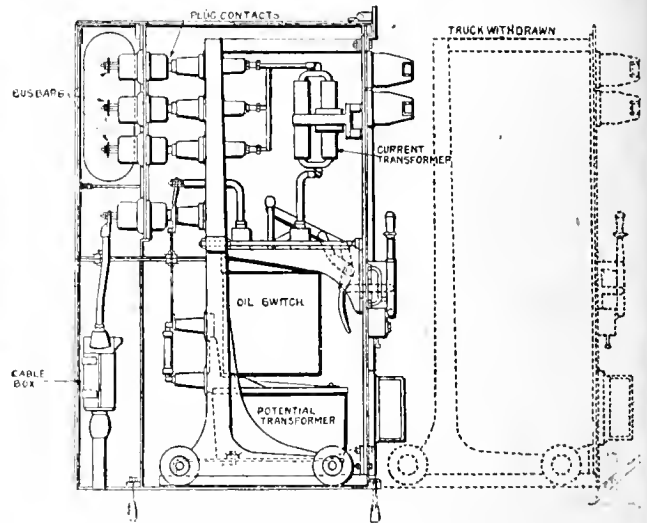


FIG. 6.—GENERAL ARRANGEMENT OF B.T.H. THREE-PHASE PANEL.

truck, which has contact jaws at the back which engage with fixed contact blades mounted in the back of the cell. The contact blades are sunk into porcelain insulators so as to obviate accidental shocks, &c., when the truck is drawn out.

Safety interlocks prevent the withdrawal or insertion of a truck with a closed switch. Non-automatic switches can be supplied on trucks required for bus-bar sectionalising or similar purposes. Switches can be fitted with two-coil or three-coil overload trips, low-voltage release or other automatic features. A special winch attachment can be supplied for lifting or lowering the switch tank. Potential transformers are air-cooled for circuits up to 6,600 volts, and oil-cooled for higher pressures.

Indicating and integrating instruments are mounted on the front panel of the truck, together with the switch-handle and automatic devices; synchronising equipment can be supplied, mounted on a swinging bracket or panel according to type. Standard trucks can be fitted with the B.T.H. split conductor or other special protective apparatus, and, when required, arrangements are provided for charging resistances to be added. Standard equipments are supplied for two-phase circuits of 4,000 and 7,000 max. voltage and 510 and 255 max. amperes respectively, and for 3,300, 6,600, and 11,000 max. voltage and 510, 510, and 255 max. amperes respectively.

THE MANCHESTER TRAFFIC CONGESTION REPORT.

THE Manchester City Council in March, 1915, decided to refer to a special committee on traffic congestion the reports of several committees dealing with traffic congestion and passenger transportation, with instructions to examine the various proposals, and make recommendations on the subject.

This committee (which was representative of the Finance, Buildings, Highways, Tramways, Watch, and Infirmary Site Committees) observes, as regards the Tramway Committee's report on the Passenger Transport Problem, that it points out that in order that the annual growth of passenger traffic in Manchester and the surrounding districts may be satisfactorily dealt with, new and improved transit facilities will be required. In planning these facilities a wide outlook is all-important. Any schemes carried out on narrow or confined lines ultimately result in serious losses to the community in every way.

The ultimate volume of passenger traffic which a tramway system can deal with is limited by the capacity of the arterial lines near the central parts of the city. When the traffic on these lines approaches the "saturation" point, then it is obvious that additional main arteries must be opened out or other transit facilities provided.

Certain main arterial lines near the central area of the city—particularly London Road and Oxford Road—have practically reached the limit of their capacity, and they will be quite incapable of dealing with the increased passenger traffic which will have to be handled in the future from the southerly and easterly sides of the city.

The report deals in detail with the following questions: (1) Is it the wisest course to open out new arteries for the increasing traffic? (2) Should new transit facilities be provided?

The Committee reviewed all the possible alternatives to the existing mode of transit, namely:—(1) Rapid transit lines (a) in shallow subways; (b) in deep level "tubes"; and (c) on elevated structures; (2) shallow tramway subways in the congested areas into which the surface cars could be run; (3) motor omnibuses; and came to the conclusion that the best method of meeting the requirements of the passenger traffic of the city was:—(1) The provision of additional arterial routes, and (2) the provision of suitable tramway terminals in the centre of the city.

The additional arterial routes and the tramway terminals suggested were considered by the Traffic Congestion Special Committee in conjunction with the reports and recommendations of the Watch and Improvement and Buildings Committees.

The report of the Watch Committee deals with the general question of traffic congestion in the public thoroughfares of the city, and states that there is an inner area where the congestion is rapidly creating a crisis which can only be met by the exercise of a firm control supported by adequate statutory powers. This area is that inner portion within a radius circumscribed by Deansgate, Market Street, Portland Street, and Peter Street.

Some modifications of the suggestions of the Tramways Committee were proposed by the Improvement and Buildings Committee, but, in the main, it approved the suggestions, particularly those relating to the proposed tramway terminals.

Although the three Committees concerned have approached the subject from divergent standpoints, there appears to be a general agreement (1) that there should be a limitation of tramway traffic within a certain prescribed area in the centre of the city, (2) that additional arterial routes should be opened out, (3) that certain tramway terminals should be established.

The Traffic Congestion Special Committee, having carefully considered the matter, endorses these points of principle, and, with certain modifications, approves the proposals for six arterial routes, which would necessitate the carrying out of extensive and costly street works.

The terminals proposed by the Tramways Committee are as follows:—(1) The old infirmary site, (2) Albert Square, (3) St. Peter's Square, (4) Marsden Square, (5) Cannon Street (Corporation Street), (6) Stevenson Square—a rearrangement of the existing terminal.

The Traffic Congestion Special Committee, whilst not committing itself to details of such proposals, is of opinion that they are absolutely necessary, not only as a means of meeting the constantly growing demands of the tramway traffic, but also as a means of lessening the general traffic congestion in the central area of the city.

By means of the proposed terminals the number of tramcars which now travel along the principal streets in the city centre will be reduced by at least 50 per cent.

The Traffic Congestion Special Committee is of opinion that it is necessary that some part of the old infirmary site should be utilised as a tramway terminal, but recognises that a complete scheme for dealing with such site should be prepared.

The tramway terminals which are suggested will greatly assist in dealing with the growth of passenger traffic on the north, the east, and the south sides of the city, but there still remains the question of the traffic from the west—the Salford traffic.

The Tramways Committee points out that, in view of the fact that the agreement with the Salford Corporation terminates on May 4th, 1924, it is not expedient to make any definite proposals at the present time as regards Deansgate and the provision of a tramway terminal at that side of the city; but the Committee suggested that negotiations should be opened up with the Salford Corporation with a view of coming to some new arrangements as to the future working of the two tramway systems so as to effect improvements in the general interests—a suggestion which the Traffic Congestion Special Committee fully agrees with.

The Watch Committee also calls attention to the obstruction caused by lorries and other vehicles having to stand in the streets waiting their turn to load or unload at the warehouses, and it suggests that regulations should be made with a view to the compulsory provision of adequate and modern appliances to deal with the loading and unloading of merchandise, and with proper accommodation for waiting vehicles other than in the street.

The Traffic Congestion Special Committee agrees with the Watch Committee that the congestion could be minimised by more complete control by the police, and it is of opinion that with this object in view wider powers should be sought from Parliament.

In submitting this report to the City Council, the Traffic Congestion Special Committee desires to emphasise that steps should be taken for providing additional arterial routes, giving quick and convenient access to the heart of the city.

In considering the requirements for passenger transport, the Committee has had in mind not simply the present form of surface transit tramways—but it has been alive to the possibility of other forms of passenger transport being developed in the future. It should, however, be clearly understood that, whatever form of surface transit may come along, more street accommodation in the shape of new arterial routes is urgently required. As has already been pointed out, London Road and Oxford Road have practically reached the "saturation" point for surface transit of any kind, and some relief routes must therefore be opened out.

The congestion caused by the ordinary vehicular traffic in the central parts of the city has been considerably reduced since the outbreak of war, and it is probable that after the war a large proportion of the merchandise transport will be dealt with by motor traction.

The scheme is presented as a whole, but the Traffic Congestion Special Committee points out that it is not suggested that all the proposals should be carried out at the present time, nor in the immediate future. Financial considerations arising in consequence of the war would obviously preclude this from being done.

A number of appendices are attached to the report which elaborate the various points dealt with in the latter.

One of these points out that, judging by past experience, the population 20 years hence will be one and a half millions; the number of journeys per head of population will, it is estimated, have reached 300, and consequently the total passengers carried will be at least 150 millions a year. The traffic density on seven of the principal routes varied (at the time of the report, 1914) from four and a half million to about three million passengers per route mile per annum, which compared roughly with the London tube traffic in density; the average revenue per passenger was, however, of the order of 1.1d., as against 1.5d.-1.7d. for the tubes.

The Committee adds that it is quite clear that the constant growth of passenger traffic on the surface lines must at no distant date reach a point when the construction of underground facilities will become an absolute necessity, and further recommends that a scheme be prepared, so that a rapid transit system can be dovetailed into the tramway system and the two worked as a combined system.

Touching on the use of motor 'buses, it is pointed out that if they were substituted for tramway cars on the Rochdale Road route, where observation showed a car every 40 seconds between 8 a.m. and 9 a.m., a 20-seconds' service would be required if full inside and outside, while in wet weather the service would require to be a 10 seconds one, practically necessitating a long string of 'buses nearly the whole length of Rochdale Road from Queen's Park to town.

The enormous increase in vehicles would add to the present difficulty in finding men to work the rush traffic. The tramways, in addition to giving £100,000 in relief of rates, pays over £30,000 rates on track and repairs, and maintains practically half the width of the principal highways of the city at a cost of about £30,000, and these two latter items would disappear if 'buses were employed.

The Watch Committee's report refers to the narrow width of the streets of the central area, the volume of traffic thereon, and the obstruction to free movement of traffic by the tramway cars monopolising the central portion of the streets, and goes on to suggest that next to widening the streets, the reduction or exclusion of tramway traffic would do more to relieve congestion than any other course. The time suggested for reduction or exclusion from the central area is between 10 a.m. and 5 p.m. It is suggested that this would interfere with public convenience very little, and that the cross passenger traffic could be fully met by the provision of motor 'buses.

ELECTRIC DRIVE FOR THE BATTLESHIP "TENNESSEE."

CONSIDERABLE interest is being taken in the superdreadnought U.S.S. *Tennessee*—one of the largest and most powerful battleships at present under construction—because it will be electrically driven. The displacement of the ship will be approximately 32,000 tons, and it will have a speed of 21 knots.

The propelling machinery will consist of four motors supplied by two turbo-generators, each motor driving one propeller shaft and developing 6,700 H.P. at 175 R.P.M. The current for the motors will be furnished by two standard Westinghouse steam turbo-driven alternators similar to those used in large power houses throughout the country. These will be of sufficient capacity to furnish power to the four motors, each of which is capable of developing a maximum of 13,500 H.P.

The steam turbines are of the impulse-reaction semi-double flow type, the high-pressure steam being expanded in suitable nozzles, and passing through a two-impulse wheel, after which it passes through the first reaction expansion, which is single-flow. It will then pass through a second expansion, which is double-flow. The dummy piston will be located

between the impulse wheel and the low-pressure reaction stage.

The turbine speeds will be controlled both from the engine room and from the operating room as follows:—

From engine room: Throttle valve mechanically operated; quick-operating safety-stop valve, hand-operated; quick-operating safety-stop valve, automatically operated by safety governor.

From operating room: Automatic governor control, regulated by adjustable speed-control valve; an emergency trip operated by pull wires for stopping the turbines.

The guaranteed steam consumption for the main generators and auxiliaries is as follows:—

Speed in knots.	R.P.M. Propellers.	S.H.P., total.	Steam consumption, lb. per S.H.P.
21	175.0	26,800	11.9
19	154.4	18,850	11.65
15	118.3	8,500	12.1
10	81.0	2,600	15.45

The motors for driving the propellers are of the alternating-current wound-rotor type, wound for approximately 3,400 volts, the stator having two independent windings, one for 24 and one for 36 poles, enabling different speeds to be obtained. The rotor winding will have one three-phase connection to three slip rings, and will be arranged so that with the 24-pole connection, the motor will act as an ordinary wound-rotor machine, and by means of suitable cross-connections it will act as a squirrel-cage machine on the 36-pole connection. Each motor will be separately ventilated by means of duplicate fans mounted on the top.

The motors will have a normal capacity of 6,700 H.P. at 175 R.P.M. on the 24-pole connection, and 2,125 H.P. at 118.3 R.P.M. on the 36-pole connection, and an overload capacity of 25 per cent. for four hours, or 8,375 H.P. at the maximum speed of 185 R.P.M.

Power from one of the turbo-generators will be supplied to the motors at any speed up to 138 R.P.M., corresponding to 13,500 shaft H.P. Speeds up to 118.3 R.P.M. will be obtained by running the motors on the 36-pole connection and varying the speed of the turbine. Above this speed the motors will be run on the 24-pole connection.

The motors will be operated as wound-rotor machines for starting and reversing, the 24-pole connection being used for this purpose. On the 36-pole connection, the motor operates as a squirrel-cage machine. In starting the motors for running on the 36-pole connection, they will be brought up to about the normal 36-pole speed, and then thrown from the 24-pole to the 36-pole connection. In this way the advantages of the wound-rotor motor for starting and reversing are obtained without the complication of the change-over switches for the rotor, and the six slip rings that would be required if an ordinary two-speed machine were used.

The direction of rotation for either pair of motors will be changed by the reversing switches. The switching apparatus will be arranged so that only the proper levers need be thrown to enable any pair or all the motors to be run from either generator.

One of the most important features of these machines is the method of insulation. Owing to the conditions under which they may have to operate, it was considered essential that the insulation used should contain a minimum of fibrous material. The windings, therefore, have been so designed that only mica is used for insulation in the slots, and any fibrous material used is required only to hold the insulation in position. All the coils will be given a large number of treatments of suitable varnish to seal up all possible inlets for moisture, so that the insulation will be moisture as well as heat-resisting. The construction adopted permits the temperature to be raised to 300 deg. F. without injury to the machine.

For starting the propelling motors, liquid rheostats are used. These are designed to give a fixed rate of acceleration. This type of rheostat gives an infinite number of starting points, and will be arranged to limit the rate of acceleration, and the current drawn from the generators, to any desired amount.

The control gear, beyond the point of space limitation and the necessity of interlocks for making it "foolproof," does not differ materially from an installation on land. The control and switching equipment in a land power plant has developed into a large and expensive part of the installation, in many cases occupying more space than the generating equipment, but on shipboard special care has to be taken to design it to conform to the restricted space available. In this instance the control is so designed that the motors can be started singly or in group, also reversed quickly.

The turbo-generating equipment in the two engine rooms and the four propeller motors will all be controlled from a central control room communicating with the bridge. All operations for the control of the ship will be performed from this room except starting the turbines and the auxiliary machines. In this control room will be placed all the switches for connecting the generators to the motors and control mechanism for the governors. The only connection from the control room to the engine room will be the cables and pipes to the turbine governor, gauge piping, and the shafts of the revolution counters.

All switches and rheostats required for the operation of

the main propelling machinery will be operated by levers mounted in front of the instrument boards. The switching apparatus will give all the combinations that will be required, and will all be manually operated. The various levers will be mechanically interlocked, so as to prevent any improper combinations being made. All the circuits will be controlled by oil switches, which are arranged in a novel manner so that when open for inspection they are entirely disconnected from any live parts. This eliminates the possibility of any danger due to the failure to open disconnecting switches.

In addition to the main generating and propelling equipment, there will be furnished auxiliary direct-current turbo-generator sets for supplying current for excitation of the alternators, light, power, signals, and the several hundred motors used on a battleship for practically all mechanical operations.

Electricity on board ship finds many uses, such as steering, searchlights, raising anchor, baking bread, operating laundry and refrigerating plants, raising big shells from the magazine to the guns, and many others.

The auxiliaries for the engine room will be electrically driven, and for supplying power for the uses mentioned, six 300-kw. geared turbo-generator units will be supplied, four of which are for non-condensing operation, their exhaust steam entering the main turbines at a suitable point.

For varying the excitation of the main turbo-generators, two motor-generator booster sets will be furnished. These booster sets will be capable of "bucking" the excitation to zero or "boosting" the normal 240 volts bus-bar voltage to about 315 volts.

All the propelling machinery for the ship is being built by the Westinghouse Electric & Manufacturing Co. at East Pittsburgh, Penn. Similar equipment is being furnished for the new battleships *Colorado* and *Washington*, now under construction.—*Power*.

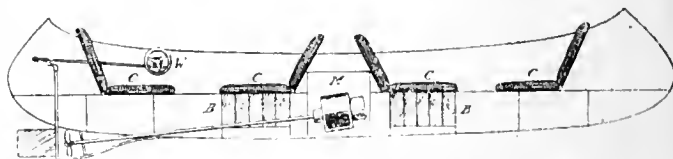
ELECTRIC CANOES.

THE *Motor Ship and Motor Boat* for September 6th contains an illustrated article on the electric canoes which have become popular on certain sections of the River Thames. We are indebted to this source for the following particulars.

This form of propulsion has the great advantage of running practically without noise or vibration, while it is perfectly clean to handle, starts with certainty, and requires no mechanical knowledge on the part of the person in charge—important considerations under existing conditions, when crews often consist of girls in summer frocks.

Electric launches have been used on the Thames for many years, and at one time they became very popular, but were more or less ousted by the motor launch, which, before the war, offered higher speeds at a lower cost. The increased price of petrol has altered conditions, with the result that electricity has obtained a new lease of life.

Our contemporary remarks that it is by no means improbable that electric propulsion for pleasure purposes on inland waterways has come to stay, until the small marine motor



M, motor; B, battery; C, seat; W, steering wheel.
FIG. 1.—SECTION OF ELECTRIC CANOE.

has been improved so as closely to approach the electric outfit in smoothness of running and flexibility.

Those accustomed to taking their pleasure upon the water in boats propelled by oars or sails have always complained of the noise and vibration inseparable from the small motor boat, and many such are willing to sacrifice speed to peace and quietness. Another advantage of the electric boat is that it does not appreciably interfere with the enjoyment of those taking their pleasure in skiffs or punts, whereas the ordinary motor launch causes a considerable amount of discomfort to other craft in the way of noise, wash, and smells.

There are few motor engines that can even approach the steady torque and quiet movement of an electric motor.

On some reaches, electric launches are to be found in considerable number, but there is perhaps a rather general impression to the effect that the motor itself and the accompanying storage battery must necessarily introduce so much weight as to be applicable only to the larger craft. For some years past there has, however, been growing in popularity on certain reaches a type of boat that is not as yet generally known. This is the electric canoe, the hull of which is to all intents and purposes that of an ordinary clinker-built

Canadian canoe, somewhat enlarged in all directions without departing materially from the proportions of the model. Additional strength is provided to carry the extra weight, and a deck is formed which extends unbroken throughout the length of the vessel, except for a short space amidships. In this central space is accommodated the electric motor, and sometimes also the battery. There is, of course, very little head room below the deck itself, so that the space there available cannot be used for the accommodation of adequate batteries unless they are specially constructed with short wide plates.

The first electric canoe, which was launched in June, 1908, was built by Messrs. Wilder, at Maidenhead, to the requirements of a customer. The boat was known as the *Viren*, and since that date it has been superseded by other *Virens*, each one showing an advance over its predecessor. The present *Viren* is well over 30 ft. in length, and carries an unusually large battery. This is of the E.P.S. type, and consists of 50 cells rated at 200 ampere-hours. The motor is of the Blenheim type, and is rated at 100 volts, 45 amperes. It is an ordinary two-pole series-wound machine with the field windings on either side, and the poles above and below the armature. The end thrust is taken by a single thrust ball race on the after-end of the armature shaft. The motor can run at 25 per cent. overload without undue heating. Current is supplied to the motor through a simple controller, which provides two speeds forward and reverse. When running at full speed the current consumption is about 38 amperes at approximately 100 volts, and the average speed attained up and down stream is 11 miles per hour. A lower speed is provided by putting the two halves of the battery into parallel, so that in effect it becomes a 50-volt battery with a capacity of 400 ampere-hours. Under these conditions, the speed of the boat is about six miles an hour, and current is discharged at the rate of 25 amperes. On a day's run, the current consumption may work out approximately to be such as to discharge the battery in about eight hours' running time. The present *Viren* is, we believe, the fastest craft of her type on the river, but she certainly runs very silently, and with very little wash up to something approaching her full speed.

For a canoe of 30 ft. or over, there does not appear to be any special object in saving space amidships by putting the batteries under the floorboards. If they are carried in a central position with the motor, the accommodation for passengers forward and aft of the installation is quite adequate. Some people, however, prefer electric canoes which approximate as nearly as possible in size to the ordinary Canadian. In that case, the saving of space becomes important, and the use of short cells under the floorboards is a marked advance. There would be no object, however, in endeavouring to design a motor which can be similarly accommodated, because the central seat backs must be kept far enough apart to ensure that ladies' hats, however generously dimensioned, shall not come into collision across the intervening space. The seating accommodation is peculiarly comfortable, and in this respect is only equalled by the ordinary punt. It consists of large-shaped cushions on the floorboards, and also resting against the sloped seat backs, the angle of which can be varied. Some canoes provide comfortable accommodation for eight passengers, but the lines of others are such that only the central seats are sufficiently roomy to accommodate two each in comfort.

The whole of the control comes directly to the hands of the driver, while leaving him in every respect just as comfortable as his passengers. At one side of him is the controller, providing full and half-speed ahead and full and half-speed astern, as well as a neutral position. On the other side is the steering wheel, mounted vertically near the gunwale, and working through the medium of a small pinion and ratchet, in conjunction with a bent rod connecting to the tiller, as shown in fig. 1.

The majority of the canoes in service in the Maidenhead district have batteries of 30 cells, which are generally adequate for a day's run, unless exceptionally high speeds are desired. In some the motors are of the submersible four-pole type, with separate thrust bearings and special flexible couplings. It is generally found that the positive plates of a canoe battery will last for four years, and the negatives for eight years.

Several of the local boatbuilders have their riverside premises equipped with excellent charging plants. The regular price charged by boatbuilders to boat owners is 1s. per unit.

In the opinion of the writer of the article, the electric canoe is bound to increase very largely in popularity. In time charging facilities will be thoroughly well distributed. Thus, the only limitation of the electric boat on the upper river will be removed, since the batteries can always be charged up every night, and have sufficient capacity for the whole day's run. At present, of course, one cannot depend with certainty on finding suitable recharging facilities elsewhere than in a district where craft of this type are already in use.

The draught of an electric canoe is very small. The system gives the maximum of comfort, is quite free from vibration, and is absolutely silent. It combines, in fact, all the merits that one can want short of a capability for developing enormous speeds. One imagines that the type will not be limited to the Thames, but will presently be found in many other places, its distribution depending partially on the provi-

sion for recharging facilities. Beyond this, it has few limitations. So far as the upper Thames is concerned, the electric canoe bids fair to bring about a revolution in mechanically-propelled craft.

WAR ITEMS.

Big American Electric Signs may be Cut Off.—In order to save coal Mr. Garfield, the American Fuel Administrator, contemplates the abolition of the famous electric signs in Broadway and other big American thoroughfares.—*Times*.

Abusing the Trade Protection Certificates.—At Bermondsey, the Military Representative drew attention to another abuse of the issue of the trade protection certificates, which he characterised as the most flagrant case which had come under his notice. It referred to a man who described himself as a manufacturing chemist. The Tribunal made the most minute inquiries into his claim, visiting the works, and took up a very strong attitude, granting him a final period of exemption. The man took the case to the Appeal Tribunal, where his claim was disallowed, but he had since obtained a trade protection card. At the Appeal Tribunal he maintained that he was making Glauber salts, but, in answer to questions, he was unable to describe the minute details of their manufacture. He was nothing more or less than a glorified commercial traveller surrounded by a halo of verbiage not uncommon to the sect. The Tribunal should protest strongly against abuses like this, especially when engineers and men working in munition factories could not get protection cards. The Military Representative added that some men, if they had the gift of the "gab," could obtain the certificates after they had been turned down by the local and appeal tribunals. The Tribunal decided to communicate with the Government Department and the local officer responsible for issuing the cards, stating that unless there was some alteration in the mode in which the cards were being indiscriminately issued they would consider whether they should not suspend hearing any further appeals.

Exemption Applications.—At the Hampshire Appeal Tribunal, J. J. Vertue (37, married, Class A) applied for further exemption. In June, when two months was granted, he was told to bring a clear statement of his position at the next hearing. A letter was now produced from Captain Mayne, Chief Electrical Engineer, Aldershot Command, stating that applicant's partner, F. Burch, was solely and fully employed by the War Department on electrical services in that command. Vertue said he was now the sole managing director of the business. Captain Morley put in a letter from Major-General G. F. Ellison, in charge of administration, stating that certain work was now drawing to a conclusion. It could not conveniently be put out to contract, and for some time it had been carried out by labour supplied by Burch and Vertue at military contract rates, but it was necessary for the firm to constantly apply to the Tribunal for exemption, and to avoid this Mr. Burch and his men were taken on directly by the War Department. Captain Morley said that there were two partners, and he was asking that one should serve. A further two months was granted, no further appeal to be made without the leave of the Tribunal.

At the Perth Tribunal, the Warden of Trinity College, Glenalmond, appeared on behalf of the electrician at the College, who had previously been temporarily exempted. It was pointed out that the man was a discharged soldier, who had full charge of the electrical installation, and it had been impossible to get a substitute. Conditional exemption was granted.

At Camberwell Tribunal, Mr. J. L. Simon, consulting electrical engineer, of Herne Hill, appeared at the request of the Military Representative to show cause why his certificate of conditional exemption should not be withdrawn. He was 36 years of age, and passed for labour at home (C3). He stated that he was responsible for the running of the electrical plant of seven large water and gas undertakings. His certificate of conditional exemption was confirmed.

At Hastings, exemption held by W. A. Berryman (39, B1), controller examiner to the Hastings Tramway Co., was opposed by the Military Representative. It was stated that the man was now engaged entirely on night work, and that he was not fit for military service. The case was referred to the Special Medical Board.

At Watford, M. J. Connari (Class A), electrician, sought exemption on the ground that he was engaged in a certified occupation, and was the owner of a one-man business. He claimed to be the oldest-established electrician in the town, and put in letters from local firms showing that he was attending to their electric plant. As he was dissatisfied with his classification, the case was referred to the London Medical Board.

At Hove, a Military review was made of the case of the accountant and chief clerk (37, B1) at the Hove electricity works. He is the only male left in the office, but it was

urged by the Military that, having regard to his age and classification, he would be of more use in the Army. For the respondent it was asserted that on account of his health he was not fit for military duties. A fresh medical examination was ordered.

Wigan Tribunal had before them the case of 30 men engaged on the Corporation tramways. Lieutenant Pool stated that he had gone through the list with the manager, Mr. Buckley, and it was decided that three of the youngest men should join up, and that the others should be temporarily exempted until February 1st. This was acquiesced in by the Tribunal.

At Sevenoaks, the Electricity Co. appealed for J. H. Wickenden (31, B 2), cable jointer, and J. A. Shaw (30, A 2), engine fitter, who was invalided home with malarial fever in 1916. The manager stated that they were now running eight-hour shifts with three men. Wickenden was given conditional exemption, and the appeal for Shaw was refused.

In an appeal at Stratford-on-Avon by O. T. Kemp (33), electrician, it was reported that he was working four days per week at the electricity works, and that he had been given a protection card by the Ministry of Munitions. The appeal was respite *sine die*.

At Romsey, Colonel Ashley appealed for the retention of his electrician (28, C 2), and stated that he himself was engaged on War Office work. Exemption until October 1st.

At Reigate, the Surrey Asylums Visiting Committee appealed for J. L. Cochrane (34, B 1), electrical engineer at Netherine Asylum. As he is indispensable, the Military Representative assented to exemption until February 28th.

At Gillingham (Kent), the Corporation electric light department appealed for W. A. M. Paton (19), electrical engineer. Mr. A. D. Chalmers, borough electrical engineer, stated that it had been left to the Military to supply a substitute, and the one sent had had to return to hospital. The Military Representative observed that a number of women were now employed on switchboards, and Mr. Chalmers said: "Can you name one? If the Military authorities supply a substitute, I am quite prepared to let this man go, but if not, and they take him, I cannot guarantee a continuity of supply. This man is not only a switchboard attendant, he is a charge engineer." The Military Representative: I am sorry for the concern if they employ so young a man as charge engineer. Exemption, subject to substitution, was granted.

At Reading, an appeal was made by A. S. Sayers (32, B 3), electrical engineer, trading as the Felgate Electrical Co. He claimed to be in a certified occupation, and that he was more successfully occupied in his present capacity than he would be if he went into the Army. The Military Representative replied that applicant's age took him out of the certified list, and added that electrical engineers were badly needed in the Army. Three months were conceded.

BUSINESS NOTES.

Prohibited Swedish Exports.—The Swedish Government has now prohibited the exportation from the country of all electrical machines such as generators, motors, converters, and transformers, and also parts of such machines, incandescent and arc lamps, carbon and metal filaments, current regulators, telephone and telegraph apparatus, and electro-technical apparatus, such as X-ray machines, wireless telegraphy plant, &c.

Schaffer and Budenberg Shares.—The Public Trustee is inviting offers, under the Trading with the Enemy Acts, for the purchase in one lot of 3,000 ordinary £10 shares in Schaffer and Budenberg, Ltd., Broadheath, near Manchester.

Japanese Development.—An article, contributed to the Japanese Press by a University Professor, states that, as might be expected, the unusually large excess of exports over imports, and the consequent increase of specie in the possession of the nation, tended to stimulate Japanese enterprise to a remarkable extent. The total capital stock of various partnership and joint stock companies projected during the first six months of the present year, including capital increases of existing concerns, is estimated at nearly 560,000,000 yen, which exceeds by more than 100 per cent. similar projected investments during the corresponding period of any previous year. Of the 560,000,000 yen of new capital, nearly 190,000,000 yen are devoted to manufacturing industries, 112,000,000 yen to banking, 56,000,000 yen to mining, 41,000,000 yen to electrical undertakings, while the remainder is distributed among various enterprises engaged in cotton spinning, transport by rail and sea, insurance, business, commerce, &c. *Board of Trade Journal*.

Trade Inquiries.—H.M. Minister at Bogota, Columbia, reports that a British commission agent and manufacturers' representative at Cali wishes to represent a British commission house which could obtain any articles that his clients may require, including small electric motors, lamps, and supplies, to compete with German and American goods. The inquirer states that the trade in electrical goods, though small at present, owing to the fact that electricity has not long been installed in the Cali district, is bound to increase with the development of the country. Applications for his name and address should be made to the Department

of Commercial Intelligence, 73, Basinghall Street, London, E.C. 2. [Reference 322.]

Catalogues and Lists.—CENTURY ELECTRIC CO., St. Louis, U.S.A.—Sixty-four-page illustrated catalogue describing the design, construction, &c., of their single-phase, self-starting motors, $\frac{1}{2}$ to 40 h.p., repulsion start induction type, and illustrating their application to the driving of machines, &c., of many kinds.

NATIONAL X-RAY REFLECTOR CO., Chicago.—Circulars illustrating and discussing their reflectors for industrial electric lighting fittings, also the Curtis lamp adapter.

INTERNATIONAL TIME RECORDING CO. LTD., 57, City Road, London, E.C. 1.—Forty-eight-page publication illustrating examples of Def. Bundy, International and Rochester Automatic Time Recorders, and quoting testimonials of users.

Bankruptcy Proceedings.—WILLIAM PARSONS, 63, Parade, Leamington, late 66, Regent Street, Leamington, Warwick, engineer.—The Receiving Order in this matter was made on the debtor's own petition, and, according to the accounts prepared, the liabilities amount to £452, to meet which there are assets of £37, leaving a deficiency of £415. The debtor commenced to trade as an electrical engineer about 16 years ago, without capital, in partnership with F. E. Brown, at 46, Regent Street, Leamington, under the style of Brown & Parsons. The only capital was about £50 put in by Mr. Brown. The business was removed to 63, Parade, Leamington, after two years' trading, and, after a further three years, a dissolution of partnership took place. The whole of the liabilities and assets were taken over by Mr. Brown, with the exception of about £30 cash, and stock to the value of £100, which the debtor took. With this he immediately started a new business of his own at 66, Regent Street, Leamington, under the style of W. Parsons & Co. Mr. Brown continued to trade under the style of Brown & Parsons, at 63, Parade, Leamington, and in September, 1913, the business having been in the meantime converted into a limited liability company, under the name of Brown & Parsons, Ltd., he asked the debtor to assist in the reconstruction of the business by subscribing his name, with others, as joint and several guarantors of debentures of a new company to be formed for the purpose of taking over the business of Brown & Parsons, Ltd., which thereupon went into liquidation. This the debtor agreed to do without receiving any monetary consideration, and debentures to the extent of £600 were accordingly issued by the newly-formed company (Brown & Parsons (1913), Ltd.), with the debtor as one of four guarantors. At the same time the debtor's business was converted into a limited liability company, under the style of W. Parsons & Co. Ltd., the capital at that time being about £750, and debtor was allotted 750 £1 ordinary shares in the new company. For the purposes of obtaining additional working capital, debentures were issued for £300, and were guaranteed by the debtor and Mr. Brown. In consequence of the liquidation of Brown and Parsons, Ltd., the workmen attached to that business left, and were immediately taken into the employ of W. Parsons & Co., Ltd., and thereafter the whole of the orders received by Brown & Parsons (1913), Ltd., were executed for them by W. Parsons & Co., Ltd., with the result that the former company became indebted to the latter company in a continually increasing amount. The indebtedness amounted to £397 in April, 1915, and, owing to the inability of Brown & Parsons (1913), Ltd., to discharge such indebtedness, and the consequent effect on the business of W. Parsons & Co. Ltd., the position of affairs was placed before the debenture-holder, who commenced proceedings in the Chancery Division of the High Court, these proceedings resulting in the appointment of Mr. A. E. Mason, C.A., Dudley, as Receiver. Within a few days of the commencement of these proceedings, the debenture-holder of Brown and Parsons (1913), Ltd., appointed Mr. Mason Receiver in the matter. A new business was commenced in July, 1914, under the management of the debtor at 84, Tilton Road, Birmingham, under the style of the Birmingham Central Supply Co. for the purpose of carrying on a wholesale trade in electrical fittings, &c. Mr. Brown put in £200, the debtor £120; and the debtor's wife £80. The business was shortly afterwards converted into a limited liability company, under the name of the Birmingham Central Supply Co., Ltd. 120 £1 shares were allotted to the debtor, as consideration for the money provided by Mr. Brown and the debtor's wife debentures to the value of £300 were issued to the debtor's wife, who held them in part as trustee for Mr. Brown. The business was discontinued in 1916, the whole of the trade creditors being paid in full with moneys collected from the book debts. A new company was formed early in 1916, to take over the stock in trade of Parsons & Co., Ltd., Brown & Parsons (1913), Ltd., and the Birmingham Central Supply Co., Ltd., the style of this new company being Parsons & Hodges, Ltd. Debentures were immediately issued by the new company to the extent of £600, with the debtor as sole guarantor. In addition, the debtor became guarantor jointly with Mr. Brown in or about July, 1913, in respect of debentures to the extent of £800 issued by a company known as the Shipston Electrical Co., Ltd., which had been created and was then managed by Mr. Brown. This concern has since been wound up by Mr. Mason as Receiver for the debenture-holders, but the debtor states that it is not probable that any liability will fall on him in respect of this transaction. The debtor attributes his position to guaranteeing payment of debentures issued by Brown and Parsons (1913), Ltd., and W. Parsons & Co., Ltd. He first became aware of his position about six weeks ago, when he received notification that the assets of W. Parsons & Co., Ltd., were insufficient to pay the amount due to the debenture-holder.

PARFITT, G. J. T. J., consulting electrical engineer, Keynsham, near Bristol.—Supplemental dividend, 1s. 6d., payable September 12th, by the Official Receiver, at 26, Baldwin Street, Bristol.

U.S. Electrical Exports to Canada.—Figures are now available showing the foreign trade of Canada for the fiscal year ended March 31st, 1917. The total imports of electrical merchandise during that period were \$6,342,490, as compared with \$4,896,106 for the corresponding period a year previous. Of the 1916-17 total, \$176,700 came from the United Kingdom and \$6,149,342, or 97 per cent., from the United States. While these figures show that virtually the entire amount of Canadian electrical imports originated in the United States, they do not show the extent to which Canada depends on electrical goods manufactured under supervision of interests in the United States. Many of the larger manufacturers in the States have Canadian branch factories where electrical goods for Canadian consumption are produced. The goods are identical with those manufactured in the States. They are made in Canada so as to avoid import duty. *Electrical Railway Journal.*

Trade Announcement.—THE CONSOLIDATED PNEUMATIC TOOL CO., LTD., have taken premises at Egyptian House, 170, Piccadilly, W. 1, as the Government has commandeered their Palace Chambers offices. Telegraphic address: "Caulking-Piccy, London." Telephone: 9215 Gerrard (three lines).

Book Notices.—*Aims and Achievements.* The activities of the Society for Electrical Development, U.S.A., are described in this review of the Society's work which has just been issued. The booklet is a concise digest of what the Society is doing; it describes its endeavours to combine engineering, publicity, merchandising, advertising and field co-operation for the benefit of its membership and the entire industry. A graphic chart, which is a feature of the book, separates this work into three divisions—educational work with the public, investigation and educational work with other trades and industries, and trade development and sales promotion work with the electrical industry itself. In each of these fields the Society is doing important work, along lines not duplicated by any other organisation. Upon request, a copy of the booklet will be sent free to anyone interested. The address of the Society is United Engineering Societies' Building, New York.

"The Journal of the Junior Institution of Engineers" for September contains a list of 253 names of members serving with the Forces, of whom 17 have lost their lives. A useful paper on "Engineers' Non-Ferrous Alloys," by W. Rawlinson, summarises the properties, uses, and compositions of a large number of alloys.

"Electricity and its Applications" (the "Hawkins Electrical Guide") Nos. 1 and 6, New Brighton (Cheshire): Edwin A. Mansfield & Co. Second edition. Price 5s. per volume (10 volumes).

LIGHTING AND POWER NOTES.

Accrington.—The T.C. has appointed a Sub-Committee to inquire into proposed alterations at the electricity and destructor works, the object being to secure the more economical working of the two departments, and to be prepared with a complete scheme to anticipate the demands of the future. Councillor Welch asked, in view of the great losses in the electricity and tramway departments during the past year, approaching £12,000, if it would not be expedient to prepare an interim report as to profit and loss covering the six months from March last; but Alderman Higham, chairman of the Committee, said that a report for six months' working would show a greater loss in proportion than one at the end of the year, as all electricity works lost more or less money in the summer, which had to be recovered on the winter load.

Argentina.—The German Electric Light Co.'s operatives in Buenos Ayres struck on Tuesday night, last week. The Government promptly supplied naval stokers and adequate police protection. *Times.*

Australia.—The Electric Light Committee of the Sydney City Council has decided, by 5 votes to 3, to recommend that the city electrical engineer, Mr. Forbes Mackay, be authorised to visit America and Canada within the next few months, for the purpose of inspecting large electricity supply systems in these countries. It was pointed out that as soon as the necessary plant was obtained extensive additions would be carried out at the power house. The resolution included an item of £500 for travelling and other expenses.

The Sydney Electric Light Committee recently decided to acquire 3 acres of land offered by the Government on which to stock an emergency supply of coal, the present stock in hand being only 6,000 tons, or about two weeks' supply; it was also decided to hold in reserve 20,000 tons of coal, and a siding is to be constructed to enable the railway authorities to convey the coal direct to the new depot. *Sydney Daily Telegraph.*

The Quēanbeyan (N.S.W.) Municipal Council is considering the question of installing an electricity supply system in the town, and a poll of ratepayers is to be taken on the proposal. It is intended to secure a bulk supply of electricity from the Federal Capital power house at Canberra, and the Home and Territories Department has offered to supply for a term of 20 years at 6d. per unit for lighting and 2d. per unit for power, with a minimum charge to the Council of £250.

The South Perth (W.A.) municipal electric lighting scheme is expected this year to show a margin of profit after providing for interest, depreciation, and other charges. The town clerk reported that the Council could save 2d. per unit on the cost of generation by purchasing in bulk from the Perth electricity department at 2½d. per unit; this would enable the Council to supply local consumers at 6d. per unit and still show a margin of profit. The electric lighting account had a credit balance at its bankers of £1,600, and by utilising a portion of this and selling the present meters and unnecessary plant it would be possible to effect the change-over without raising any loan; he urged the Council to make an agreement without delay. *Commonwealth Engineer.*

An Order in Council has been issued authorising the City Electric Light Co., Ltd., to supply electricity within the extended area of the city of Brisbane.

The Buninyong (Vic.) Shire Council has asked the Electric Supply Co. of Victoria to erect a transmission line in connection with the Ballarat undertaking to Buninyong, some 10 miles distant, to supply the town with electricity. The company has informed the Council that it is intended to increase the capacity of the works at the close of the war, but until then it cannot entertain the application. *Tenders.*

Bolton.—**SALE OF FITTINGS.**—The Corporation Electricity Committee passed a resolution in favour of the establishment of a separate staff for dealing with electricity fittings, and a deputation was appointed to confer with the Gas Committee as to carrying out the proposal. At the Town Council meeting it was denied that the Gas Committee had intimated to the Electricity Committee that it should leave the gas offices. Councillor Crowther, however, said that when the Electricity Committee made a similar proposal two years ago, the Gas Committee insulted the former by laying it on the table. It was absolutely necessary that the two departments should be divided; there was considerable feeling between them, and the further apart they were, the better. The minutes were approved. A letter was read from the Bolton, Farnworth, and Horwich Building Trade Employers' Association stating that the Electrical Trade Section of the Association had been informed that the Electricity Committee proposed opening premises for the display of electrical fittings, and submitting that if such a course were adopted it would have a serious effect upon the private trader. No action was taken on the letter.

Bootle.—**PROVISIONAL ESTIMATES.**—At the last meeting of the T.C., the Electric Power and Lighting Committee recommended the approval of provisional estimates amounting to £71,000 to be incurred after the termination of the war on the execution of works and the supply of plant in connection with the electricity undertaking, and that application be made to the L.G.B. for sanction to borrow this amount. An amendment was carried, however, that expert opinion and advice should be obtained before the scheme was entered into.

Bradford.—**MAINS EXTENSION.**—The Electricity Committee has authorised the extension of mains across Harewood Street and along Browning Street, including transformer equipment, at a cost of £600.

Doncaster.—**STRIKE NOTICE.**—Nearly 300 Corporation employes at Doncaster—members of the National Amalgamated Union of Labour—tendered a week's notice on Thursday last week, owing to their demand for an extra shilling a day, in addition to the 8s. per week advance already given, not being met. The men concerned include gas workers, electricity and tramway men, as well as other departments, but not the drivers and conductors of the trams. To grant the demand would cost the town £5,000 per year, and if the grant were made to all the Corporation employes it would cost £8,000, equal to an eight-penny rate. As the notices were handed in despite the fact that the matter had been referred to the Committee on Production, the Corporation decided to take no action.

Dover.—**BULK SUPPLY.**—At a special meeting of the Electricity Committee, a communication from the town clerk of Sutton Coldfield, stating that he was to give evidence before the B. of T. on September 3rd, and asking for the views of the Committee on the subject of electricity supply, was considered. It was decided that he should be requested to state that the Corporation had under consideration the advisability of extending its undertaking by the erection of another station outside the borough, with a view not only of meeting the needs of the existing area at the present time and in the near future, but of supplying a larger area; and to point out the position of the Corporation with regard to the capital already expended, and the detrimental financial result that might accrue in the event of the Corporation not being able to adopt a scheme of this nature.

Eastbourne.—**YEAR'S WORKING.**—The report of Mr. Brydges, the borough electrical engineer, on the last year's operation of the electricity department, shows that the output sold increased from 1,773,737 units in 1915-16 to 1,944,528 units in 1916-17, approximately 10 per cent. The total income for the year amounted to £31,212; working expenses absorbed £16,768, leaving a gross profit of £14,444. After meeting capital charges of £13,601, there remains a net profit of £843, as against a deficit of £911 in the previous year. This satisfactory result has been achieved despite the increase in the price of coal for four months of the year of 20 per cent. for an inferior grade of coal, owing to the great economy effected by the new Ljungström turbine.

Foleshill.—**ELECTRIC PUMPING.**—The Bedworth Waterworks Committee has under consideration a scheme for installing electric plant at the waterworks for pumping purposes.

Gillingham.—**TAR OIL.**—The Electricity Committee has decided to adapt the two engines at the electricity works for use with tar oil, at a cost of about £250. The cost of tar oil being 11s. per ton against the present price of fuel oil of 21s. 3d., the saving to the end of March next would be £700 to £800, after paying for the cost of the apparatus and installation.

Ireland.—**WATER POWERS.**—Some of the Irish local bodies are supporting the request of the Dublin Section of the Institution of Civil Engineers to the Board of Trade Electrical Committee to take steps to ascertain the places in Ireland where water power is obtainable, and the amount of power at each place, together with data giving the volume of water at different times of the year.

At the annual Conference in Limerick of the Irish Municipal Authorities' Association, a letter was read from Mr. J. F. Crowley, suggesting that the Dublin, Belfast, and Cork Municipalities should nominate each a witness to give evidence before the Board of Trade Committee on the extension of electrical power. It was pointed out that the matter was of more importance for small urban districts than for large cities.

WIRING POWERS.—The Association of Irish Municipal Authorities passed a resolution asking that power should be given to municipal authorities having electrical undertakings to wire houses and premises, and to spread the cost of the work over a period.

Launceston.—**PRICE INCREASE.**—Consumers of the Launceston Electric Supply Co., Ltd., recently met to discuss the company's proposal to apply to the B. of T. for leave to charge more than the present maximum price for electricity. The meeting was adjourned for representatives of the company to attend and explain matters.

Leeds.—**WAR BONUS.**—An award of a further 2s. per week war bonus, on top of the existing 7s., to members of the General Workers' Union in the electricity and gas departments of the Corporation, has been extended by the City Council, on the recommendation of the General Purposes Committee, to all Corporation officials and workmen whose salaries or wages do not exceed £250 per annum. It is retrospective to August 1st. Alderman Wilson told the City Council that the Tramway Men's Union officials had agreed to his suggestion that, unless untoward circumstances should arise, the award should be considered final.

London.—**CONFERENCE ON ELECTRICITY SUPPLY.**—The Hammersmith Electricity Committee has received a letter from the L.C.C. referring to the conference held in May, 1915, between its Special Committee on London Electricity Supply and representatives of the City Corporation, Metropolitan B.C.'s, and the London electric supply companies upon the question of the supply of electricity in London, and stating that, in the opinion of its Special Committee, the appointment by the B. of T. of the Electric Power Supply Committee and other circumstances had rendered it desirable that a further conference should be held at an early date, and asking if the Council had any suggestions to make on the subject. The Committee pointed out that for some time past the conference of local authorities owning electricity undertakings in Greater London had been in consultation with the Metropolitan supply companies with the object of formulating a scheme for linking-up, in order to give effect to certain suggestions of the B. of T. The last-mentioned conference was representative of the majority, if not all, of the electricity undertakings in Greater London, and a Joint Committee of the Engineers had a report in course of preparation which it was proposed to present to the conference at an early date. Meanwhile, the Committee had received a letter from the hon. secretary of the Conference inviting the Council to attend a further Conference on September 5th, to consider the following resolution adopted by the Executive Committee of the Engineers' Conference, it being felt that, although the Engineers' Conference was called for the purpose of reporting upon ways and means of giving effect to the suggestion contained in the above-mentioned letter from the Board of Trade, as the Board of Trade had extended the scope of its proposals, the reference to the Engineers' Conference should be extended accordingly, viz.:—That as the Board of Trade Electric Power Supply Committee now sitting has been constituted without any representative of the electrical interests—municipalities, purchasable companies, or railways—in Greater London, it is desirable, in the opinion of the Executive Committee of this Conference, that steps should be taken to place the financial and statutory position of all these electrical undertakings before that Committee.

WAR WAGES.—The Hammersmith Establishment Committee recommends the B.C. to grant the latest award of the Committee on Production of 3s. per week to eight fitters and 1s. 6d. per week to three youths in the electricity department, as from August 1st.

LINKING-UP SCHEME. The Hammersmith, Battersea, and Fulham Councils have decided to submit the matters in dispute between the three Councils with regard to the terms for the proposed interconnection scheme, to an arbitrator to be appointed by the B. of T., whose decision is to be final.

Maidstone.—The T.C. has applied to the L.G.B. for leave to borrow £1,800 for mechanical coal-handling plant at the electricity works. The Ministry of Munitions has granted a priority certificate, and the plant is estimated to save £350 a year.

Oldham.—The latest return of the Corporation Electricity Committee shows an increased output on the corresponding period of last year, a reduction in the coal consumption, the amount per unit being given as 2.95 as against 3.30 lb., and a higher efficiency, 78.67 per cent. as against 78.01.

Portsmouth.—**PRICE INCREASE.**—The Electric Lighting Committee recommends increased charges of 20 per cent.—which will make a total increase of 45 per cent.—for power and heating, and a 10 per cent. increase—making 30 per cent. in all—for lighting, from the end of December.

The Committee has secured the promise of a P. I certificate to enable the work on the new turbine to be carried out with all possible speed.

Rochdale.—Satisfactory progress in the electricity undertaking was reported by Sir James E. Jones at the T.C. meeting. He pointed out that a year ago only four of the eight Lancashire boilers and two of the six water-tube boilers were in running condition, and there were many other troubles; from August to December, 1916, they were only able to give consumers about half the supply they required, and some consumers had to be stopped three and four times a week. He was glad to say this was past history. There were only six stoppages from April to July, and only one since then. During the last seven weeks the works had turned out 50,000 units a week more than a year ago, equal to an increase of 15 per cent., and the total increase since April 1st was half-a-million units. They were still waiting for certain plant, and for months they had been working without any spares, liable to stoppages, and working up to their utmost capacity. It would be early next year before the alterations and improvements showed their full value in economical working. Mr. F. H. Rudd had practically overcome the difficulties, and the Committee unanimously recommended his appointment as chief electrical manager at a salary of £400, rising to £500 in two years. The appointment was approved.

Sheffield.—**NEW PLANT.**—Extensions of mains are to be carried out at an estimated cost of £7,100. Of the total, £5,202 are to be spent in extensions to Messrs. Kayser, Ellison & Co.'s works. A plot of land adjoining the Neepsend power station is to be purchased at £125. The Finance Consultative Committee has approved proposals of the Electric Supply Committee with regard to spending £560,000 on the Blackburn Meadows power station, installing machinery, &c.

Swansea.—The Electric Lighting and Tramways Committee has received a communication from the Amalgamated Society of Engineers, asking that the wages of the engineering employees at the generating station be advanced 3s. per week, in accordance with the latest award. It was decided to grant 3s. per week to two of the men, and to refer the cases of the other three to the Council to decide. The new water-tube boiler about to be erected at the generating station is to be installed in a temporary position pending the Government permission to allow the Corporation to proceed with the main reconstruction scheme, which involves a complete readjustment of the boiler house.

Walsall.—The engineer is to prepare a schedule of the plant at the Wolverhampton Street works about to be placed out of commission, and to advertise for tenders for the purchase of such plant. An appeal is to be made against the assessment of the Wolverhampton Street works, on the ground that since the Birehills generating station commenced to operate, the former station has been over-assessed.

West Hartlepool.—**PRICE INCREASE.**—At a meeting of the T.C. on the 4th inst., a recommendation of the Electricity Committee that the increase recently made in the charges for energy to ordinary consumers should be 15 per cent., instead of 10 per cent., was agreed to.

Wolverhampton.—**LOANS SANCTIONED.**—The L.G.B. has sanctioned the borrowing of £2,064, £56,452, £9,218, £8,387, and £2,000 for the purposes of the electricity undertaking; the Board has also sanctioned loans for £178 and £476 in connection with the same department.

YEAR'S WORKING.—The report of the year's working of the electricity department to March 31st last shows gross revenue £74,732, an increase of £8,778 on the previous year; of this amount, power supply shows an increase of £10,315, while the supply for lighting shows a decrease of approximately £700. After deducting working expenses, there remains a gross profit of £27,796: interest, sinking fund, and income-tax charges absorb £25,669, leaving a net profit of £2,127, which has been carried to reserve, which stood at £14,944 at the end of the financial year. The units sold amount to 17,161,275, as compared with 15,280,697 the previous year, an increase of 1,880,578 units, or 10 per cent. during the year; the equivalent of 15,479 32-watt lamps were connected to the mains, including 572 n.p. additional motors.

TRAMWAY AND RAILWAY NOTES.

Aberdeen.—**YEAR'S WORKING.**—The report of the year's working of the Corporation tramways to May 31st last shows that the total revenue was £100,073, an increase of £5,745 on the previous year. Working expenses amounted to £61,026, an increase of £5,828, and after payment of £27,283 for interest and sinking

fund and other charges, there was a net profit of £8,763, as against £9,697 in 1916 and £11,000 in 1915. Of this £2,921 has been allocated to the relief of rates and £5,842 carried to the reserve account. During the year £623 was expended out of capital, making a total capital expenditure of £369,392. The depreciation and renewal funds stand at £177,666, the sinking fund at £63,241, and the reserve account at £49,113, making a total of £290,020. Mileage run 2,033,793, an increase of 65,178 miles; electricity used 2,543,875 units, an increase of 62,491 units, at an average cost of '839d., as against '841d. in the previous year. During the year 28,623,659 passengers were carried, as compared with 26,593,730 in the previous year.

Anstralia.—According to the *Sydney Evening News*, included in the cargo of the s.s. *Mongolia*, which was sunk, was a large quantity of material intended for use in connection with the Victorian railway electrification scheme. The Victorian Government has restricted its programme for the electrification of the railways, but intends to proceed with certain work on suburban lines, which will be further delayed by the loss of necessary material.

Blackburn.—The Lancashire and Cheshire Tramways Managers' Association has been invited by the Electricity and Tramways Committee of the Blackburn Corporation to hold its next meeting in November at Blackburn, and Councillor Higham (vice-chairman) and Mr. Cowell (tramway manager) have been authorised to make the necessary arrangements.

Bradford.—The tramway service is suffering considerable dislocation, owing to the large number of cars which have to lie up in the sheds awaiting repairs, on account of the shortage of both labour and materials. It is understood that one car has been practically taken to pieces to provide parts for the repair of other cars.

Brentford.—**RATING APPEAL.**—The Assessment Committee of Brentford Union has had under consideration an appeal from the London United Tramways Co. for a reduction of their assessment which was fixed some years ago, and confirmed by the Divisional Court and the Court of Appeal, at the following figures:—Gross, £40,537; rateable, £10,302. The grounds of the company's appeal were depreciation and falling-off in the patronage of the lines. The Guardians' assessor (Mr. R. C. Lowe) reported that the company asked for a great reduction—practically to nil. The Guardians were unable to agree to the new figure. The official statement prepared for the Receiver for the debenture-holders showed that the company had been unable to set aside much for repairs of rolling stock. The consideration of the matter was not concluded.

Glasgow.—**TRAFFIC RETURNS.**—For the first three months of the current financial year of the Glasgow Corporation tramways, commencing on June 1st, the receipts were £348,860, as compared with £308,221 for the corresponding period of last year. The number of passengers carried was 104,380,398, as against 94,543,964 last year.

Manchester.—**TRAFFIC CONGESTION REPORT.**—The City Council, without committing itself to the details of the schemes, has approved the general principle of the report of the Traffic Congestion Committee. Ald. Wilson, who said that nothing could be done at present, because of the Government ban on expenditure, thought the provision of the tramway terminals would be the first step which the Council would be asked to sanction, as it would relieve the traffic in the centre of the city by 50 per cent. Over 13 million more people were carried by the Manchester tramways last year than in the previous year.

Sheffield.—Estimates of proposed schemes are to be considered for the lowering of the road under the Midland Railway Co.'s bridge at Brightside, so as to enable double-decked instead of single-decked cars to be run along this route. Negotiations have been opened with the Urban Electric Supply Co., Ltd., Glossop, for the sale to the company of single-decked cars.

U.S.A.—**ELECTRICAL VEHICLE PROGRESS.**—It is estimated that there are now over 250 industrial electric motor vehicles in use in Washington, U.S.A., a city which has always been regarded as an ideal district for electricies owing to its level and good roads.

TELEGRAPH AND TELEPHONE NOTES.

Canada.—The new Canadian National Press Service will operate 12,000 miles of leased wire, connect Sydney, Cape Breton, with Victoria, British Columbia, and employ 90 telegraphists. By the new organisation Canadian newspapers in the Atlantic and Western Provinces are relieved of dependence upon American news agencies. The enterprise is made possible by the active sympathy of Sir Robert Borden and a Federal grant of \$50,000 (£10,000).—*The Times*.

German News Service.—According to the *Svenska Export*, the dependence of German mercantile interests on Lloyd's for marine information in peace time, and the absolute cessation of this supply since the outbreak of the war, have led to the formation of an organisation intended to provide the necessary informa-

tion independently of British sources. For this purpose, and to free Germany from the network of British submarine cable systems, wireless telegraphy will be employed on a large scale.

Telephoning from a Moving Train.—Successful experiments with a telephone apparatus installed on a railroad car were carried out recently on the Canadian Government Railways, writes the United States Consul at Moncton, N.B., Canada. Reports of the tests state that the communication established was in every way satisfactory, although the train was in motion. There was no difficulty in hearing distinctly every word of the messages exchanged. The experiment was tried on a double-track line where the rails were properly bonded for the block signal system, but it is claimed that equally good results can be obtained on any track where the rails are similarly bonded without regard to the presence or absence of a block signal installation. *T. and T. Age*.

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—**MELBOURNE.**—October 10th. Department of the Navy. Pumping plant and equipment for the Commonwealth Naval Dockyard, Cockatoo Island, Sydney. Specifications from the Director of Navy Contracts, Melbourne.

Dublin.—September 13th. Electricity Supply Committee. Supply and installation of one Green's economiser. See "Official Notices" to-day.

Kirkcaldy.—October 2nd. Corporation. Converting plant and switchgear. See "Official Notices" to-day.

London.—**H.M. COMMISSIONERS OF WORKS.**—September 18th. Twelve months' supply of incandescent electric lamps. See "Official Notices" to-day.

Manchester.—September 17th. B. of G. Installation of a telephone system at the offices, All Saints. Particulars from Mr. J. Macdonald, Clerk.

Warrington.—September 19th. Supply, &c., of electrical goods at the Workhouse, Warrington, or Cottage Homes, Padgate. Mr. A. Bottomley, Clerk to the Guardians, Bewsey Chambers, Warrington.

CLOSED.

Bradford.—Electricity Committee. One 800-K.V.A. transformer: Brush Electrical Engineering Co., Ltd.

Kettering.—**U.D.C.** Tenders received for '06 feeder cable, feeder pillar, &c.:—

Siemens Bros. & Co., Ltd.	.. .. .	(accepted)	£1,737
Johnson & Phillips, Ltd.	.. .. .		1,764
Henley's Telegraph Works Co., Ltd.	.. .. .		1,788
B.I. & Helsby Cables, Ltd.	.. .. .		1,790
Callender's Cable & Construction Co., Ltd.	.. .. .		1,827
W. T. Glover & Co., Ltd.	.. .. .		1,839
Macintosh Cable Co., Ltd.	.. .. .	(Incomplete)	1,753
Pirelli-General Cable Co., Ltd.	.. .. .	(Incomplete)	1,103

London.—**HAMMERSMITH.**—Electricity Committee:—

W. H. Bowater & Co., Ltd.—150 tons per week for 12 months of Holly Bank Welsh slack coal, at 21s. 3d. per ton at Shepherds Bush Station, or 23s. 6d. per ton alongside the works in barges.

Repairs to coal conveyor:—

F. Bird & Co.	.. .. .	(accepted)	£59	Lucy & Co.	.. .. .	£79
Cadogan Iron Works	.. .. .		63	Wicks & Dale	.. .. .	80
C. Jenkins & Co.	.. .. .		£89			

Repairs to boiler insulating valves:—

Devrance & Co.	.. .. .	£101	A. Turnbull & Co.	.. .. .	£106
J. Hopkinson & Co., Ltd.	.. .. .		Glenfield & Kennedy	.. .. .	198
	(recommended)	147			

Baths and Wash-houses Committee. Stand-by motor for use in the event of a breakdown:

Marryat & Place	.. .. .	£71	Marshall & Plumtree	.. .. .	£84
Marryat & McNaught	.. .. .	73	Victoria Electric Co.	.. .. .	80
Langdon Davies Elec. Motor Co.	.. .. .		T. Barton & Co.	.. .. .	84
	(accepted)	71	Drake & Gorbam	.. .. .	98
			Rubery, Owen & Co.	.. .. .	£125

Sheffield.—**T.C.** Electricity Department:—

Staveley Coal and Iron Co., Ltd.—2,000 four-inch c.i. cable pipes.
British Electric Plant Co., Ltd.—Two 6-stage centrifugal boiler feed pumps.

Sunderland.—**T.C.** Fairgrieve & Co.—Rewinding armature of 250 kW. motor generator at Dunning Street Works.

Wolverhampton.—Corporation Electricity Committee:—

Alley & McLellan.—Valves for pumping plant, £226.
Rees Roturbo Manufacturing Co., Ltd.—Two motor-driven pumps, £384.
Electric Construction Co., Ltd.—Motors for new plant, £1,272.
Film Cooling Towers, Ltd.—Cooling towers, £5,144.
John Spencer, Ltd.—Steam feed water pipes, £280.

FORTHCOMING EVENTS.

Institute of Metals.—Wednesday, September 19th. At 4 p.m. At Burlington House, Piccadilly. Annual autumn meeting.

Iron and Steel Institute.—Thursday and Friday, September 20th and 21st. At 10.30 a.m. At the Institution of Civil Engineers, Westminster, S.W. Annual meeting.

Municipal Tramways Association (Inc.).—Thursday and Friday, September 20th and 21st. At 11 a.m. At the Savoy Hotel, Blackpool. Annual general meeting.

NOTES.

The Evening Press and Industrial Unrest.—We have heard a great deal during the past six months concerning industrial unrest. The Government, after investigating the causes by means of District Committees, decided to adopt certain measures designed to remove them. We think it is a great pity, therefore, that irresponsible evening newspapers, which probably would have far smaller circulations but for their efforts to be sensational, are allowed to publish disturbing announcements respecting new and drastic National Service schemes which will "rope in" every man not already with the Forces. Premature and unofficial statements of this kind, which are officially contradicted in the next morning's papers, should be deprecated most strongly. The Censor is very particular about some things—Why does he allow this?

National Insurance (Unemployment) Acts, 1911-1916.—The following is a further decision of the Umpire. Contributions are payable in respect of:—

2,387 X. Workmen engaged in attending automatic machines for welding wire together to form the reinforcement for concrete.

Educational.—UNIVERSITY OF LONDON, Goldsmiths' College, New Cross, S.E.—Engineering Department. The new session commences Monday, September 24th. Full particulars are given in our advertisement pages to-day.

BATTERSEA POLYTECHNIC.—The new session opens on September 25th. Special classes are provided for the training of men and women munition workers, courses for women in engineering tracing, and free courses for disabled soldiers and sailors in engineering, electrical testing and switchboard work, &c.

Copper for Cables.—With regard to the regulations issued by the Ministry of Munitions Priority Department, dated June 2nd, 1917, governing the manufacture and supply of insulated copper wire and cables, the arrangement made by which for a period of three months a monthly ration of copper for insulated wire or cable for repairs and maintenance for definite classes of work was placed in the hands of the Cable Makers' Association for distribution, came to an end on August 31st. Since this arrangement was made, the Copper Department has allowed copper to be supplied for repairs and maintenance to industrial machinery under the customer's own "B" certificates.

The Cable Makers' Association therefore suggested to the Priority Department that it would simplify matters to discontinue the rationing arrangement, and we are informed by Mr. Llewelyn B. Atkinson, secretary to the Association, that this procedure has been adopted.

Lead: Ministry of Munitions Order.—Last week, says the *Times*, the Minister of Munitions gave notice of his intention to take possession as from September 1st until further notice of all pig lead, whether virgin or remelted, old and scrap lead, and lead residues, situated in the United Kingdom, excepting all such lead as may be in the possession of or due under an existing lawful contract in writing for future delivery to a manufacturer for use in such manufacturer's own works, and all such lead as may be specially excepted under the written authority of the Minister of Munitions. The lead of which possession is taken until further notice will be paid for by the Minister of Munitions on delivery. A full copy of the Order will be found in the *London Gazette* for September 7th.

Factory Operations Delayed by Workers.—At Smethwick, on September 6th, several men, by occupation ash-wheelers and bunker men, were summoned at the instance of the Shropshire, Worcestershire, and Staffordshire Electric Power Co. for neglect of work. According to the *Birmingham Post*, Mr. Chapman, for the prosecutors, explained that the men absented themselves from work on various days in August, and the resultant loss was no less than £300. On one occasion the conduct of the defendants resulted in six or eight large works being compelled to stop, and 1,000 hands were unable to work. Defendants contended that on occasions seven men had to do the work of nine, and they were not physically capable of doing it. The magistrates ordered each defendant to pay £5 damages and 12s. costs, remarking that discipline must be maintained. It was stated that if the men returned to work and worked regularly the company would sympathetically deal with the question of damages.

Belfast Electrical Strike Ended.—At a recent sitting of the General Munitions Tribunal for Belfast and North-East Ireland, the Belfast Corporation summoned 32 employees in the electricity department for alleged contravention of the Munitions of War Act, 1915, by taking part in a strike in connection with

a difference as to terms or conditions of employment, without such differences having been reported to the Board of Trade and 21 days having elapsed from the date of such report, and said differences not having been during that time referred to the Board of Trade for settlement.

Mr. A. J. Lewis, who appeared for the Corporation, explained that, in the opinion of the Corporation, the case was, perhaps, the most serious that had come before the Tribunal since it was called into existence. The 30 defendants were employed in the electricity or the electric power department of the Corporation. That was a separate and distinct department of municipal enterprise, with management of its own, and with internal arrangements of its own. It was not pretended by the men that they had any grievance or any cause of complaint against the Corporation. Their wages were good, their hours of labour reasonable, and their periods of rest abundant. They formed the idea, however—a wholly erroneous idea—that other employees in the Corporation, employed in an entirely different department—namely, the tramway department—had a grievance; and although they had no cause of complaint themselves they had, in sympathy with the grievance of other men, thrown down their tools at a moment's notice and gone out on strike. A constant supply of electricity was necessary not merely for the lighting of the immense industrial works in the city, but many of them were driven by that power, and, of course, if it was withdrawn, the consequences might amount to almost a catastrophe. He did not need to point out how much greater the catastrophe would have been in France and Flanders if the supply of munitions were diminished in the slightest degree. The only notice the men gave was in a telegram that was addressed to the Town Clerk, City Hall, and sent at 11.30 p.m. on August 23rd, which stated:—"All members of Electrical Trades Union are on strike as from 6.30 a.m., August 24th, owing to tramway manager's action in reducing wages." That was clearly in contravention of the Act, which provided that they must report their differences to the Board of Trade and allow 21 days to elapse from the date of such report.

Mr. T. W. Bloxam, manager of the electricity department, gave formal evidence.

After an adjournment and consultation, Mr. Lewis announced that the Tribunal would not be further troubled with the case, as the defendants had agreed to go back to work unconditionally.

The order of the Court was that the men should go back to their work that morning, and continue at their work until such time as their cases were finally disposed of by the Tribunal. The personal undertaking of the men to this effect was accepted.

Electric Signals for Constables.—In the crypt at Leeds Town Hall on Thursday last week, a demonstration took place, before the superintendents, inspectors, and sergeants of the Leeds Special Constabulary, of an electrical signalling apparatus for constables on point duty at night. The inventor is Mr. Whiteside, electrician at the Grand Theatre, who is himself a special constable. It is a light dry battery, strapped to the lower part of, the back by a belt, with cross-over straps in front. From the battery three flexible wires run, one to a red electric bulb in the centre of the shoulders at the back, to safeguard the constable at the rear, and the two others to the hands, one of which carries a red light and the other a white one, so that the constable may hold up traffic with the red and wave traffic forward with the white. The wires to the hands are attached to two metal rings on the thumb and forefinger, which, when brought into contact, light a metal filament bulb in the centre of the hand. Six of these outfits are to be supplied for special constables on point duty during the first of the dark evenings now approaching, and, if the trial is successful, the system is to be applied to the regular police.

Volunteer Notes.—COUNTY OF LONDON VOLUNTEER ENGINEERS (FIELD COMPANIES).—Headquarters, Balderton Street, Oxford Street, W. 1.

Orders for the week, by Lieut.-Colonel C. B. Clay, V.D., commanding:—

Officer for the Week.—Second Lieut. E. A. Ullman.

Monday, September 17th.—Technical instruction (searchlight) for No. 3 Company, Right Half Company, at Regency Street. Drill, No. 3 Company, Left Half Company. Signalling Class, 6.30. Recruits' Drill, 6.30.

Tuesday, September 18th.—Physical drill and bayonet fighting.

Wednesday, September 19th.—Drill and elementary bridge construction, for No. 1 Company, Left Half Company.

Thursday, September 20th.—Drill and elementary bridge construction for No. 2 Company, Left Half Company. Signalling Class, 6.30. Ambulance Class, 6.30.

Friday, September 21st.—Technical instruction (searchlight) for No. 3 Company, Left Half Company, at Regency Street. Drill, No. 3 Company, Right Half Company. Recruits' Drill, 6.30.

Sunday, September 23rd.—Commandant's Parade for technical instruction at Esher. Parade at Waterloo Station, 8.45 a.m., opposite No. 10 Platform. Uniform, haversacks, and water-bottles to be worn. Mid-day rations to be carried. Compulsory for "A" and "B" men.

(By order) MACLEOD YEARLEY, Capt. and Adjutant.

Tramway Allotment Holders.—A successful show of allotment produce was made by the employees of the Bradford city tramways. There were two sections, one for the produce of experienced gardeners and the other for war-time allotment holders only. There were 132 entries in the one and 131 in the other. Much good produce was displayed. The lady supervisors of the tramways provided a special prize in the shape of a rose bowl, and other prize-givers were Sir James Hill, Bart., M.P., and Mr. C. J. Spencer, the tramway manager. The show was opened by Mr. Enoch Priestley, chairman of the Tramways Committee, and all the produce was subsequently sent to the local war hospital.

Exports to China.—The *London Gazette* for September 11th contains names of further bodies and persons to whom exports to China may be consigned.

Lightning Storm.—On Wednesday evening last week an electric storm of exceptional violence was experienced in London and the surrounding districts. The lightning played in vivid flashes for four hours, and was accompanied by heavy peals of thunder and torrential showers of rain. Floods resulted in the S.W. area, and caused much damage to houses and gardens. Several buildings were struck by lightning.

Appointments Vacant.—Station engineer (60s.) and engine driver (40s.) for the oil-driven power station in the Northern Command; assistant (temporary) to take charge of the medical electrical department, including installation work, of the Royal Baths, Harrogate; chief assistant engineer (£230) for the Chesterfield Corporation Electricity Department; assistant lecturer and demonstrator in electrical engineering (£200) for the Battersea Polytechnic. See our advertising pages to-day.

Our Commercial Intelligence.—The Council of the Association of Chambers of Commerce of the United Kingdom regard the proposals put forward by the Board of Trade and the Foreign Office on commercial intelligence as a "compromise," which, while open to objection, is a step in the right direction. They hold that it affords a foundation upon which other reforms may be based, and that it does not preclude development in the direction of a Ministry of Commerce.

Chambers of Commerce and Banking.—According to the *Times*, the Council of the Association of Chambers of Commerce has passed a resolution urging that as the revision of the charter of the Bank of England is likely to come before Parliament in the near future, the operations and functions of the Bank of England should be referred for investigation by a Government Committee appointed for the purpose of inquiring into the position of the Bank—(a) As the national bank of the Empire; (b) as a possible closer co-operator with the banking institutions of the country in promoting trade and commerce at home and overseas.

Coal Prices.—An Order has been prepared by the Controller of Coal Mines for the purpose of regulating the charges made by coal factors and merchants. The prices chargeable by the owner of the coal at the pit's mouth are already controlled by the Price of Coal (Limitation) Act, and factors' and merchants' charges have for the past two years been the subject of voluntary arrangement between the merchants and the Board of Trade or local authorities, which have, on the whole, been successful in maintaining prices at a reasonable level. In certain cases, however, the number of which is not large, relatively speaking, complaints have been made from which it is clear that excessive charges have been made, and the Controller of Coal Mines has taken the opportunity afforded by the introduction of the Coal Transport Reorganisation Scheme on Monday last to cancel all contracts for coal for inland consumption on that date, so that there shall be a general review of colliery companies' and wholesale merchants' prices.

For the purpose of this review of prices, the Controller has addressed to the collieries a series of instructions dealing with certain points which have from time to time been the subject of disputes between sellers and purchasers, and the Wholesale Coal Prices Order issued on September 5th specified the maximum charges which factors and wholesale merchants shall in future be entitled to make.

Particular attention is called to the fact that in order to avoid interruption of supplies as a result of the general cancellation of contracts, it is laid down in the Order that deliveries shall in all cases continue precisely as if the contract were in existence. It is also provided that in no case shall there be any increase in price without the consent of the Controller.

The Order referred to above contains the following provisions:—

1. The price at which a factor or merchant may sell coal in railway wagon or large load, or cargo, to a consumer or to a retail coal merchant for resale by him to consumers shall, except as hereunder provided, not exceed the pit price chargeable by the owner of the mine at which the coal was produced, or in the case of washed fuel, the price chargeable for the fuel at the washery by the owner of the fuel by whom, or on whose behalf it was washed, in addition to the actual cost of transport (in which cost no charge shall be made by the seller of the coal in respect of the office expenses, salaries, or other overhead charges or loss in handling) by more than the following amounts:—

Coal purchased by railway companies in Great Britain (not for consumption on locomotives)	6d. per ton
Coal consumed in national factories	6d. "
Coal consumed in gas and electric supply undertakings in Great Britain	9d. "

All coal sold for consumption in Ireland, 1s. 3d. per ton. Where coal sold direct to a consumer not having rail or wharf accommodation, who makes his own cartage arrangements, is delivered in railway wagon by the factor or merchant in quantities less than 30 tons, the amount chargeable in addition to the price at pit or washery, and the transport charges as above defined, shall be 2s. per ton, unless the consumer has ordered not less than 500 tons of the coal in question for delivery over the following 12 months.

Where coal is dealt with by more than one factor or merchant before reaching the consumer or retail merchant, the above amounts shall be divisible between the different factors and merchants; and each seller shall at the time of the sale inform the purchaser how much of the above amounts is included in the price, in order that the maximum price may not be exceeded.

In the case of washed fuel, where loss of weight in transit is borne by the factor or merchant, a charge may be made by the

factor or merchant in respect of such loss by way of addition to the price per ton at which the fuel is sold to the consumer, not exceeding in any case 2 per cent. of such price.

Where payment is not made by the consumer or retail merchant before the date on which payment is due to the original owner of the coal, or within 30 days of delivery of the coal, whichever is the later, the factor or wholesale merchant may make a reasonable charge in respect of credit to the consumer or retail merchant.

The maximum charges specified in this article, including the transport charges, may be increased or reduced by the Board of Trade, either generally or as respects any particular class of business, or any individual contract or sale.

2. All contracts for the purchase or sale of coal in the United Kingdom under which deliveries were being made, or were due prior to September 10th, 1917, are hereby abrogated, provided that notwithstanding such abrogation, the seller shall continue to deliver to the purchaser, and the purchaser shall continue to receive, the coal during the period of the currency of the contract, and under the conditions and at the rates specified thereunder unless otherwise agreed by both parties, and the price charged as from September 10th, shall not exceed the price chargeable under the contract in accordance with the provisions of the Price of Coal (Limitation) Act, and of this Order; provided also that in no case shall the price be increased without the consent of the Controller of Coal Mines. Any party to such contract may apply to the Controller for the variation of or relief against any term or condition of such contract, and such application shall be heard and determined by the Controller.

7. If any person acts in contravention of this Order, or aids or abets any other person in doing anything in contravention of this Order, that person is guilty of a summary offence against the Defence of the Realm Regulations.

"Some Engineer."—The following conversation was overheard by a "REVIEW" peruser:—

Man Porter: "So you're leaving on Monday, are you?"

Boy Porter (age about 14): "Yes, I'm going to ———" (mentioning a well-known firm of engineers).

M.P.: "What are you going as?"

B.P.: "An Electrical Engineer!"

To this incident we may add a quotation from the *Daily Mail* of Tuesday last—a foot-line to a portrait of a boy with a pair of wire-cutters:—"ELECTRICAL ENGINEER, AGED 15." This small South Wales lad, who is only 15 years of age, is earning full man's wages as a war-time expert electrical engineer." *Expert*, forsooth!

When will the lay Press and the public learn the difference between an engineer and a mechanic? The popular view still appears to be that an engineer is a manual worker, more or less skilled in the use of tools and the running of machines, and the public readily grants the title to anyone who claims it: one might as well style a dispenser a physician, or a lawyer's clerk a barrister.

An engineer works with his brains, designing, constructing, or erecting works of public utility, to which experience and special training are indispensable preliminaries, and, apart from cases of exceptional genius, we hold that no man under the age of 22, at the very least, can possibly substantiate a claim to the title.

Natural Gas in Italy.—Pisa is now lit with natural gas, a large supply of good quality having been found some two miles from the town. The shortage of coal in Italy makes the discovery especially welcome.—*The Times*.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station and Tramway Officials.—In compliance with a request from the Coal Control Department, the Committee have authorised the Bradford city electrical engineer, Mr. C. ROLES, to render part-time service to the Coal Controller in waiting upon local authorities in Yorkshire, with the object of discussing possible fuel economies, the position being honorary.

The *Commonwealth Engineer* states that Mr. ASHTON BREMNER, electrical engineer, has been appointed engineer-in-charge of the New South Wales Government electric power supply scheme at Newcastle.

The South Shields F.C. has granted the following increases of salary:—The tramways manager (Mr. J. C. WHITLEY), from £300 to £400; assistant engineer of the tramways department (Mr. F. R. BATTY) from £3 5s. to £4 per week; electrical stations superintendent, from £220 to £245; electrical mains superintendent, £220 to £245; chief clerk in electricity department, from £175 to £200.

The marriage took place, at Kettering Parish Church, on September 5th, of CHARLES PERCY SECKHAM, mains assistant at Wakefield, to Lucy Neale Mander, of Kettering.

General.—Mr. W. A. CHAMEN presided at the inaugural luncheon of the Cardiff Rotary Club recently. Mr. A. HOME-MORTON, president of the London Rotary Club, was one of the

speakers. Mr. Chamen announced that at future meetings the addresses would include one by himself on "Electrical Power Supply as a National Asset," and one by Principal Coles on "Technical Education."

Ald. G. T. JACKSON, who has intimated his intention of retiring from the Salford Town Council, owing to ill-health, is the general secretary of the Tramway and Vehicle Workers' Association, which he was instrumental in forming in 1889. At that time tramway men were working 80 and 100 hours a week for a wage of 21s. to 23s. He was elected to the Town Council in 1893, and was one of the pioneers in securing the municipalisation of the tramways service of the borough.

On Monday last, at a meeting of the employés of the Sterling Telephone & Electric Co., Ltd., Mr. GUY BURNEY, the managing director, founder and president of the Sterling Athletic and Social Club, was presented by Mr. Gordon Lloyd, the chairman of the Executive Committee, on behalf of the members, with a chaste silver and ebony tablet, bearing the following inscription:—"Presented to Guy Burney, Esq., President of the Athletic and Social Club, in grateful recognition and appreciation of his efforts as Founder of the Club."

Roll of Honour.—Second-Lieutenant MARSHALL, R.E., formerly a draughtsman at the South Shields electricity department, has been accidentally killed in a motor accident while on duty.

Private JOHN KINSEY, K.O. Royal Lancasters, who has died from wounds, was employed at Blackpool Corporation electricity works.

Signaller LEWIS FOSTER, Warwickshire Regiment, who has been killed in action, was employed at the tramway offices, Bolton.

Private D. CLARK, Loyal North Lancashire Regiment, who has been wounded, was employed in the office of the Darwen Corporation tramways manager.

Private J. GILLIBRAND, L.N.L. Regiment, aged 31, who was employed with the United Electric Car Co., Preston, has been killed in action.

The D.C.M. for exceptional bravery on the battlefield in Flanders, has been awarded to Corporal FRANCIS HIRST, R.F.A., who was an electrician in the Blackpool Corporation tramways department.

Lieutenant F. HARRIS, of the Tanks Corps, who has lost his left arm and right leg, was an electrical engineer.

Sapper A. SMART, R.E., who has died of wounds, was an electrician, employed at the Victoria Picture Palace, Manchester.

Private J. MITCHELL, King's Own Royal Lancaster Regiment, who has been killed, aged 20, was employed as an electrician by Mr. G. L. Adamson, electrical engineer, Rochdale.

Private J. HORNBY, R.E., who has been wounded, was employed as an electrician at the works of the United Alkali Co., Thornton-le-Fylde.

Fitter-Sergeant SMITH, R.F.A., who has been awarded the Military Medal for devotion to duty, was in the employ of the Liverpool Corporation electric light department.

Lance-Corporal CLIFFORD GARLAND, S.M.R.E., accidentally killed in France, aged 22, served his time with Messrs. Rouch and Penny, electrical engineers, Bristol.

Corporal FARRINGTON, King's Lancaster Regiment, formerly on the Southport Corporation tramway staff, has gained the Military Medal for gallantry in the field.

Gunner E. ROUNCE, R.A., an electrician on the staff of Mr. Newbald, Epsom, has fallen in action.

Second-Lieutenant E. B. GREENHOUSE, R.F.C., who has fallen in action, belonged to Bishop's Castle (Salop), and was an electrician.

Private W. WHAPSHOLT, Labour Company, attached to the R.W. Surrey Regiment, who has been killed in action, was with the County of London Electric Supply Co., at City Road.

Lance-Corporal J. RADBONE, Oxford and Bucks Light Infantry, who was on the staff of the Oxford Electric Light Co., has fallen in action.

At Norton Barracks, last week, Corporal C. RIPP, R.E., was presented with the Médaille Militaire. While in charge of his wireless sub-section with a Naval Division, Corporal Ripp made four successful trips under heavy shell fire from the wireless station to the neighbouring dump to obtain further supplies of stores required for immediate use at the wireless station. By this means the station was kept in action, and a message was successfully transmitted by wireless when all other action had failed. This message was promptly acted upon and reserves were brought up in time to render valuable assistance to the infantry holding the trenches, which were heavily counter-attacked at the time.—*Birmingham Post*

Second-Lieutenant F. G. MOTTERSHAW, Sherwood Foresters, wounded and suffering from shell shock, was employed by Messrs. Charles Macintosh & Co., Ltd., Manchester.

Signaller J. FRICHAM, R.F.A., previously reported missing, is now officially reported drowned at sea whilst coming home on leave. He was an engineer employed by the Phoenix Dynamo Manufacturing Co., Bradford.

Sergeant D. BENNETT, a conductor on the Glasgow Corporation tramways, has been awarded the D.C.M. for conspicuous conduct and gallantry on the field.

Will.—The late Mr. WILLIAM MESGRAVE, Grange-over-Sands, formerly of Bolton, engineer, left £119,771.

NEW COMPANIES REGISTERED.

Rotasphere Co., Ltd. (148,393).—Private company. Registered September 4th. Capital, £5,000 in £1 shares. To take over the business carried on at 82, Belvedere Road, Lambeth, S.E., as the Rotasphere Co., and to carry on the business of electrical, hydraulic, motor, and general engineers, &c. The subscribers (each with one share) are: Louis B. Cousans, 82, Belvedere Road, S.E.1, engineer; Robert V. Holliday, The Haven, Kinsdale Road, Peckham Rye, S.E.15, engineer. The first directors are Louis B. Cousans and Robert V. Holliday. Registered office: 82, Belvedere Road, S.E.1.

Rapid Electric Arc Welding & Engineering (Ireland) Co., Ltd. (4,493).—Private company. Registered in Dublin on September 4th. Capital, £5,000 in £1 shares (1,000 pref.). Objects as title. Agreement with J. L. Gordon. The subscribers (each with one share) are: J. L. Gordon, Castle Street, Liverpool, electrical welder and engineer; Ed. R. Hoskinson, 22, Walter Street, Liverpool, solicitor. The first directors are: J. L. Gordon and T. McKinty. Registered office: 45, Rosemary Street, Belfast.

Automatic & Electric Furnaces, Ltd. (148,419).—Private company. Registered September 7th. Capital, £2,000 in £1 shares. Manufacturers of and dealers in furnaces, plant, and materials for the hardening or other treatment of steel and other metals, &c. Agreement with L. W. Wild and E. P. Barfield. The subscribers (each with one share) are: E. P. Barfield, Porlock, Athanum Road, Whetstone, Middlesex, electrical engineer; G. J. Anderson, 36, Barnsdale Road, Maida Hill, W., solicitor's clerk. The first directors are: E. P. Barfield (managing director), and such others as the shareholders may appoint. Registered office: 6, Old Queen Street, S.W.

Wholesale Battery Co., Ltd. (148,408).—Private company. Registered September 5th. Capital, £100 in £1 shares. Electricians, engineers, &c. The subscribers (each with one share) are: W. A. S. Hellyar, 8, Paternoster Row, E.C.4, gentleman; S. Anderson, 58a, Sydenham Road, North Croydon, electrical engineer. The first directors are to be appointed by the subscribers. Registered office: 14, Derby Road, Croydon.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Electric Holdings, Ltd.—Trust deed dated August 22nd, 1917, to secure £1,243,300 10-year prior lien stock, constituting a first charge on £675,000 4 per cent. debenture stock, 313,397 preference shares of £2 each, 54,121 ordinary shares, and 500,000 deferred shares of 1s. each of the British Westinghouse Electric & Manufacturing Co., Ltd., and a floating charge on the company's undertaking and general assets. Trustees: City Safe Deposit & Agency Co., Ltd.

W. F. Smith & Co. (1907), Ltd.—Mortgage debenture dated August 9th, 1917, to secure £250, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Mrs. E. Smith-Cleburn Peel, I.O.M.

A. Reyrolle & Co., Ltd.—Memorandum of satisfaction to the extent of £7,800 on June 30th, 1917, of debentures dated June 6th, 1907, to July 12th, 1912, securing £15,300 has been filed.

Seear, Scott & Co., Ltd.—Particulars of £1,500 debentures created August 28th, 1917, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £1,500. Property charged: The company's undertaking and property, present and future, including capital. No trustees.

British Electric Tanning Syndicate, Ltd.—Mortgage dated August 28th, 1917, to secure £1,500, charged on tanyard, house, land, &c., Swimbridge, Devon. Holders: J. C. Smith and W. H. Smith.

White, Jacoby & Co., Ltd.—Issue on August 30th, 1917, of £450 debentures, part of a series of which particulars have already been filed.

Chile Telephone Co., Ltd. (29,252).—Capital, £360,000 in £5 shares. Return dated August 2nd, 1917. 66,000 shares taken up; £220,000 paid; £110,000 considered as paid. Mortgages and charges: Nil.

John Davis & Son (Derby), Ltd.—Capital, £35,000 in 20,000 ord. and 15,000 pref. shares of £1 each. Return dated July 5th, 1917. 15,000 ord. and 11,000 pref. shares taken up; £26,000 paid. Mortgages and charges: Nil.

Consolidated Electrical Co., Ltd. (77,054).—Capital, £125,000 in 15,000 pref. and 110,000 ord. shares of £1 each. Return dated July 10th, 1917. All shares taken up. 5s. per share called up on 109,243 ord., £1 per share on 757 ord., and £1 per share on 15,000 pref.; £43,067 15s. paid; £81,932 5s. considered as paid, being 15s. per share on the said 109,243 ord. shares. Mortgages and charges: Nil.

CITY NOTES.

Victoria Falls and Transvaal Power Co., Ltd.

The report to December, 1916, gives the issued share capital at £3,000,000, and the debenture capital at £4,237,840, a further £75,680 of the 5½ per cent. second mortgage debentures and £152,100 of the 5 per cent. first mortgage debentures having been purchased or drawn for redemption during 1916. The net earnings for the year were £800,026. After providing for interest and premium on debentures (£239,706), and for depreciation and income-tax (£305,713), £251,607 remains as net profit, together with £161,568 brought forward, leaving a total

of £416,175. Of this £150,000 has been transferred to reserve fund, leaving £266,175. In respect of this balance, a dividend of 6 per cent., less income-tax, on the preference shares for the year 1916 was paid on January 8th, 1917, absorbing £93,000, leaving a surplus of £173,175. On June 21st, 1917, a dividend of 5 per cent., less income tax, on the ordinary shares for the year ended December 31st, 1916, was declared, and as the preference shares are entitled to share *pro rata* with the ordinary shares in the surplus profits distributed until the preference shares have received a total dividend of 10 per cent. for the year in respect of which the distribution is made, the directors at the same time declared a further and final dividend of 4 per cent., less income-tax, on the preference shares in respect of 1916. The above dividends (paid on July 9th) absorbed £100,750, leaving a balance to the credit of the profit and loss account of £72,425, which will be carried forward. Since the last report there has been no additional generating plant installed in the company's stations. All the plant has been in commission, and has been maintained in an entirely satisfactory manner.

Annual meeting: September 21st, London.

Russia.—The Russian General Electric Co. closed its 1916 working year with a net profit of 2,803,838 roubles, against 2,238,371 roubles in the preceding year, and will pay 1,200,000 roubles in dividend, as last year, making 10 per cent. The board consists of E. Shaikevich (president), G. Bloch, A. Dreier, A. Holstaub, N. Koksharoff, V. Morzhitsky, and N. Dmitrieff.

Stock Exchange Notice.—Application has been made to the Committee to allow the following to be quoted in the Official List:—

Anglo-Portuguese Telephone Co., Ltd.—150,000 shares of £1 each, fully paid, Nos. 1 to 150,000 (special application).

Folkestone Electricity Supply Co., Ltd.—Interim dividend, 6 per cent. per annum, less income-tax, on ordinary shares for the half-year.

Gandy Belt Manufacturing Co., Ltd.—Interim dividend, 20 per cent. per annum, less tax, on the ordinary shares for the half-year.

Bromley (Kent) Electric Light & Power Co., Ltd.—Interim dividend, 4 per cent. per annum, less tax, on ordinary shares for the half-year.

Chloride Electrical Storage Co., Ltd.—The report for the year ended March 31st shows, after making provision for depreciation and for the reduction of investments to market value and for war taxation, a profit of £35,459. Dividends amounting to 10 per cent. have been paid, free of income-tax, on the ordinary shares, and the directors now recommend a transfer of £20,750 to reserve fund, making £22,500, carrying forward the balance, £15,325.—*Financial Times*.

Brotherton Tubes & Conduits, Ltd.—Annual report shows a profit of £5,613. The credit balance of £3,030 brought down was increased to £6,770, but the directors are unable to deal with it owing to the accounts not yet having been passed by the Ministry of Munitions.

Cape Town Consolidated Tramways & Land Co., Ltd.—The report for 1916 states that the profit and loss account shows a debit balance of £631, as against £817 for the previous year.

Companies to be Struck Off the Register.—The following companies are to be struck off the register and dissolved unless cause to the contrary is shown within three months:—

Adjustable Cover & Boiler Block Co.
Forced Lubrication Co.
South African Engineer Co.

Dumbarton Burgh & County Tramways Co.—Dividend of 3½ per cent. on the ordinary shares for the year.

STOCKS AND SHARES.

TUESDAY EVENING.

THE most depressing factors in Stock Exchange markets for the time being are naturally Russia and Sweden; but from the point of view of actual influence over prices, the steady demand from the public for industrials is considerably more potent. There is little doubt, however, that the Russian and Swedish developments have the effect of stopping business amongst investment stocks, although, even here, the amount of trade which is being done is surprising enough, having regard to the news from the Riga region. But Stock Exchange markets are throwing off much of that feeling of

sympathy which in the old days used to permeate everything, and which made Kaffirs weak if Consols happened to fall ½ and produced dulness in Brazil Traction if there were a momentary break in Yankees.

Mexican stocks and shares of all kinds have undergone something of a shake-out after their big rises. It is said that the loan negotiations, whereby the United States is understood to have in contemplation the advance of a substantial sum to Mexico, are proceeding satisfactorily. But, on the other hand, the fresh outbreak of internal disorder, as evidenced by the assassination of a band of Carranza's soldiers at the end of last week, is not exactly a bull point for Mexican securities of any kind.

It must be remembered, too, that Mexicans had gone ahead very fast beforehand; and those of us who considered the rise was being overdone, in view of the continued uncertainty in regard to Mexican politics, can point to this week's fall as testimony to the correctness of the attitude. No doubt Mexicans will "come again," in Stock Exchange phrase; and, in point of fact, the falls of the past few days are not much, as compared with the previous big rises. Mexican Light and Power common shares are 2½ lower, Mexican Tramways 3 points down. Oddly enough, the 6 per cent. bonds of this company are a point to the good; but Mexican Light preferred at 31 have shed 4½. Brisbane Electric Tramways preference have risen 5s. to 4½.

The foreign group is dullish as a whole, with the exception of Argentines. Brazil Traction dropped to 46. On the other hand, Anglo-Argentine Tramways again rose 1/16, and the 5 per cent. debenture stock at 67½ shows a gain of the fraction; would-be buyers find that the stock is by no means easy to come at. In the British Columbia group, the 4½ per cent. debenture at 54 is easier. Victoria Falls ordinary are maintained at 19s. 6d., and the preference are steady at 23s. 9d. There is a little disappointment at what is regarded by certain quarters as the colourless character of the report. It is somewhat resentfully remarked that the directors could have produced a much more optimistic report had they chosen to do so; but those who prefer the cautious line can only commend the board for their refusal of the temptation to paint the present, as well as the future, in glowing colours.

The electric lighting market is firm, though without any further changes, save for a rise of 5s. in City of London preference, which brings the shares into line with the County preference at 10½. Illumination shares of all kinds are firm at present, and within the past few days gas stocks have been steadily mounting, following no doubt the example set by the electric lighting list two or three weeks ago. With the approach of the darker days, and reverting to winter time, it is natural enough that the lighting companies should begin to attract fresh attention.

The manufacturing group is also very firm, and once again the most active shares in the list are those of the Edison Swan Co., £3 paid. On profit-taking, the price relapsed to 21s. 6d., from which it was quickly taken up to 23s. Active dealings in the new preference are taking place at 1s. premium. The official quotation for the shares £5 paid is 1½-2, which, if we may be allowed to say so, is an absurd quotation, seeing that there is in the market ½ price, which itself is modified into something closer when buyers or sellers come to deal. The excuse for these nominal margins between prices is that, at times, a market becomes less active, and accordingly dealers cannot quote such close prices as they are able to do when there is a fair amount of business going on. But why the margin need be maintained whether the market is active or stagnant is not clear. The proper price of the £5 shares is 1½-1½, so that the official 1½-2 is not only misleading, but incorrect.

The rumours to which we have made reference on several occasions, with regard to a possible combination in the electrical manufacturing trade, have received no further confirmation, so far as we are aware. At the same time, it has been pointed out that those who are in closer touch with the industry than a financial scribe can hope to be, are probably able to obtain a better judgment on the point than he can. General Electric ordinary at 16½ are 10s. up, and British Aluminium have risen to 31s. 6d., with a noticeable amount of activity to help the price.

Underground Electric income bonds relapsed 2 to 82½, although the "A" shares at 6s. are 6d. better. Metropolitan fell ¾ to 23½, and Central London assented ordinary stock is weak at 58½. The effect of the fare revision upon the various Underground and omnibus systems has worn off; and some folks who recently bought with the idea of realising a quick profit are anxious to carry out their intention. Moreover, the railway market is dull as a whole; and with the possibility of fresh Labour trouble in Scotland, there is not much inducement to buy Home Rails at present.

Fresh rises have occurred amongst the good cable stocks; Eastern Extensions at 14½ and Eastern Telegraph ordinary stock at 148½ are both better on the week. A rise of ¼ in Anglo "A" took the price to 23. The investor continues to search this market diligently for sound stock. Marconis at 3½ are 1/16 harder and Marines eased off a shade to 2 9/32.

In the activity amongst industrials of which mention has already been made in the opening paragraph, rubber shares have again come to the front, in consequence of a rise in the price of the raw material to 2s. 10½d. per lb., while optimism looks for a further recovery in the quotation because of the

demand that is likely to be stimulated by the entry of America into the theatre of war. Armament shares are better, and there has been a good deal of inquiry during the past few days for the shares of some of the base-metal companies, particularly those which are affected by the rise in the price of silver, the white metal having reached a level higher than has been marked for many years past.

SHARE LIST OF ELECTRICAL COMPANIES.

		Dividend		Price	Rise or fall	Yield
		1915.	1916.	Sept. 11, 1917.	this week.	p.o.
Brompton Ordinary	10	9	6½	—	—	£7 4 0
Charing Cross Ordinary ..	5	5	8½	—	—	6 9 0
do. do. 4½ Pref. ..	4½	4½	8½	—	—	6 13 4
Chelsea	4	8	24	—	—	6 4 4
City of London	8	8	13½	—	—	6 0 9
do. do. 8 per cent. Pref. ..	8	6	10½	—	+ ½	5 17 1
County of London	7	7	11½	—	—	6 8 1
do. do. 6 per cent. Pref. ..	6	6	10½	—	—	5 17 1
Kensington Ordinary	7	6	5½	—	—	5 14 8
London Electric	8	8	1	—	—	Nil
do. do. 6 per cent. Pref. ..	8	4	8½	—	—	5 6 8
Metropolitan	8	8	8	—	—	5 0 0
do. 4½ per cent. Pref. ..	4½	4½	8½	—	—	7 4 0
St. James' and Pall Mall ..	8	8	7	—	—	5 14 6
South London	5	5	2½	—	—	7 5 6
South Metropolitan Pref. ..	7	7	21½	—	—	8 10 3
Westminster Ordinary	7	7	6½	—	—	5 7 8

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	8	6	98	—	—	8 2 5
do. Def.	83½	1½	28	—	+ ½	8 10 5
Chile Telephone	8	8	7½	—	—	5 11 4
Cuba Sub. Ord.	5	5	8½	—	—	5 14 3
Eastern Extension	8	8	14½	—	+ ½	5 8 4
Eastern Tel. Ord.	8	8	148½	—	+ 1	5 7 9
Globe Tel. and T. Ord. ..	7	7	12½	—	—	5 9 10
do. Pref.	6	6	10½	—	—	6 15 8
Great Northern Tel.	23	24	86	—	—	6 13 4
Indo-European	13	13	54½	—	—	5 19 3
Marconi	10	15	3½	—	+ ½	4 15 10
Oriental Telephone Ord. ..	10	10	8½	—	—	3 1 6
United R. Plate Tel.	8	8	61½	—	—	5 15 4
West India and Pan.	6d.	6d.	1½	—	—	1 12 0
Western Telegraph	8	8	14½	—	—	5 10 4

HOME RAILS.

Central London, Ord. Assented	4	4	58½xd	—3	—	6 16 9
Metropolitan	1	1	23½	—	—	4 5 1
do. District	Nil	Nil	16½	—	—	Nil
Underground Electric Ordinary	Nil	Nil	1½	—	—	Nil
do. do. "A"	Nil	Nil	6½	—	+ 6d	Nil
do. do. Income	6	4	82½	—2	—	4 17 0

FOREIGN TRAMS, &c.

		Dividend				
		1915.	1916.			
Adelaide Sup. 8 per cent. Pref.	8	8	4½	—	—	6 3 1
Anglo-Arg. Trams, First Pref. ..	6½	6½	8½	—	+ ½	8 19 6
do. 2nd Pref.	5½	—	2½	—	—	—
do. 5 Deb.	5	5	67½	—	+ ½	7 8 3
Brazil Traction	4	4	47	—	—	—
Bombay Electric Pref.	6	8	98	—	—	6 4 8
British Columbia Elec. Rly. Pfc. 5	5	6	42½	—	+ 1	11 15 4
do. do. Preferred Nil	Nil	Nil	81	—	—	Nil
do. do. Deferred Nil	Nil	Nil	29	—	—	Nil
do. do. Deb.	4½	4½	54	—	—	7 17 7
Mexico Trams 5 per cent. Bonds	Nil	Nil	47½	—	—	Nil
do. 6 per cent. Bonds	Nil	Nil	84½	—	+ 1	Nil
Mexican Light Common	Nil	Nil	22½	—	—	Nil
do. Pref.	Nil	Nil	31	—	—	Nil
do. 1st Bonds	Nil	Nil	46½	—	—	—

MANUFACTURING COMPANIES.

Babcock & Wilcox	15	15	3½	—	—	4 15 10
British Aluminium Ord. ..	7	10	1½	—	+ ½	5 16 3
British Insulated Ord. ..	17½	20	14	—	—	7 3 10
British Westinghouse Pref. ..	7½	7½	22	—	—	5 9 1
Callenders	20	20	14½	—	—	7 0 6
do. 5 Pref.	5	6	4½	—	—	6 1 8
Castner-Kellner	22	22	8½	—	—	6 8 0
Edison Swan, fully paid ..	—	—	1½	—	—	Nil
do. do. 4 per cent. Deb. ..	4	4	72½	—	+ 1	5 10 4
Electric Construction	7½	7½	4½	—	—	8 6 0
Gen. Elec. Pref.	8	6	10½	—	—	5 17 1
do. Ord.	10	10	16½	—	+ ½	8 1 3
Henley	25	25	16	—	—	7 16 3
do. 4½ Pref.	4½	4½	4	—	—	5 12 8
India-Rubber	10	10	12½	—	—	7 6 10
Telegraph Con.	20	20	38½	—	—	6 6 2

* Dividends paid free of income tax

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, September 12th.

		Latest Price.	Fortnight's Inc. or Dec.
CHEMICALS, &c.			
a Acid, Oxalic	per lb.	1/6	..
a Ammoniac Sal	per ton	£76	..
a Ammonia, Murate (large crystal)	"	£54	..
a Bisulphide of Carbon	"	£23	..
a Borax	"	£38	..
a Copper Sulphate	"	£61	..
a Potash, Chlorate	per lb.	2/8	..
a " Perchlorate	"	2/-	..
a Shellac	per cwt.	£19	10/- inc.
a Sulphate of Magnesia	per ton	£16	..
a Sulphur, Sublimed Flowers ..	"	£35	..
a " Lump	"	£25	..
a Soda, Chlorate	per lb.	10½d.	..
a " Crystals	per ton	120/-	..
a Sodium Bichromate, casks ..	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2" to 12" basis)	per lb.	..	..
c " Tubes (solid drawn) .. ..	"	..	..
c " Wire, basis .. ..	"	..	..
c Copper Tubes (solid drawn) ..	"	1/7½ to 1/8½	..
g " Bars (best selected)	per ton	£160	..
g " Sheet	"	£160	..
g " Rod	"	£160	..
d " (Electrolytic) Bars	"	£137	..
d " " Sheets	"	£162	..
d " " Wire Rods	"	£145	..
d " " H.C. Wire	per lb.	1/5½	..
f Ebonite Rod	"	3/-	..
f " Sheet	"	2/6	..
n German Silver Wire	"	2/8	..
h Gutta-percha, fine	"	6/10	..
h India-rubber, Para fine	"	3/2½	..
i Iron, Pig (Cleveland warrants) ..	per ton	Nom.	..
l " Wire, galv. No. 8, P.O. qual.	"	£42	..
g Lead, English Pig .. ..	"	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small ..	per lb.	8d. to 8/-	..
e " " " medium	"	8/6 to 6/-	..
e " " " large	"	7/6 to 14/- & up.	..
d Silicon Bronzes Wire	per lb.	1/9½	..
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English) .. ..	"	..	..
n " Wire, Nos. 1 to 16	per lb.	8/6	..

Quotations supplied by—

a G. Boor & Co.	g James & Shakespeare.
c Thos. Bolton & Sons, Ltd.	h Edward Till & Co.
d Frederick Smith & Co.	i Bolling & Lowe.
e F. Wiggins & Sons.	l Richard Johnson & Nephew, Ltd.
f India-Rubber, Gutta-Percha and	n P. Ormiston & Sons.
Telegraph Works Co., Ltd.	r W. F. Dennis & Co.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.
		£	£		£	£	
Bristol (Trams)	Aug. 31	25,458	+3,190	35	186,559	+15,957	80½
Cork	" 30	2,171	+ 125	35	18,891	+ 1,155	9·89
Dublin	" 31	29,588	+ 924	35	231,744	+23,080	54·25
Hastings	" 23	8,065	+ 546	31	40,973	+ 6,194	19·3
Lancashire United	" 24	12,215	+3,785	35	79,839	+17,399	42
Llandudno-Col. Bay	" 31	3,393	— 171	39½	13,261	— 878	6·5
Anglo-Argentine	" 26	203,191	+7,523	34	1,798,652	+14,596	..
Auckland	July 27	21,799	+ 292	4	21,799	+ 292	26·69
Calcutta	Aug. 28	14,497	+ 67	—	—	+ 1,289	..
Kalgoorlie, W.A.	May ..	2,692	—	21	12,793	—	29·5
Madras	Aug. 31	4,892	+ 440	35	86,994	+ 3,302	..
Montevideo	August	28,860	+2,816	43	800,453	+ 7,921	..

Electrical Trade in China.—In the course of an article on China's electrical industry, the *British Export Gazette* says that a good deal has been done during the last few years to encourage optimistic anticipations for trade in the future. "To take the electrical industry as an example, in China this is, of course, still in its infancy, and practically confined to large towns and open ports. Altogether there are some 87 electrical undertakings scattered throughout China, of which 62 are in China proper and 25 in Manchuria. As many as 80 of these enterprises are light or power services or the two combined; four are carried on in conjunction with electric railways, and three are devoted to the manufacture of electrical apparatus and supplies. In the aggregate, the electric energy supplied for power totals 30,000 H.P., and for light, 1,375,000 C.P. Steam is in nearly all cases the prime mover, but water is used in the Province of Yunnan. Of these 87 undertakings, no fewer than 53 are managed by Chinese private individuals or companies and six are run by the Government, while 28 are under foreign control, the Japanese being interested in 10. The total capitalisation of all these undertakings is about £2,000,000.

The value of the imports of electrical apparatus and supplies averages about £260,000 annually, and up to 1913 Germany was far and away the largest supplier, with an interest in the trade amounting to over 35 per cent. of the total, the United Kingdom coming second with about 24 per cent., and Japan third with 16 per cent. Now the position is entirely reversed, Japan taking first place with over 40 per cent., and the United Kingdom coming next with 19 per cent., Germany, of course, being entirely eliminated. In the last year or two, however, the imports *via* Hong-kong have rapidly increased, and a large proportion of these goods may safely be put to the credit of the United Kingdom. Settled conditions in China and the return of peace to Europe may be expected to expand the electrical industry altogether beyond its present proportions, the interest being taken in the market by American capitalists being specially hopeful of enormously increased demands for material and machinery. So far as Japanese manufactures are concerned, they are not altogether giving that satisfaction which was anticipated, and it is therefore quite unlikely that they will retain their present position when British electrical engineers are once more able to devote their energies to overseas markets.

THE FUSING OF AN ELECTRIC WIRE.

[COMMUNICATED.]

"It is believed that the outbreak was caused by the fusing of an electric wire."

This is a typical "explanation" given as the cause of an outbreak of fire nowadays, and it is one we can read almost every week in our newspapers.

It is quite true that, with the ever-increasing applications of electricity to the routine of life, conflagrations occasionally occur for which it is responsible, but generally in such cases the outbreak is shown to be due, not to the use of electricity, but to its misuse; but it is equally certain that the use or misuse of electricity is in many instances blamed for fires with which it has nothing whatever to do. What further proof of this statement do we need than the first three words of our opening sentence? This sentence is copied exactly from a weekly newspaper; and it is rarely that we find the accusation against supposed fused wires made more directly. There is nearly always that qualifying "It is believed," or "It is supposed." These words can only mean to an unbiased mind that there was no direct evidence that the fire was caused by the fusing of an electric wire, or, on the other hand, and perhaps more likely, that no better and more readily-adopted explanation presented itself. To the layman, electricity is shrouded in mystery; what, then, could be more fitting than that a mysterious fire should have a mysterious cause?

The writer well remembers one such mysterious fire, for he was one of the first on the spot after the alarm had been given. Acting in an official capacity, he went straight to the distribution boxes and main fuses of the electricity supply, and drew and retained every fuse. A careful examination afterwards showed that not a single fuse was of such extraordinary capacity that it would fail to give adequate protection to the installation; but although none of these had blown, or even showed signs of overheating, to this day it is the firm belief of several of those most nearly concerned that the outbreak originated with the fusing of an electric wire.

The occasion of this fire was the weekly half-holiday of the assistants employed, who, among other things, made frequent use of electric irons. Now, the fire did not break out till about four o'clock in the afternoon, the establishment having closed at one o'clock. It is, therefore, the opinion of the writer that an electric iron had inadvertently been left on, and had in time set fire to the table on which it stood, for it was well known that irons had on previous occasions been stood on the bare table without any protection whatever.

The risk of such an action, apparently, does not strike the culprit until something unlooked-for has happened. There is a prominent chief electrical engineer in whose house this same thing occurred. He once related how, in the small hours of the morning, he awoke, conscious of a very strong smell of burning in the house. He promptly hurried down stairs to ascertain the cause, and found an electric iron embedded some $\frac{1}{2}$ in. deep in his kitchen table. Someone had gone to bed and left the iron on. It was a narrow squeak.

Against such accidents as these, accidents the outcome of carelessness, for which electricity is not to blame, there is little protection, but there is ample protection for the wires in a properly installed electrical installation. That, compared with other forms of power and illumination, electricity is safe, has been from time to time amply proved by statistics.

For some time the writer has been specially interested in the question of fire protection, he having once been privileged to take an active part in a research on "the effect of fire on building materials." While thus engaged he had the opportunity of carefully examining the records of various fire brigades in the country. Where these records had been properly classified there was clear proof that the percentage of fires traced directly to the use of electricity was very small compared with its great rivals.

Yet we must not rest on our laurels. So long as there are fires which can reasonably be attributed to electricity we

feel there is something wrong. The whole question is one of efficiency—the efficiency of the electrical engineer and his workmen.

Try to call to mind some of the installations you have seen at different times, and ask yourself the question—Were they or are they safe? The writer will give one or two instances. The first is a motor circuit in a hay and straw merchant's stores. The motor drives the chaff cutter, and is on the first floor with its starter. The main switch is downstairs among the cut chaff. There is no overload or no-volt release on the starter, and it is, of course, usual to shut down from downstairs; and although it is usual to go upstairs immediately and throw the starter over to the "off" position, yet, sad to relate, it is sometimes forgotten. On various occasions, to the writer's knowledge, has this occurred, the result, of course, always being a blown fuse; but suppose, some day, that the glass of the fuse-box is broken, and the fuse, a No. 18 copper wire, blows out into the chaff; what then? A fire most probably, and caused by the fusing of an electric wire in all truth.

We next visit a draper's shop, a veritable death-trap. In the window, among the flannelette and other good burning materials, is the distribution-box. It is of the old type, and once had a wooden door with a glass front, but the hinges were weak, and the door has fallen off. Does the draper replace it? No! and he will not until the fusing of an electric wire has caused another fire, and the draper is selling off his salvage stock in his new premises.

We now arrive at a dwelling-house, to be introduced to a budding electrical engineer. This lad has run extensions from the existing installation, all over the house, but his electrical knowledge at present does not carry him beyond flexibles, and these are tacked and tied up in every conceivable manner. His indulgent parents are proud of him, and marvel at such cleverness, but if they wish to protect themselves against the fusing of an electric wire they will be well advised to double the fire insurance policy.

Our last call is a double one, for we are to visit two controlled establishments. We shall on arrival find both in the same trouble. There has been a mishap at the electricity works, and the supply has been off for a few minutes. The supply is A.C., single-phase, and the starters of the motors in the controlled works are, as usual with this type of motor, not automatically released. The supply has been off for just sufficient time to allow the motors to stop, and has then been put on again with the motors standing and the starting switches in the running position.

Two motors have been burnt out on account of the non-fusing of two electric wires; for, because of the trouble and delay caused by the blowing of fuses, these have been strengthened out of all proportion, and now when they should protect the motor they hold in, and the motor is burnt out, causing more trouble, delay, and expense than the blowing of a hundred fuses.

The writer vouches for the accuracy of all the incidents quoted above, and hopes that some lessons may be learned from them. The chief lesson is that inefficiency does not pay. We are all, at the present time, earnestly considering how best we can capture German trade; we have learned only too well how this nation in the past has consistently outpaced us in the race for commercial supremacy. We have also seen and realised the importance our enemies have attached to a scientific training. There is, however, one direction in which it has been proved that they can claim no superiority over us, and that is in practical workmanship. Yet who would think so, after reading the incidents quoted above?

We are on the eve of great changes, changes which we venture to hope will alter our whole commercial position. Cannot engineers, wiring contractors and electricians generally see that the standard of electrical work is greatly improved as well as the quantity?

The shortage of labour to-day is made an excuse for many misdeeds, yet logically, owing to this shortage of labour and consequent delays in putting troubles right, we should take no risks at all.

Cheapness must be combated to the death; it has never been good for anyone. An electrical installation should be so good that, after completion, it can be left entirely to itself, and almost forgotten.

Almost, if not quite, the most important part of an electric installation is the fuse-box. It is here that fires are prevented. The fusing of an electric wire should always happen to prevent, and never to cause, fire; and this can be brought about. It will never entirely fulfil its purpose, however, until the draper ceases to put a hairpin across to keep him going, or until the factory electrician realises that a motor that takes too much current is not working properly, and should be attended to at once.

Too many are satisfied to "carry on" so long as the lamps will light or so long as the motor will run; but this is not efficiency. The difference between efficiency and inefficiency is heat, and heat spells fire, and fire spells "the fusing of an electric wire."

For the reputation of electricity, for the welfare of our pockets, and for the benefit of the future generation, let us see that all our electrical installations are well put in and well taken care of afterwards, for it is only by this means that we shall be enabled to say to all the world: "It is *known* that a serious fire was prevented by the fusing of an electric wire."

TRADE IN NEW ZEALAND.

SOME extracts are given below from the report by H.M. Trade Commissioner in New Zealand (Mr. R. W. Dalton) for the year 1916, which has recently been issued by the Board of Trade. The report itself is published by H.M. Stationery Office (Cd. 8,686), price 6d.

The following table shows the total imports of electrical machinery and appliances into New Zealand, distinguishing those from the United Kingdom and the United States:—

	1915. £	1916. £	1915. % of total.	1916. % of total.
United Kingdom ...	245,706	325,942	71.2	68.7
United States ...	76,521	114,151	20.4	24.1
Other Countries ...	29,365	34,362	8.4	7.2
Totals ...	345,592	474,455	100.0	100.0

The war has given American firms a big advantage in this trade, but I see no reason why, if United Kingdom firms are so determined, they should not more firmly establish themselves when war is over. New Zealand is bound to become a big electrical country, and it is not unlikely that the greatest development will take place within the next few years. It is unfortunate from the point of view of United Kingdom firms that immediately before such a development American interests should have had such an opportunity to get a hold on the market. Wherever one goes in New Zealand one finds the view held that New Zealand, which is a water-power country, is almost the prerogative of American firms. I do not see for a moment why this should be so, and I believe that the comparative ability of the two countries to deal with high-tension work and long-distance transmission from water-power schemes is misunderstood. I would say that the need for very efficient representation of British firms is greater now than it has ever been in order to equalise American and British effort on the market, and to be ready for the big extensions of electrical work which will undoubtedly take place.

The greatest difficulty is to be found in securing reliable agents for machinery and engineering lines for which technical agents are required. Agents with technical knowledge are difficult to find, and those who have technical knowledge are usually so well supplied with agencies that they cannot adequately work any more. This is a very real obstacle in the way of United Kingdom firms, and it is one to which I think they will have to give their attention when the war is over. The only way out of the difficulty that I can see is that they should combine in groups to send out one technical representative from home to represent each group.

WATER-POWER SCHEMES.

One of the most important developments in the near future will be in the direction of the utilisation for light and power of the extensive water powers of the Dominion. In spite of its size and importance, the Lake Coleridge scheme, as it has been developed so far, may perhaps be regarded as only an experiment in relation to the possibilities of water-power development in New Zealand. There seems to be no doubt whatever that the Lake Coleridge scheme has been a success. The Government are eminently satisfied with the scheme and that further development of this work is to be anticipated. The Christchurch municipality, by their energy and enterprise, are also managing successfully to prove to the district that electricity will open up a new era for industries.

There has already been talk of the establishment of new industries in this district as a result of the scheme, and of developments of electrochemical and electrometallurgical enter-

prises which are made possible by the power now available, or to be made available in the future; and a contract has already been entered into with a firm proposing to produce caustic soda and hydrochloric acid. But the greater result will probably be found in the development of similar schemes in other parts of the Dominion.

During the past year the electrical engineer to the Government (Mr. E. Parry) has been engaged on the examination of a scheme to supply the whole of the North Island with electric power. The initial intention was to develop one water power for the whole island, but it was eventually decided that in view of the difficulties (chiefly of long-distance transmission) it would be desirable to have three sources. It is thought that the scheme which best satisfies all requirements is one in which, at the outset, three water-power sources would be developed for supplying respectively the Auckland District, the Hawkes Bay District, and the Wellington District. These sources would, in the ordinary course of development, be linked-up together, and by reinforcing each other provide additional guarantee of continuity of supply.

For the Auckland supply a source on the Waikato river, where 120,000 H.P. can be obtained, is thought to be best; for Wanganui and Masterton, the Mangahao river is suggested, and the power estimated for is 25,000 H.P.; for the Hawkes Bay district the best source is the Waikaremoana Lake, which is also suggested as a supplementary source for the Wellington district. It is proposed that the Wellington and Auckland schemes should proceed simultaneously; the estimated cost of these works is £1,000,000 and £1,200,000 respectively. If labour is available work may be begun at an early date on the tunnelling, road-making, &c., but it is not likely that any work involving plant will be carried out before the end of the war. As far as the Waikaremoana scheme is concerned, it is proposed that this should be deferred for the present, and be made dependent on the construction of the Napier-Gisborne railway, which the engineer favours operating electrically; without this, railway construction work would be made very difficult.

In addition to these large schemes there have been a number of smaller schemes carried out, or proposed, by local bodies and others. The Wairua Falls plant, which was installed by a new cement works in the North Auckland district in order to supply itself with power, was opened during the year, and supplies the town of Whangarei with light. It is probable, however, that most of the schemes which have not actually been carried out will be held up until a definite decision is arrived at by the Government in the matter of the larger works.

ELECTRICAL SUPPLIES.

A branch of trade which is open to improvement from the point of view of British trade is that in cooking, heating and similar appliances for household use. Domestic service in New Zealand is very difficult to obtain; it lives in a state of constant unrest, and is very intractable. The average householder is, therefore, driven to employ as many labour-saving devices as possible, and as a result the use of electrical appliances is more a necessity than a luxury, even in quite small households. British articles of this class are seldom seen, and it is generally stated that they do not compare, either in efficiency or finish, with similar appliances from other sources. For all these articles there is an ever-increasing demand.

There has been an enormous trade done in New Zealand in electric torches and batteries. Japan has delivered a great number, but these have been found very unsatisfactory. The torches and batteries with the greatest sale are now American, and for similar articles they are very much cheaper than British; the range is a very big one so far as cases are concerned. In regard to the batteries, the main attraction is a guarantee of service with every battery, the date to which the battery is guaranteed being marked on each article. There is an undoubted opportunity for the trade in British articles of this class. There are one or two well-known makes already on the market, but buyers complain of the price.

Japan has done a fair trade in electrical supplies, but it has been found that these are unsatisfactory, and I am told that unless considerable alteration is made the trade will not last.

THE EFFORT NEEDED.

It is fairly safe to assume that for reasons both of improvements in producing methods at home and of the quickened patriotic sentiment in the Dominion, British manufacturers will be in a more favourable position for competing when the war is over. The advance of foreign trade at the expense of British trade is not serious in the total, but it should be remembered that it is fairly serious in some individual lines. Preparation may be made, and should be made now, to deal with the position when the war is over; the actual effort in most trades may have to be deferred, but in the meantime British firms should explain to customers the difficulties of delivery.

Many complaints have been made to me as to the treatment customers have received from firms at home since the war, but I find that when buyers here understand the difficulties under which all business in the United Kingdom is being carried on, imagined grievances largely disappear; most people understand in general the straits to which firms at

home have been put, but they do not understand in detail that expert packers have gone; that office and shipping staffs are almost entirely new to their work; that in many cases actual producers are new, and have to be trained, and so forth. It is on these points that firms should give more information.

As regards machinery, in cases where the position of British firms is unsatisfactory the reason is to be found chiefly in one or more of the following facts:—(1) That our manufacturers have not examined the development of the Dominion; (2) that if they knew of the development, they either have not realised its importance or have not attempted to cater for it, but have persisted in offering unsuitable lines; and (3) that their selling campaigns are not adequate. I can quite understand that firms may not find it profitable to manufacture certain lines exclusively for this market, if those lines are different from their standard designs. If this is so, however, it would be better for themselves and for the reputation of British trade in general to refrain from offering on this market lines which are unsuitable, or from offering suitable goods in such a manner as would seem to indicate that it was immaterial to them whether they got the trade or not. As it is, our manufacturers are continually being compared with American manufacturers to their disadvantage. The fact is, of course, that the American manufacturers supply to this market machinery which is such as they have to manufacture for their own home conditions, and it is, therefore, not particularly enterprising of them thus to supply New Zealand's needs.

As I said last year, American production is so much standardised that in the majority of cases, perhaps, manufacturers in that country would be even less disposed than British firms to alter their patterns—the trouble is that they are not so frequently asked to do so because, for the reasons already indicated, there is not the same need.

SCIENTIFIC AND INDUSTRIAL RESEARCH.

(Abstract of Report of the ADVISORY COUNCIL OF THE DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH.)

(Concluded from page 227).

It will be an important part of our duties to arrange for surveys to be made of existing scientific knowledge and the fields for research in particular industries. Systematic surveys of this kind are needed in many directions, and we are arranging for their production as rapidly as circumstances will permit.

On the advice of the non-ferrous section of our Standing Committee on Metallurgy we have appointed a committee to prepare for us two surveys giving the existing knowledge and practice as to the zinc industry, and as to the smelting and refining of copper, and the qualities of copper and the copper alloys. We are entrusting to this Committee as an interim arrangement, pending the establishment of an Association for Research into the non-ferrous alloys, the direction of a research into the best method of making sound castings of copper and brass. The Brass and Copper Tube Association have offered a contribution of £1,000 towards the cost of this investigation, and we have recommended the Council to make an equal contribution.

We have asked a Special Committee of the Standing Committee on Engineering to prepare a memorandum on the field for research into lubricants and lubrication, with an analysis of the problems involved, and a suggested scheme of research. We have also offered a grant to the Bradford Association for Engineering Research towards the cost of preparing a survey of the field for research into the flow of steam in pipes.

As the result of representations made to us by the Society of Illuminating Engineers we have appointed a joint Sub-Committee of our Standing Committee on Engineering and Glass and Optical Instruments, together with certain co-opted members from the Society of Illuminating Engineers, to make a survey of the field for research in illuminating engineering.

The Government of the Commonwealth of Australia have appointed an Advisory Council of Science and Industry with an Executive Committee, of which the Prime Minister is the chairman. The Executive Committee have entered into direct relations with our Council.

In June of this year the Secretary of State for the Colonies forwarded to the Department a copy of a dispatch from the Governor-General of the Union announcing that "arrangements" had "been completed for the organisation and carrying out of a system of investigation into the national resources of South Africa with a view to assisting and developing industrial activity within the Union." We have opened semi-official correspondence with the South African Scientific and Technical Advisory Committee, and have offered to furnish them with all information and assistance in our power.

Progress.—The investigation into the corrosion of non-ferrous metals in sea-water initiated by the Institute of Metals has already yielded positive results which may prove of great practical value. With the assistance of the Brighton Corporation full-scale experiments running night and day were arranged under the general supervision of Captain Bengough, who was in charge of the research. The pro-

gress now made is not the result of the large scale tests—valuable as these are likely to prove—but the result of systematic laboratory attack. The research has now been extended, on the initiative and with the assistance of the British Electrical and Allied Manufacturers' Association, to cover corrosion of condenser tubes in service on land.

The Institution of Gas Engineers have long supported a research under Dr. Mellor into refractories at Stoke. The Council recognise that the problems connected with refractory materials call for greatly increased attention. Any scheme to be satisfactory must find a proper place not only for the work which has so long been carried on at Stoke, but also for that more recently begun with valuable results at the National Physical Laboratory, as well as for that in contemplation at Sheffield and elsewhere.

Another important research being conducted at the Stoke School under Dr. Mellor and Mr. Bernard Moore is making very satisfactory progress; it is an attempt to produce a marketable hard porcelain from purely British material. A ware has already been produced which is expected to prove cheaper than English earthenware. A cheap and new glaze has also been developed.

The flow of steam through nozzles is a matter of deep importance to steam turbine manufacturers, and the Council recommended a grant for a series of preliminary investigations in which the University of Manchester, the Royal Technical College, Glasgow, the British Westinghouse Co., and the British Thomson-Houston Co. are taking part.

A research at the National Physical Laboratory into the heating of buried cables, planned by the Institution of Electrical Engineers more than four years ago, had been held up through lack of funds until the Committee of Council made a considerable grant on our advice. The work was put in hand early in 1916, and the experimental cables are now all laid and connected except one. The installation of apparatus in the huts is complete, and regular observations are in progress. The cables, which are all paper-insulated, include armoured cables laid direct in the ground, cables laid solid in bitumen, and cables drawn into a six-way stone-ware duct. The County of London Electricity Supply Co. undertook the drawing-in and jointing of the larger cable. Lengths of concentric cable have been lent by the same company, and five lengths of three-conductor cable have been lent by the Newcastle-on-Tyne Electric Supply Co.

The electricity supply undertakings of Bristol, St. Marylebone, and Wolverhampton have co-operated by placing sections of their cable systems at the disposal of the staff of the National Physical Laboratory for observations and measurements extending over considerable periods of time.

Concurrently with this work, and with the aid of the Department, extensive research has also been carried out for the Institution of Electrical Engineers at the University of Liverpool under the direction of Prof. E. W. Marchant and Mr. F. J. Teago. A careful study has been made of the heating of feeder cables of various sections laid in stone-ware troughs filled with bitumen at a depth of about 3 ft. below ground. The mains were laid by the staff of the Liverpool Corporation electricity works. Valuable results have been obtained showing the relation between final temperature rise and current density. In addition, the values of the thermal resistances of the cable coverings and the trough are being determined.

Another research, initiated by the Institution of Electrical Engineers, into the properties of insulating oils and aided by the Department, has been carried out with the assistance of a number of important engineering laboratories and firms, who have placed the services of their technical staffs and their works, together with a considerable quantity of oil, at the disposal of the research. The research had already been in progress three years before it was aided by the Department. Reports received show that considerable progress has been made.

On the advice of our Standing Committee on Engineering, we have initiated a series of preliminary experiments in steam plant for high temperatures and pressures, which is being carried out with the assistance of Messrs. Babcock & Wilcox, Ltd., at the Royal Technical College, Glasgow. We have arranged that the investigation shall begin with careful observations of the internal and external deterioration of superheaters operating at high temperatures. The investigation is being conducted under the direction of a Special Sub-Committee of the Standing Committee on Engineering, with Sir Maurice Fitzmaurice as chairman.

We have refused during the past year to recommend grants in 25 cases.

When we reported last year we had recommended maintenance grants to nearly 40 individuals under a provisional scheme, but a number of these were unable to begin work, mostly because they were called to the Colours. The actual awards made during the session 1916-17 amounted to 36, of which 24 were to students being trained in the methods of research (of whom six were women), 10 were made to independent research workers, and two were made for research assistants.

The Committee of Council have placed a sum not exceeding £6,000 at our disposal for grants to research workers to be made during the session 1917-18, and we intend to continue our experiment of last year. We propose to consider applications for personal allowances, and for assistants,

apparatus, materials, and equipment from research workers in general, and not to confine the grants, as we did at first, to workers in educational institutions.

We have given considerable thought during this year to the question of encouraging inventors. The Department cannot assist in the commercial exploitation of patented inventions. In any suitable cases, however, where funds were needed for working out on a full scale a process or device already patented, we think that we might properly recommend a grant for this purpose, since it would clearly fall within the meaning of industrial research. Inventors who submit suggestions or ideas for investigation are advised if they wish to retain proprietary rights in their invention to obtain provisional protection before submitting details of their invention to the Department.

The encouragement of the discoverer and inventor is a matter with which we have great sympathy. The Department propose to make it a condition of their recognising trade associations for research that provision should be made in the articles of association for the results of any researches being communicated in the first instance to the Committee of Council in order that, after consultation with the board of the association, and any other co-operating bodies and persons, the Committee may determine in the national interest whether, and to what extent and under what conditions, the results shall be made available. This clause will enable the Department to secure, among other things, the interests of the inventor or discoverer who has done work for such an association.

We have received a number of applications from individual firms asking for assistance in dealing with difficulties encountered in the course of manufacture. The co-operative associations for research which we hope to see established will no doubt prove very useful to their constituent firms who are in difficulties of this kind; in the meantime, we shall do our best to assist inquirers to obtain the best advice available. In cases where the difficulty put before us appears to raise a problem of research, we shall, in suitable cases, provide the necessary funds. When a result is obtained we shall invite the manufacturer to repay the cost, or part of the cost, of the investigation, in return for an exclusive right to the use of the results for a period to be agreed on.

We have been considering other possible means of encouraging individual manufacturers who have shown in an unmistakable way that they are anxious to place their works on a scientific basis. In cases such as these we should be prepared to entertain a proposal to attach a young research worker to the works laboratory for an agreed length of time, which might be divided into three periods. During the first period the Department would pay the salary of the worker, during the second the Department would pay half, and during the third the firm would pay the whole.

Whatever has been accomplished will be better understood by comparing the general attitude of manufacturers to-day with their attitude before the war, or even 18 months ago; by noticing the rapidity with which men of science at long last are coming to their own; by listening to the altered tone of all classes, and not least the men of business, towards the claims of education.

A Gas Engine Record.—The experiences of gasolene engines are not usually entertaining, but an exception to the general rule is provided by the career of an engine which was formerly part of the equipment of the No. 1 Australian General Hospital at Lemnos Island. Dr. Stanley Argyle, in the course of a lecture, recited its history. He had to take it over from Egypt to Mudros, where its main function was to supply electric power for the X-ray apparatus at the hospital. Incidentally, it furnished electric illumination for all the tents, and was generally a great boon to the patients. Later it was taken over to Gallipoli, where it survived to the end, and supplied light in numerous dug-outs. At the famous evacuation it was not abandoned, but, together with the electrical equipment connected with it, was removed from the peninsula, "not a yard of wire," added Dr. Argyle, amid applause, "being left behind." *Melbourne Age.*

Research in Japan.—According to a paragraph in *L'Economista d'Italia*, the Japanese have decided on the establishment at Tokio of a laboratory for scientific and industrial research. The chief work of the institution will be to develop Japanese industry by the application of modern methods. The main sections of the laboratory will be those devoted to researches in electricity, chemistry, electrochemistry, textiles, and metallurgy. To cover the expenses, Parliament has passed a law empowering the Government to make a grant to the laboratory of two million yen (over £200,000), payable in instalments of 200,000 yen per annum over a period of 10 years. The Imperial Household has also made a grant of one million yen (£100,000). At a recent meeting, the promoters of the scheme elected a Committee, whose object will be the collection of funds independently of Government grants. A sum of 2,900,000 yen (over £290,000) has already been collected, so that the laboratory will have available funds exceeding five million yen (half a million sterling).

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

- 12,268. "Electrical condensers." W. S. DENNETT. August 27th.
- 12,276. "Power systems." BRITISH THOMSON-HOUSTON Co. (General Electric Co., U.S.A.). August 27th.
- 12,278. "Spark plugs." LA FRENCH POWER SPARK PLUG CO. & E. C. R. MARKS. August 27th.
- 12,280. "Testing for dynamo balance." N. W. AKIMOFF. August 27th.
- 12,284. "Junction-box coupling for electric conduits." J. N. SCISM. August 27th.
- 12,290. "Apparatus for ignition in explosive engines." J. H. STRINGHAM. August 27th.
- 12,291. "Indicators for electric switches, &c." J. M. DE VRIES-DE WAAL. August 27th.
- 12,303. "Armatures of electric motors." W. J. STURGESS. August 27th.
- 12,308. "Electric illuminated walking-stick, &c." F. S. KNIGHT. August 28th.
- 12,320. "Combined electric light fitting and lampholder." R. J. HART. August 28th.
- 12,326. "Electro-deposition of tubes." C. W. DENNY. August 28th.
- 12,351. "Time-limit electric circuit-breaker." AKT. GES. BROWN, BOVERI & CO. August 28th. (Germany, February 20th.)
- 12,357. "Galvanic batteries." G. OLDHAM & J. OLDHAM. August 28th.
- 12,373. "Electric gramophone." D. BRANSON. August 29th.
- 12,382. "Magnetic clutch, gear-box and differential combination." J. LAUDUREY & W. WARNIER. August 29th.
- 12,414. "Fittings for electric lamp shades, reflectors, &c." A. REYNOLDS and F. A. REYNOLDS. August 29th.
- 12,421. "Receivers for wireless signals." C. S. FRANKLIN & MARCONI'S WIRELESS TELEGRAPH CO. August 29th.
- 12,423. "Surface electrical conduits and fittings therefor." AMERICAN CONDUIT MANUFACTURING CO. & A. E. WHITE. August 29th.
- 12,425. "Electrolytic deposition of iron, &c." P. S. DEVEREUX. August 29th.
- 12,427. "Ignition devices." E. C. R. MARKS (Splittorf Electrical Co., U.S.A.). August 29th.
- 12,441. "Reflectors for wireless telegraphy and telephony." C. S. FRANKLIN & MARCONI'S WIRELESS TELEGRAPH CO. August 29th.
- 12,456. "Electrical switches." W. H. COX. August 30th.
- 12,460. "Selector systems for telegraph typewriters." A. E. ALEXANDER (Kleinschmidt Electric Co., U.S.A.). August 30th.
- 12,462. "Electric heating elements." H. J. DOWSING & DOWSING RADIANT HEAT CO. August 30th.
- 12,469. "Phase advancers." BRITISH THOMSON-HOUSTON Co. & N. SHUTTLEWORTH. August 30th.
- 12,473. "Electric bells." E. A. GRAHAM. August 30th.
- 12,478. "Control systems for electric motors." BRITISH WESTINGHOUSE ELECTRIC & MANUFACTURING CO. (Westinghouse Electric & Manufacturing Co., U.S.A.). August 30th.
- 12,479. "Phase converters for polyphase distributing systems." BRITISH WESTINGHOUSE ELECTRIC & MANUFACTURING CO. (Westinghouse Electric & Manufacturing Co., U.S.A.). August 30th.
- 12,480. "Phase balancers for polyphase distributing systems." BRITISH WESTINGHOUSE ELECTRIC & MANUFACTURING CO. (Westinghouse Electric & Manufacturing Co., U.S.A.). August 30th.
- 12,520. "Electromagnets." C. H. FRITCHARD. August 31st.
- 12,539. "Generating ignition currents for internal-combustion engines." SPLITTOF ELECTRIC CO. August 31st. (U.S.A., August 31st, 1916.)
- 11,047. "Electric accumulators." C. H. WORKSOP. September 1st.
- 12,552. "Electric heating and cooking apparatus." G. PATE & A. R. WOOD. September 1st.
- 12,577. "Receivers for wireless signals." C. S. FRANKLIN & MARCONI'S WIRELESS TELEGRAPH CO. September 1st.

PUBLISHED SPECIFICATIONS.

1916.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

- 6,404. ELECTRICAL REGULATORS. C. F. Kettering. July 26th, 1915. (101,014.)
- 6,405. SYSTEMS OF ELECTRICAL GENERATION. C. F. Kettering & W. A. Christ. October 27th, 1915. (101,960.)
- 10,491. ELECTRICAL DRIVING, PARTICULARLY FOR MOTOR VEHICLES. H. Crochal May 9th, 1916. (Addition to 4,962/16.) (106,263.)
- 11,047. CUT-OUT FOR ELECTRIC CIRCUITS. E. C. R. MARKS (Kuntziger, J. H. Charvin & F. Fontaine). August 4th, 1916. (108,511.)
- 11,146. ELECTRICALLY-HEATED WEAVING APPARATUS. A. Salvatico. August 7th, 1916. (108,516.)
- 11,326. DYNAMO-ELECTRIC MACHINES. G. Schroeder. August 10th, 1916. (108,529.)
- 11,382. ELECTRIC TRANSFORMERS. A. F. Berry. August 11th, 1916. (108,532.)
- 11,787. SPARKING PLUGS FOR USE IN INTERNAL-COMBUSTION ENGINES. H. G. Longford, W. W. Longford & W. A. Clark. August 19th, 1916. (108,546.)
- 13,005. MAGNETS FOR TELEPHONIC AND LIKE CALLS. J. B. Naberes. September 18th, 1915. (101,542.)
- 13,007. TELEPHONE HAND SET. Western Electric Co., G. H. Nash & B. B. Brace. September 13th, 1916. (108,565.)
- 13,198. ELECTRICAL FUSES OR CUT-OUTS. H. W. Cox. September 18th, 1916. (Addition to 2,491/16.) (108,567.)
- 14,012. ELECTRIC HEATING DEVICES. R. K. Hearn. October 3rd, 1916. (108,578.)
- 14,518. METHODS OF AND APPARATUS FOR ELECTRIC SHIP PROPULSION. British Thomson-Houston Co. (General Electric Co., U.S.A.). October 12th, 1916. (108,586.)
- 14,821. MEANS AND APPARATUS FOR OBTAINING HIGH VACUA. British Thomson-Houston Co. (General Electric Co., U.S.A.). October 18th, 1916. (108,590.)
- 15,837. INTERFERERS FOR IGNITION MAGNETS. M-L. Magneto Syndicate and E. A. Watson. November 6th, 1916. (108,603.)
- 17,451. DYNAMO-ELECTRIC MACHINES. H. A. GILL (United States Light and Heat Corporation). December 5th, 1916. (108,620.)
- 17,304. MANUFACTURE OF POROUS MINERAL PRODUCT FOR USE IN CHEMICAL AND ELECTRIC OPERATIONS, AS REFRACTORY MATERIAL, AND FOR OTHER PURPOSES. M. Barrelet. December 2nd, 1916. (108,619.)

1917.

- 4,005. GALVANOMETERS. March 19th, 1917. J. Rymer-Jones. (108,649.)
- 4,188. ELECTRIC CIRCUIT BREAKERS FOR POLYPHASE ALTERNATING-CURRENT CIRCUITS. Igran Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.). March 22nd, 1917. (108,651.)

THE ELECTRICAL REVIEW.

VOL. LXXXI.

SEPTEMBER 21, 1917.

No. 2,078.

ELECTRICAL REVIEW.

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PARIS TRAMWAYS AND WAR TROUBLES.

A TYPICAL instance of the difficulties with which French tramway companies have to contend under the conditions of the war is afforded by the experience of the East Parisian Tramways Co. (Tramways de l'Est Parisien), whose gross profits in 1916 were less than in the preceding year, and which succeeded in equalising the expenditure in 1916 only as a result of the gross profits which were realised on the manufacture of munitions of war. These matters are fully set forth in the company's annual report, and amplifications were given by the chairman at the recent general meeting, particular interest being manifested in figures showing the great advance in the cost of materials as compared with the period before the war.

The report states that, while the normal working conditions upon which the fares fixed by the company's concession were based have been completely changed by events which could not be foreseen, and while the sale prices in trade and industry everywhere have increased at a rate corresponding to the advance in cost prices, the company are prohibited from making any modification in the fares to be paid by passengers. The steps taken by the directors with the object of securing a change on the part of the local authority which granted the concession have had no effect, and the intervention of the Government has only been manifested in the direction of increasing the company's burdens by enforcing the grant of war bonuses to the tramway workers, whereas such bonuses, it is contended, should have been simultaneous with the giving of permission to raise the fares. In addition, the conceding authority, persistently ignoring the state of war, has applied the penal clauses of the concession contract by inflicting daily fines upon the company for the non-observation of the time tables in operation in peace times, whereas the present conditions render it impossible to adhere to these time tables absolutely. Not only so, but despite numerous applications, the company have not yet been authorised to bring into operation certain advantageous arrangements in the concession contract which only require the fulfilment of certain formalities which were already concluded some time ago.

The difficulties which were referred to in the report for 1915 have been accentuated with the continuation of the war. Although the company were eventually empowered to extend the use of female labour in the working of the cars, it is not possible to maintain the effectives without trouble, and the maintenance staff in particular has not been adequately reconstituted. The scarcity of specialised labour, and the impossibility of obtaining all necessary raw materials and spare parts for the maintenance of the rolling stock and tracks, have compelled the company to limit their efforts to the execution of the most urgent works, the others being postponed for the future. The same circumstances have prevented the execution of renewals to the extent followed in normal times, but the delay will be overtaken as soon as the means are available. It has, however, been possible to double four lines in connection with the scheme for the reorganisation of the system.

M. Bonsquet, chairman of the company, directed the attention of the shareholders at the meeting held in 1916 to the exceptional charges which the company had to bear, and which arose from (1) the enhanced cost of raw materials, (2) the increased cost of coal, and (3) the rise in wages.

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ADELAIDE: Messrs. Atkinson, & Co., Gresham Street.
AUCKLAND, N.Z.: Gordon & Gotch, Albert Street; The Mining and Engineering Review, 31A, Strand Arcade, Queen Street.
BRISBANE: Gordon & Gotch, Queen St.
CHRISTCHURCH, N.Z.: Gordon and Gotch, Manchester Street.
DUNEDIN, N.Z.: Gordon & Gotch, Princes Street.
JOHANNESBURG, CAPETOWN, BLOEMFONTEIN, DURBAN, PORT ELIZABETH, &c.: Central News Agency, Ltd.
LANCESTON: Gordon & Gotch, Cemetery Street.

MELBOURNE: The Mining & Engineering Review, 90, William Street; Gordon & Gotch, Queen Street.
MILAN: Fratelli Treves.
NEW YORK: D. Van Nostrand, 25, Park Place.
PARIS: Boyveau & Chevillet, 22, Rue de la Banque.
PERTH, W.A.: Gordon & Gotch, William Street.
ROME: Loescher & Co., Corso Umberto I° 307.
SYDNEY: The Mining & Engineering Review, 273, George Street; Gordon and Gotch, Pitt Street.
TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.
WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

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THE "ELECTRICAL REVIEW'S"

ELECTRICAL & ALLIED TRADES DIRECTORY (THE RED BOOK),

1917 EDITION

NOW READY.

H. ALABASTER, GATEHOUSE & KEMPE,
4, Ludgate Hill, London, E.C. 4.

Amplifying this information at the recent meeting, the chairman quoted the following figures in regard to the prices which prevailed before the war and those which were charged in June, 1917 :—

THE COST PRICES OF MATERIALS IN FRANCE.

	Pre-war period in		June, 1917.
	1914.	1914.	
Cast-iron	33'00	110'00	
Cast-steel	90'00	240'00	
Brake blocks	18'00	75'00	
Trolley poles	21'00	63'50	
Wheel tires	36'00	115'00	
Tool steel	8'00	35'00	
Copper wire	230'00	670'00	
Oak wood	1'50	5'40	
Motor oil	45'00	210'00	
Coal	29'00	182'00	

The chairman did not mention the weights, &c., to which the figures apply, excepting in the case of coal, but the differences are sufficient for the purpose of illustrating the great advance. The cost of the imported coal relates to the tonnage price delivered at the company's power station, the coal having to be conveyed from the ports up the Seine as far as Vitry. In this connection it is stated that the coal now being received is far from equalling that which was supplied prior to the war. The mines, the chairman explained, are no longer worked with the same care as in times of peace, and the coal forwarded is not well sorted or well washed, so that it does not yield the same efficiency. For instance, the consumption of coal at the company's power station, which amounted in peace times to 1,300 grammes per kw.-hour produced, has now risen to 1,450 grammes per kw.-hour, so that a larger quantity of coal has to be consumed in order to obtain the same quantity of energy. The chairman also referred to the labour question, and mentioned that a further war bonus of 0.75 fr. per worker per day has been compulsorily imposed upon the company by the Government, making a total advance of 1.50 fr. per individual since September, 1916.

The effect of the increases under the foregoing three classes has been to double the working expenses per car-kilometre run, as contrasted with the pre-war period. This fact is illustrated by the following figures concerning the working expenses in the first four months of the five years mentioned :—

WORKING EXPENSES PER CAR-KILOMETRE.

First four months of 1913	0.539 fr.
" " " " 1914	0.564 "
" " " " 1915	0.767 "
" " " " 1916	0.776 "
" " " " 1917	1.069 "

The chairman, in conclusion, again referred to the question of fares, and remarked that it was impossible for the State to recognise the necessity for an increase in railway fares, which had been sanctioned, and to refuse to give the company any compensation in the same direction. During the discussion attention was drawn to the fact that certain tramways, notably the tramway from Paris to Bourg-la-Reine, had raised their fares by 25 per cent. It was explained, however, that the particular undertaking concerned was not a tramway, but a "railway of local interest" (light railway)—the Compagnie de Chemin de Fer sur routes de Paris à Arpajon—which is not subject to the same *régime* as the tramway companies in the Department of the Seine.

Electricity Supply Restrictions and Prices in Germany.

As a result of the comparative scarcity of coal in Germany, owing to the great demand and the shortage of mining labour, the Government recently issued an order placing restrictions on the consumption of gas in general, and this is about

to be followed by a similar order in relation to the use of electricity. The object in each instance is to effect economy in the consumption of coal, and new connections to the distributing mains will only be permitted in cases which are officially considered to be very urgent.

A war-tax on the sales of coal as from the pits was brought into force on August 1st, and producers are authorised by law to add to the accounts rendered to customers the amount of the increase arising from the imposition of the tax. In their turn, the electricity supply companies and local authorities who own supply works are also empowered, as from August 1st, to transfer to consumers the additional burden resulting from the greater cost of coal. The German War Office authorities, through the Imperial Commissioner for Gas and Electricity, have now issued a communication pointing out that since the beginning of the war the prices of coal have risen by 100 per cent., and even higher, and those of other raw materials by several hundreds per cent., whilst, at the same time, wages have advanced to an extraordinary extent. In addition, the gas and electricity supply works have also assumed considerable burdens in the direction of contributing towards the support of the families of those workmen who have been called up for army service. As a consequence, the calculations upon which supply contracts entered into before the war were based, have been completely upset. It is therefore contended that large consumers, although in individual cases having the formal right on their side, reasonably can no longer ask to be supplied at prices which result in a loss, when they themselves realise ample profits from the sale of manufactures at prices corresponding with the general advance in the costs of production. It must consequently be expected, it is said, that large consumers, just as the Government departments have done on the production of proofs of the disproportion between prices, will consent to pay to the gas and electricity works an increase in price equivalent to the expansion in the latter's cost of production.

The official communication proceeds to state that the influences of war conditions on the tariff rates arranged in the contracts for the supply of small consumers are still more surprising, as in these cases other matters come into consideration besides the growth in working expenses. For instance, the expenses of making connections for consumers are paid on the assumption of lasting and unhindered utilisation, and the tariffs were fixed on the assumption of a minimum period of consumption in the case of the installations connected up. But these contract conditions have partly experienced a decisive change and partly been abolished by the introduction of "summer-time," the restrictions imposed by local authorities on the consumption of light and power, and the stoppage of establishments or of machinery, as, for instance, bruising mills in agricultural districts. Moreover, numerous small consumers have been requisitioned for the army, and either do not meet the obligations they assumed on the connections being made, or only do so incompletely.

A large number of towns and communes for the foregoing reasons have voluntarily consented to pay an increase in the tariff rates charged to them, the advance frequently being regarded as appropriate at 25 per cent. It is held to be in the interest of the local authorities for the gas and electricity works to be maintained in an efficient condition, and in their decisions the latter cannot leave out of consideration the fact that working during war time is associated not only with a very unusual growth in the working expenses, but also with an extraordinary depreciation of the plant, and that materially higher prices will have to be paid for renewals after the war. The War Office authorities, under the circumstances, conclude by stating that they consider it requisite and just for consumers to pay to the works prices which correspond with their increased costs of production, in the interest of the works being maintained in regular operation.

SOME SUGGESTIONS FOR THE PREVENTION OF MISTAKES IN METER READING.

By G. W. STUBBINGS.

THE periodical reading of consumers' meters was, before the war, a business that was carried out smoothly and with little trouble. Meter readers were thoroughly accustomed to their work, and mistakes were of comparatively infrequent occurrence. In present circumstances, when men and women of little or no previous experience have to be put on this class of work, mistakes are considerably more frequent. The operation of meter reading is peculiar, in that the person engaged on the task works quite by himself, and cannot be supervised in the same way that other employes are. Mistakes, moreover, may be of far-reaching consequence, causing friction with consumers and involving great trouble for their satisfactory adjustment. It is therefore desirable to inquire into the various possible mistakes that can be made, the probable causes of the same, and also to consider the question as to what system of instruction will best fit the new meter reader to perform his or her work speedily and accurately.

The most serious error likely to be made is that of misreading the meter, as this is the most unlikely to be immediately discovered. The operation of meter reading, although seeming so simple to those thoroughly accustomed to it, gives great trouble to beginners. The difficulties are greatly increased by meters being fixed in bad positions for reading. It is always worth the expense of a few feet of cable and tubing to arrange for the meter to be in a position convenient for reading, as the possibility of error will be greatly reduced. A meter is not like a service cut-out, which has only to be examined in unusual circumstances, but is fixed in a building expressly in order that it may be read periodically. Meter dials should be as large as possible, and have bold plain figures; and these dials should be in a line, in the correct sequence. Some meters have three dials arranged in equilateral triangular fashion, and it requires a close inspection of the meter to discover the correct order for reading. With cyclometer or jump counters, the possibility of error should be largely reduced, but difficulties are often introduced by the necessity of having the eye of the observer level with the counter for reading. Furthermore, counters having figures engraved on white metal barrels are difficult to read in a bad light. A good dial counter can be read while at a level of 2 or 3 ft. above the eye, in a moderate light. It is of great importance in a cyclometer counter to have the decimal figures plainly marked. A red comma is not sufficient, and means should be employed to make the distinction quite obvious. Meter readers should always be instructed to read meters of large capacity with extra care, and thoroughly to examine the dial before so doing. With such meters the last dial to the right sometimes reads 10 per division. If it is the custom to set dial counters to zero in the test room, this should be carefully done, otherwise inconsistent readings of adjacent dials may cause the meter reader to blunder.

Conscientious meter readers can usually discover serious errors of reading by comparing the consumption indicated for the current quarter with that for a previous corresponding period, making intelligent allowances for altered circumstances. If meter readers could only be trained to take this simple precaution before leaving consumers' premises, and also to check their reading if the consumption appeared at all different from what should be expected, serious errors would be largely avoided. To encourage this to be done, it is not advisable to insist unduly on speed in meter reading. Accuracy is the first essential; speed, whilst being desirable, and characterising an efficient meter reader, is only secondary.

Some meter readers are very prone to errors in subtraction. This mistake is, of course, immediately detected by the clerical staff dealing with the readings, but it involves a journey to the consumer's premises to correct his meter-card, and not infrequently elicits from the consumer a facetious letter informing the department of what they have already found out. This error can be avoided if the meter

reader will perform the subtraction twice—once in the meter reading book and once on the consumer's card—and then compare the results of his two calculations. This simple precaution is very difficult to get carried out, as usually the meter reader copies from the book to the card, or *vice versa*.

Errors sometimes occur on premises having more than one meter, by confusion of the meters, and entering up the reading of one on the page in the book allotted to the other. This is usually due to gross carelessness; but, nevertheless, the system of marking the owners' numbers on meters should be a good one, and it should not be necessary for the meter reader to scratch a rusty label in order to discover such number. The system of stencilling owners' numbers on the glass, or marking it on the dial, has much to recommend it from the point of view of meter reading. This method should, however, only supplement, and not displace, the more permanent brass label.

It is an excellent practice for meter readers to try all meters on one light, or on the smallest load possible. This is not always convenient, but if the consumption shown by the meter differs considerably from that of the corresponding period of the previous year, a special effort should be made to do this. It is to be remembered that a meter does not usually stop suddenly, but gradually gets slower on low loads, with a gradually increasing starting current. A meter may show a satisfactory consumption, and, indeed, be accurate on the usual load of the installation, while stopping on one light. Next quarter such a meter may fail altogether, necessitating an estimated consumption and the possibility of dispute. Systematic inspection of meters whilst reading, and changing those unsatisfactory on one light, will greatly reduce meter stoppages. It is a good plan to have a small column provided in the meter reading book, in which a tick can be made if the meter has been tried. A different mark should be made when the meter was found going, as in the case of a power load. When readings are being examined by the consumer's clerk, those showing an unsatisfactory consumption, the meter not having been tried, can be held back in order that this may be done.

Meter readers should be instructed to endeavour not to talk to consumers, and not to express any opinion regarding any complaint they may have to make. Such a discussion is not only a waste of time, but sometimes gives rise to disputes, owing to the consumer alleging that the meter reader said something that he either actually did not say, or did not intend to say. Meter readers may be betrayed into expressing some opinion which will subsequently be quoted by the consumer as having been offered by an authorised representative of the supply authority. Meter readers should, therefore, tell consumers to make their complaints by letter. The same applies to requests by the consumer for work to be done, or minor alterations to be carried out. In cases of low consumption the meter reader might inquire of the consumer as to the reason of the same, and make a note of such reason. This will be useful, as at some future time an estimated consumption may have to be made, when the consumer may endeavour to get the low consumption, which really was due to abnormal conditions, taken as a criterion for estimation. The instruction to avoid, as far as possible, conversation with consumers must not, of course, be taken to absolve meter readers from the natural obligation to be courteous, and to endeavour to cause the consumer as little inconvenience as possible.

Seals should be examined on meters, and, as far as practicable, on service cut-outs also. It is, however, advisable for service cut-outs to be separately inspected and examined periodically. These cut-outs are often fixed in out-of-the-way positions, and to insist on an inspection of the seals by the meter reader would unduly delay the readings; while, quite possibly, some cut-outs would never be inspected. A separate inspection—say yearly—of service cut-outs is therefore desirable.

It is a good plan for the electricity department to have drafted a set of instructions representing the practice of the department regarding meter readings. Such instructions should be typewritten, and a copy should be given to each meter reader for thorough perusal. A suggested set of instructions is as follows:—

INSTRUCTIONS TO METER READERS.

1. Read meter twice, once for meter book and once for consumer's card. Subtract twice to obtain consumption, and, finally, compare entries in card and book. Do not copy from card to book, or *vice versa*.

2. If consumer's card be full, make out a fresh one. If the consumer has difficulty in finding the card, request that it be kept near the meter.

3. Endeavour to try all lighting meters on one light, and power meters on the smallest load possible. If the meter is satisfactory, make a tick in the column provided. If the meter will not work on one light, ascertain the smallest number of lights on which it goes, and note this in your memorandum book.

4. If the meter be found stopped, make a note of this, and also of the reading, but make no entry either in the meter reading book or on the consumer's card.

5. Compare the consumption with that for the corresponding quarter last year. If markedly different, check the reading, and, if low, try the meter, if this has not been done. If all is satisfactory, inquire of consumer the reason of the abnormal consumption, and make a note of the same.

6. Complaints of high consumption, or verbal orders for work to be done, are not to be taken by meter readers. Inform the consumer that such complaints and orders must be made in writing.

7. While always being civil to consumers, endeavour to have as little conversation with them as possible. Above all, refrain from expressing any opinion regarding any complaint they may have to make.

8. Inspect seals on meters, and also, if possible, on cut-outs, noting any missing. Make a note also of any broken meter or cut-out glass, or any apparently defective wiring you may come across.

THE QUESTION OF "THE STAFF" IN ENGINEERING ESTABLISHMENTS AFTER THE WAR.

[COMMUNICATED.]

At the present time discussions anent the extreme importance of harmony existing between workman and employer are as plentiful as leaves in autumn.

It is laid down as an axiom, and quite rightly, that the workman must turn out more work, and be permitted to earn higher wages, than tradition has approved of in former days; and that the manufacturer must have his works full of good orders, which will be obtained solely and simply by the fact that he can turn out articles by the 100,000, with the aid of automatic machines worked to their full output, enabling him to place his wares on the market at an extremely low price.

At the same time, we hear on every hand of the necessity of better and wider education for engineers; of the necessity of technical preparation for even the coming generation of workmen; and of insistence on study for two or three years at an institution of university standing for those who would take commissioned rank in the new engineering army.

Whilst in its way all this discussion may be quite good and necessary, it seems to the writer that the interests of one important section of the engineering army have been overlooked entirely. This section is that generally known as "The Staff"—usually spelt with a large S when referred to at annual dinners on the occasion of the annual back-patting exhibition, and with a very diminutive s when its salary is being considered.

To say that in the past, and even to-day, the staff—in which term are included all technically-trained men, whether in the drawing office, the test-bed department, or on administrative work—have been underpaid and shabbily treated, is to state a platitude. Yet, without this body of men, the engineering industry would be impossible in this or any other country.

Let us consider for a few moments what the training

and work of men engaged in such appointments include, and then consider their remuneration. A young fellow after spending, say, four to six years at a good grammar school, has usually entered some works as an apprentice, with an agreement to go through all departments, and to finish up in the drawing office; certainly, during the last 20 years, it has not been the invariable custom to pay a premium for this privilege, but a low rate of wages, and in many cases no wages at all, have been the rule.

Diligent work during the day has been supplemented by study in the evenings, the man's general education probably having taken him at least up to quadratics and through a considerable portion of Euclid, and given him also a good foundation in physics and chemistry. At the evening technical school this man has been enabled to enhance his theoretical knowledge to a considerable extent; opinions of people interested in purely day courses notwithstanding.

Thus, at the end of five or six years, by the time the man has attained the age of 22 or 23 years, he has a good practical acquaintance with actual commercial work, and a very sound theoretical education, especially in applied subjects. And let it be remembered that this training has cost him no small amount of study and thought, of a particularly tiring and concentrated type.

The same course of training has often been followed by the boy coming from a rather lower social stratum, who has worked his way from the elementary Council school up to a higher grade school, and there obtained a good sound drilling in mathematics and practical science.

Both these men will be engaged as draughtsmen for some time after they have become 21 years of age, and will be quite ready to work in subordinate appointments as long as they can gain wider and more valuable experience.

They expect, and the writer upholds them in this view, that by the time they are 25 or 26 years of age they should be able to earn, in ordinary peace time, at least £120 to £130 a year. It is well known, however, that in ordinary times this salary is not paid to a man unless he is doing responsible—in fact, very responsible—work, involving fairly difficult calculations, and at least a good working knowledge of the plant he is assisting to design, whilst he is usually nearer 30 than 25 when he reaches this meagre salary.

A step on the ladder of promotion, often looked forward to with some amount of eagerness, arrives when the draughtsman is asked, at about the age of 28 years, to go down to the works of some customer of the firm, and witness a test on some of the firm's plant.

This is responsible work; and the writer has known men almost live on the job for ten days or a fortnight on end in order to achieve guaranteed results and to give satisfaction to a customer.

Work of this type demands that a good and really smart suit of clothes be worn whilst the firm's client is being visited, and it is worthy of remark that the draughtsman provides this suit out of his own pocket; and if he is not willing so to rig himself out, he will certainly not be sent on such work.

That a smart appearance is necessary on such work is undeniable, but to expect a man on £130 a year to keep such an appearance going is in every way unfair, especially as this type of work soon ruins his clothes.

All that such men get out of such appointments is a few days at a more or less good class hotel, and, as a rule, anything from a week's to a fortnight's harassing work, which extends from first thing in the morning to late in the evening.

Naturally, having been on such work confers some amount of distinction on a man, and on first getting such work to do he is elated at his prospects. Time, however, soon shows him that he is not the only man to possess such experience, and that his value in the open market is but little enhanced on that account.

It is at this stage that dissatisfaction sets in, and it is fortunate for the man himself, the profession to which he belongs, and the country in general, that he so seldom turns out of the straight path, but contents himself with grousing and preventing his own or his friends' children from following in his footsteps.

On the other hand, there are some reckless and daring spirits who will not sit down under what they consider a grave injustice, and so decide to make society in general give them an income more in keeping with their talents than ordinary straight going will provide.

To the writer it seems obvious that the scandalous under-payment of staff engineers is nearly always at the bottom of these regrettable wrong-doings.

No decently educated fellow is going to risk his future career, and, above all, his honour and reputation, unless he has been brought to such a state of bitterness at his prospects in life, compared with the standing he should occupy and the salary he should receive, when the national importance of his work is considered, that he loses all caution, becomes reckless, and decides that the community which confers thousands a year, or even a month, on tricky company promoters, shall be laid under toll to his brains and abilities, for something better than a mere pittance.

The writer asks for no sympathy for such men, they must be put out of the reach of doing such mischief; but he does ask the great industry to which they belong to reflect that when such ability goes so far wrong, there must also be something radically at fault with the management of the industry itself.

Above all, it must be admitted that, to a man educated as outlined above, £200 a year at 30 years of age, with the off-chance of £350 by the time the age of 38 or 40 is reached, is only a meagre prospect.

What, then, must the prospect appear to those whose parents have, in addition to the training outlined, spent the necessary money to give their sons a theoretical education of University standard, such as is being called for to-day?

The prospect is practically ridiculous; and when it becomes realised, it will prevent men coming into engineering, with the consequence that either the British engineering industry will not be equipped with the type of official staff required for the very strenuous conditions immediately before us, or it will be necessary to call in the well equipped foreigner, who works for a pittance in return for learning our language, our ways, and the general lay-out of our works, the towns in which they are situated, and the roads and railways which lead to them; for it is in this way that the low-priced foreign staff engineer has taken his full payment.

To conclude, the writer draws from his own experience. Educated for some years at a well-known grammar school, he, along with others, went into engineering in the manner previously outlined, and was also a day student after reaching the age of 21.

Having always kept in touch with the "Old Boys" Association, it is pleasurable and profitable, once or twice a year in normal times, to foregather and talk matters over with the fellows who were for years in the same Form, and who went up the school in work and play alongside oneself.

Practically in every case the men who have gone into commercial pursuits, such as banking, have not only done better, from a salary point of view, than the engineers, but have had much less study to obtain their positions; whilst they are free from quite half the worry which a similarly paid engineer has to put up with, and rarely, if ever, have to face the personal discomforts and risks which are a portion of the staff engineer's daily routine. Consequently, one meets one engineer after another who does all he can to discourage suitable boys from taking up the profession, and who, as a rule, absolutely forbids his own progeny to take it up.

The workman has to be considered, because he is ready to fight. Do the heads of our great engineering firms wish to make the staff man think that he, too, will never receive fair remuneration, or fairly reasonable security of tenure, unless he also prepares to defend his interests in the same manner?

Stinginess in granting war bonuses to meet the higher cost of living, and the general absence of any idea of remembering the wants of the staff, in making after-war arrangements, go a long way to confirm this idea.

Let us hope that, before it is too late, this oversight will be remedied.

THE PLIOTRON OSCILLATOR.

In our issue of May 28th, 1915, we described the pliotron, and its varied uses in wireless telegraphy and telephony; as there explained, its operation depends upon the passage of current between electrodes in a high vacuum by means of pure electron discharge—the thermionic current. The pliotron has not yet made its appearance on the market in this country, but its construction and applications are being developed in the United States by the research laboratory of the General Electric Co., of Schenectady, and in the *General Electric Review* for August Mr. W. C. White describes its use for obtaining either a large current or a high voltage at high frequency.

When used as an oscillator for the production of alternating current from a direct-current source of energy, the pliotron has the characteristics of an amplifying relay; that is, the wave shape of any variable E.M.F. applied between the electron-emitting cathode and the grid (or controlling member) will be faithfully reproduced by the current in the main anode-to-cathode circuit. Hence the input of a small amount of A.C. energy will set up a relatively larger amount, identical in frequency and wave shape; and by utilising a small proportion of the A.C. energy thus produced to feed back to the input circuit, the system can be made self-exciting; A.C. energy can thus be obtained from a D.C. source, the pliotron and its auxiliary apparatus forming a type of converter.

For laboratory and testing purposes, there is considerable use for constant-amplitude high-frequency electrical energy.

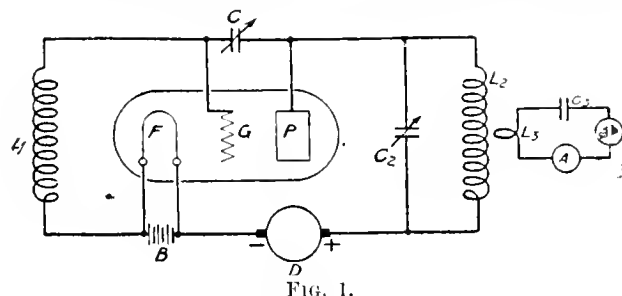


FIG. 1.

For instrument and meter calibration, heavy high-frequency currents are often required, the actual amount of electrical energy dissipated being comparatively small.

In the case of tests on insulating materials to ascertain dielectric strength and dielectric losses, high-voltage high-frequency is often necessary, although in this case also the amount of electrical energy required is small.

Two pliotron oscillator arrangements for high-frequency are described, the first for the production of relatively large current and the second for the production of relatively high voltage. In each case the amount of energy involved is comparatively small, of the order of 150 watts or less.

In a resonance circuit the current will rise until the losses become equal to the input energy. With practical circuits the lower limit of power factor obtainable is about one half of 1 per cent., unless unusual precautions are taken. This means that the maximum resonance current produced is about two hundred times the value of the true energy current fed into the resonance circuit.

Therefore, where large currents are desired from a small quantity of energy, the total volt-amperes of the circuit must be kept small; and this condition requires that for such a resonance circuit a large capacity and small inductance must be used.

It is also important to adjust the resistance of the load to the voltage of the supply so that the energy is most economically utilised. This means that the resistance of the heavy-current circuit must be given the apparent value most suitable for insertion in the pliotron circuit. This adjustment of apparent resistance is accomplished by electromagnetic coupling or transformer action.

The diagram of an arrangement to produce currents of from 10 to 25 amperes from one pliotron tube at frequencies between 100,000 cycles and 1,000,000 cycles is shown in fig. 1.

Suppose it is desired to calibrate a hot-wire ammeter by

means of direct comparison with a standard. These two ammeters are represented by A and A_1 , and are connected in series as part of a resonant circuit, the inductance and capacity of which are shown at L_3 and C_3 respectively. The product of the values of L_3 and C_3 to be used for any particular case is found by the usual resonance formula— $f = 1/2\pi \sqrt{LC}$.

As mentioned above, a low power factor and volt-ampere product is desirable; and therefore the inductance value of L_3 is made the minimum possible, consisting usually of only one or two turns of heavy conductor. With the range of frequencies specified, this gives values for C_3 of the order of about 0.1 microfarad. In this heavy-current circuit it is, of course, very necessary to use condensers of low energy loss, and to reduce the ohmic resistance of the conductors to a minimum.

The inductance L_3 obtains energy by electromagnetic coupling from the coil L_2 , which is connected in the plate circuit of the pliotron.

By means of an adjustment of the values of L_1 , L_2 , and C_1 , the pliotron system can be made to set up a high-frequency current corresponding in period to the tuned heavy-current circuit.

Owing to the relative values of L_2 and L_3 , the apparent resistance in the plate circuit of the heavy-current load circuit is greatly multiplied, but still is not of a sufficiently high value to absorb all the available energy. Further to

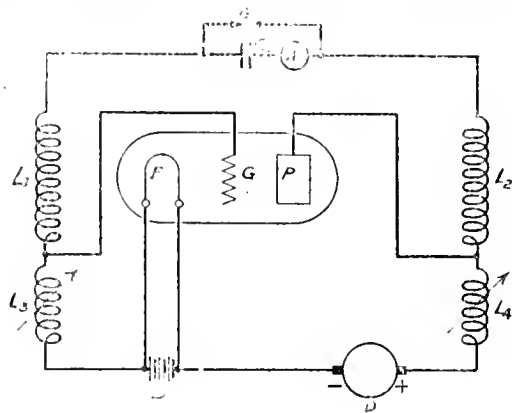


FIG. 2.

increase this apparent resistance, a variable capacity C_2 is shunted about the inductance L_2 . Then, by simultaneous variation of these two factors, the apparent resistance of the load can be adjusted to give the largest energy output available.

The heavy-current output is dependent upon the voltage of the direct-current source n , a useful range being between 200 and 750 volts. Pliotrons may be operated in parallel to produce a load current larger than that obtainable from one tube.

For the production of high voltage in a resonance circuit, the conditions are almost the reverse of those in a heavy-current circuit; that is, with a fixed value of inductance and capacity to give the desired frequency, the capacity must be small and the inductance relatively large.

A pliotron oscillator arrangement for the production of high voltages is shown in fig. 2. The high voltage is obtained across the condenser C_1 , and may be tested by the gap G . A condenser in the form of two metal plates suspended in air* is the most convenient, and it may have a capacity value between 20 and 200 micro-microfarads for a frequency of 100,000 cycles. With a hot-wire ammeter A in circuit with the condenser, and knowing the frequency, the voltage produced across C_1 may be simply calculated.

The inductances L_1 and L_2 are similar, and each has a value of about 8 millihenries. The invariable inductances L_3 and L_4 are also similar to one another, and each has a maximum value of about 2.5 millihenries.

The object of having L_4 variable is for the purpose of applying the high-frequency energy from the pliotron to the resonance circuit at the correct voltage, so that the energy

available is used most advantageously in the resistance of this circuit. The inductance L_3 is made variable, so as to supply to the grid just the right amount of high-frequency energy to make the system self-exciting and to excite it in the most efficient manner.

As in the case of the arrangement for heavy currents, a suitable range of potential for the direct-current source is from 200 to 750 volts.

With such values of inductance and capacity that a frequency of 100,000 cycles is obtained, a voltage of 12,000 may be produced from one pliotron tube operating from a direct-current source of 500 volts.

Pliotron tubes may be operated in parallel for the production of a voltage higher than that obtainable from a single tube.

A NEW HIGH-TENSION METER.

UP to the present, "high-tension" electricity meters have consisted simply of low-tension meters coupled to the high-tension circuit by instrument transformers, and subject to various errors and inconveniences due to the use of these transformers. The trend of modern power generating and distributing policy is such that it is necessary to have tariffs on high-tension current and to measure consumption in front of the consumer's step-down transformers. The meter described below* contains only low-tension components, but it avoids the use of instrument transformers by using in their stead the consumer's step-down transformer itself. The energy $P_h \cdot t$ delivered during a time interval t to the high-tension terminals of this transformer is given by:—

$$P_h t = P_l t + P_o t + [R_2 I_2^2 + R_1 (I_1 - I_o)^2] \cdot t \\ = (P_l + P_o + P_r) t$$

where P_l = power at low-tension terminals of the transformer; P_o = light-load losses of transformer; R_1 , R_2 = resistances of high-tension (primary) and low-tension (secondary) windings respectively; I_1 = primary current; I_o = light-load primary current; I_2 = secondary current; $P_r = R_2 I_2^2 + R_1 (I_1 - I_o)^2$.

This method of measuring the energy delivered to a transformer is on the same principle as the separation-of-losses method of

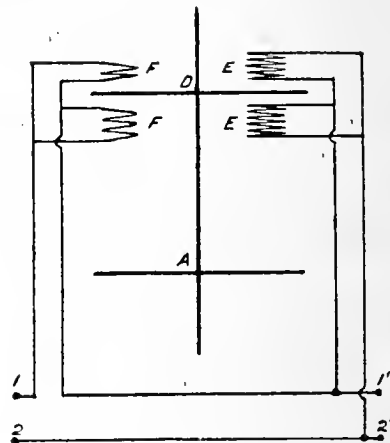


FIG. 1.

measuring power and determining efficiency during tests on electrical machinery or transformers. The measurement of $P_l t$ is effected by an ordinary low-tension meter, and that of $P_o t$ and of $P_r t$ is effected by special components, which may constitute a separate meter with its own train, or operating on the same train as the main low-tension meter. It is best, however, to let the special components act directly on the moving element of the main meter. This meter is then subjected, directly it is connected in circuit, to a relatively large driving torque due to a distinct element or part. Further, since the light-load losses of a transformer are practically constant, the starting torque on the meter is also constant. This simplifies and makes more accurate the adjustment of the main meter at all loads, and avoids the difficulty otherwise experienced in securing accurate adjustment at low loads. The danger of creeping and the effect of friction on starting are avoided.

Fig. 1 shows diagrammatically the special components recording $P_o t$ and $P_r t$ (the ordinary windings recording $P_l t$ are omitted for simplicity) in a single-phase meter recording the energy supplied to a single transformer. In this figure, A represents the main moving element of the meter, which may be a motor meter or a rotating-field meter; D is a metal disk, on the same spindle as A , and acted on by windings EE , FF , which record respectively $P_o t$ and $P_r t$. The windings EE are of different reactances, connected in parallel between the two secondary mains. If U_2 be the secondary p.d. of the transformer, r, r' the resistances of the two coils EE , and

* Two metal plates, each 10 in. by 10 in. and spaced $\frac{1}{4}$ in. apart, give a condenser having a capacity of approximately 10 micro-microfarads.

* From a paper by P. F. Dufour, *Rev. Gén. de l'Electricité*.

ϕ, ϕ' the phase displacements of their currents with regard to u_2 , the driving torque exerted by E on D is proportional to $(u_2^2/r^2) \cdot \cos \phi \cdot \cos \phi' \cdot \sin (\phi' - \phi)$. Again, if u_1 be the primary P.D. of the transformer, and θ_0 the phase difference between u_1 and i_0 , the light-load loss of the transformer is given by $P_0 = u_1 i_0 \cdot \cos \theta_0 = (u_1^2/R_1) \cos^2 \theta_0$. On light load $u_2 = m u_1$ (where m = light-load ratio of transformation); and in order that the driving couple produced by E may be proportional to P_0 , it is sufficient if $\cos^2 \theta_0 = \cos \phi \cdot \cos \phi' \cdot \sin (\phi' - \phi)$. The angles θ_0, ϕ and ϕ' vary with frequency and with the self-induction of the transformer and the coils EE. By adjusting the core saturations of the latter, the desired relationship can be obtained within the necessary limits. Also, the variations in $\cos \phi$ and $\cos \phi'$ can be made practically proportional, so that our desired relationship becomes $\cos^2 \theta_0 = \cos^2 \phi \cdot \sin (\phi' - \phi)$, which is realised by making $\phi = \theta_0$ and giving to $\sin (\phi' - \phi)$ a value near enough to unity so that a relatively large variation in $(\phi' - \phi)$ corresponds only to a small variation in its sine.

When the secondary of the transformer is loaded, the ratio of transformation is no longer constant but varies with the intensity and phase of the secondary current. Hence, in order that EE may continue to yield a driving torque proportional to P_0 , it is necessary to apply a correction to its field proportional to i_2 and to a function of the phase displacement θ_2 between i_2 and u_2 . As shown by fig. 2, u_2 is the resultant of $m u_1$ and the total voltage drop v_s . The angle $s o v$ is so small in practice, that $o s$ may be taken as equal to its projection on $o v$, hence $u_2 = m u_1 - K i_2 \cos (\theta - \theta_2)$, where $K = \sqrt{[(R_2 + m R_1)^2 + \omega^2 (L_2 + m L_1)^2]}$, and is practically constant in industrial practice. Transposing this expression for u_2 , and substituting the value for u_1 in $P_0 = (u_1^2 \cdot \cos^2 \theta_0)/R_1$, we have that $P_0 = u_2^2 \cdot \cos^2 \theta_0 + A \cdot u_2 i_2 \cos (\theta - \theta_2)$, very nearly, where A is a constant. In other words, we have to apply a corrective torque proportional to $u_2 i_2 \cos (\theta - \theta_2)$. This may be done by adding to the coils EE, a winding connected in series with one of the phase wires, or in shunt with a resistance so connected (e.g., in shunt with one or both of the windings FF). The corrective winding may be arranged to compensate the field of each of the coils E, so that these fields remain as nearly as possible proportional to the primary pressure u_1 , or it may be in the form of a special coil which, together with the coil (or coils) E and the disk D, forms a small rotating-field meter yielding a torque proportional to $u_2 i_2 \cos (\theta - \theta_2)$. The two systems EF make possible adjustment to compensate for small errors involved by the assumptions made above.

Instead of using one coil, E, and a winding traversed by all, or part, of the current i_2 , the corrective torque may be provided by

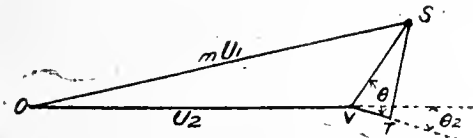


Fig. 2.

one of the coils F, and a coil mounted in series, or in parallel with the whole, or with one of the coils E. Or, yet again, the two systems EF may be so arranged that their reciprocal reactions on the currents which they induce in the disk D, yield the requisite corrective torque without the aid of a special winding.

The coils FF (fig. 1) are of different reactances, and are connected in parallel with each other and in series with one of the secondary mains. These two coils exert on the disk D a driving torque proportional to $i_2^2 \cdot \sin \alpha$, where α is the phase displacement between the currents traversing the coils. The angle α varies only with the frequency (the coils having no iron cores), hence the torque due to FF may be taken to be proportional to i_2^2 . Now, since $i_2 = (i_1 - i_0)/m$ (where m = ratio of transformation on light load), the term $P_r t$ in our original formula also varies with i_2^2 , and is therefore metered by the elements FF acting on D. The small error made in assuming $\sin \alpha$ to be constant is compensated by certain other assumptions made in connection with the system EE.

Fig. 1 and the preceding remarks refer to a single-phase meter, but the same principles and analogous arrangements apply to poly-phase instruments. Where it is desired to meter high-tension energy supplied to several transformers, as many systems EE, FF may be employed, or single systems EE, FF may be provided, with superposed windings or multiplying relays, &c. It is, however, simpler, safer, and altogether more satisfactory to provide each transformer with an independent meter. The range of loads on the individual meters is smaller, useful data are obtained concerning the distribution of consumption between the several transformers, the risk of stoppage or imperfect operation of a meter is divided, and the extra cost of individual meters is not serious.

Meters of the new type here described need not be much more costly than ordinary low-voltage meters, since they have no additional mechanical complication except, perhaps, the second disk. The additional components are exclusively electrical, and contain no permanent magnets. There are no fresh sources of error or accident. On the contrary, the supplementary electrical components provide additional means of adjustment and compensation.

It may be objected that the meter described is not really a high-tension instrument; nor is it, in the narrow sense of these words. It does, however, meter high-tension energy, and is at least as much a high-tension meter as those at present in use with current and pressure instrument transformers. The advantages of using the robust main transformer in place of special instrument trans-

formers are manifold. Instrument transformers are fragile, owing to their low power (compared with the high pressure for which they must be built); and they involve corrections which are, if anything, more complex and difficult than those described above.

It is possible to extend Duntour's principle of metering to measure, from any point in the low-tension secondary circuit, the energy received at any point in the high-tension circuit. So far we have arranged that the system EF (fig. 1) measured the transformer copper losses not included in the light-load losses (i.e., $P_r = R_2 i_2^2 + R_1 (i_1 - i_0)^2$). We can, however, just as well adjust matters so that EF records $P_r t = [(R_2 + r_2) i_2^2 + R_1 (i_1 - i_0)^2] t$, where r_2 is the resistance of part of the external circuit of the secondary. Then the meter placed at any point in the secondary line records energy delivered at the high-tension terminals of the transformer. Conversely, the meter may be made to register the energy, corresponding to a point in the secondary line ahead of its terminals, by reducing the constant of the system EF by an amount proportional to the resistance of the circuit between the meter and the point concerned.

Similarly, if r_1 be the resistance of a certain section of the primary (high-tension) circuit, the system EF may be made to record $[(R_2 + r_2) i_2^2 + r_1 i_1^2 + R_1 (i_1 - i_0)^2] t$, i.e., the energy passing a certain point on the high-tension line supplying the transformer. By applying a pair of windings EF designed and connected as above, any ordinary low-pressure meter placed at one point in a line can be made to measure the energy passing any other point (real or fictitious) in the line. One is thus able, in any case :

(1) To place the meter where most convenient from the point of view of accessibility or safety, &c., whilst still remaining strictly within the terms of the tariff in force. (2) To accept or establish tariffs based on energy received or delivered at some other point in the line than the location of the meter, even at some fictitious point in the network. This may have frequent useful application in connection with the sale or interchange of energy from network to network, and is worthy of special consideration in connection with recent linking-up schemes.

The new meter offers a cheaper substitute for equipments hitherto employed; permits even small consumers to be supplied on the basis of a "high-tension tariff," and facilitates double metering, which is always a desirable precaution where large consumers are concerned. In its various modifications, the new meter should make feasible tariffs best adjusted to the varied and numerous needs of practice.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Industrial Switchgear, and Limit Switches.

MESSRS. GEORGE ELLISON, of Wellhead Lane Works, Perry Barr, Birmingham, have developed a range of totally-enclosed industrial unit type switchgear, for D.C. and A.C. circuits up to 1,000 kW, at 750 volts, and suitable for use in factories and mines. Each unit

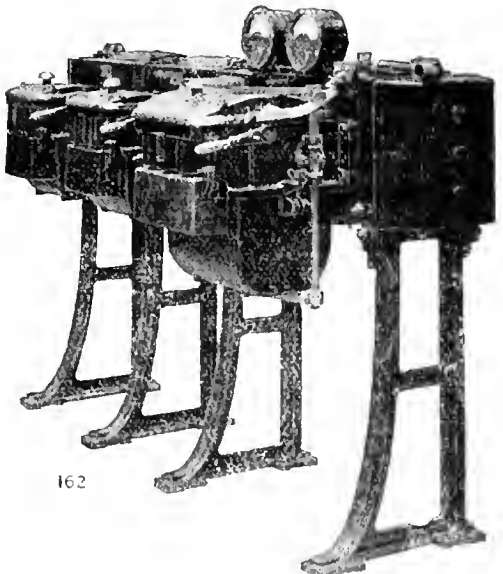


FIG. 1.—ELLISON 3-PANEL INDUSTRIAL SWITCHBOARD.

is self-contained, consisting of an oil breaker bolted to a steel chamber, which contains the isolating switches and bus-bars, and carries the necessary instruments, interlocking gear between the isolating switches and the breaker, and cable fittings. The units are supported by cast-iron stands, and are bolted together to form a totally-enclosed switchboard, capable of withstanding the weather

and rough usage. Fig. 1 shows a three-panel switchboard of this type, for an incoming feeder and two outgoing lines, and fig. 2 shows the interior of the bus-bar chamber, in which the bars are clamped to mica-covered steel rods. The strong construction obtained by this design enables the board to endure distortion without fracture or damage to the insulation, as when, for instance, a fall of roof in a mine has broken the stands without

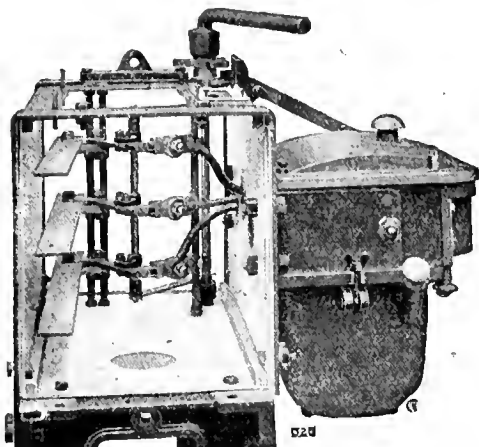


FIG. 2.—INTERIOR OF BUS-BAR CHAMBER.

interrupting the supply or necessitating costly repairs. The interlock between the isolating switches, breaker, cover, and tank is complete. A variety of control apparatus for motors can be combined with the switchgear, which is also made in several sizes.

A line of totally-enclosed self-resetting limit and emergency switches for cranes, &c., has also been introduced by Messrs. Ellison. These switches are either normally open or normally closed, according to requirements, and return automatically to the normal position after each operation, being actuated by a tappet

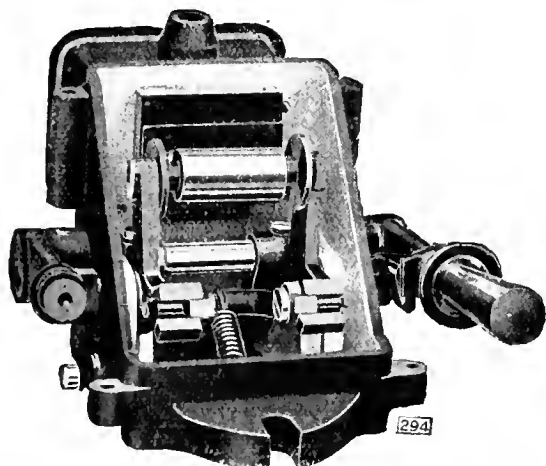


FIG. 3.—ELLISON LIMIT SWITCH, HAND-OPERATED (FRONT COVER REMOVED).

moving in any direction, or, if desired, by hand. Fig. 3 shows the No. 2 switch, hand-operated, with the front cover removed. The fixed contacts are large copper buttons, which may be rotated to equalise wear, and the moving contact is a substantial copper roller mounted to swivel and rotate, so as to bed on the fixed contacts; the mechanism is of double toggle type with no intermediate position, and sticking is impossible. The tappet may travel at practically any speed, and the switch may operate as often as 60 times a minute. The smaller size carries 5 amperes, and the larger 40 amperes, continuously, with large overload capacity on intermittent loads.

A New Generator of Static Electricity.

MR. W. H. CHAPMAN, of Portland, Maine, in U.S. patent No. 1,202,672, offers a remedy for loss of electrical and mechanical efficiency in static electricity generators. The invention consists in bringing a solid body of insulating material into intimate contact with a conducting liquid such as mercury which will not adhere to its surface, and then separating the solid body from the liquid and collecting from the surface of the solid the charge generated thereon. The rotating disk is partially immersed in the mercury. The inventor has found that a glass plate 8 in. (20.3 cm.) in diameter, making 80 R.P.M. and dipping into a mercury trough to a depth of 1½ in. (3.7 cm.) without induction plates will develop a potential of 9,000 volts on comb points, arranged to collect the charge at the top of the plate. The application of induction plates in proximity to the revolving plate at the point where it leaves the mercury raises the potential to 13,000 volts or more on the comb points and gives sparks ½ in. (1.9 cm.) long. This is still further increased by covering the induction plates with a thin sheet of rubber or glass. In order to

increase the quantity of electricity generated, a number of glass plates can be mounted on one shaft and separated by washers and all then dipped together into the one trough of mercury.—*Electrical World.*

A Large Arora Fire.

In spite of all the difficulties in the supply of labour and materials at the present time, we are informed that the sales of Arora fires have continued to increase, and have already doubled the output for last year, with the heavy season still to get through. The accompanying illustration shows a special fire which Mr. Robertson requested the ARORA CO. of Loughborough, to build up for the Mayor's parlour at Salford Town Hall. This has been already fixed in position and is reported to give great satisfaction

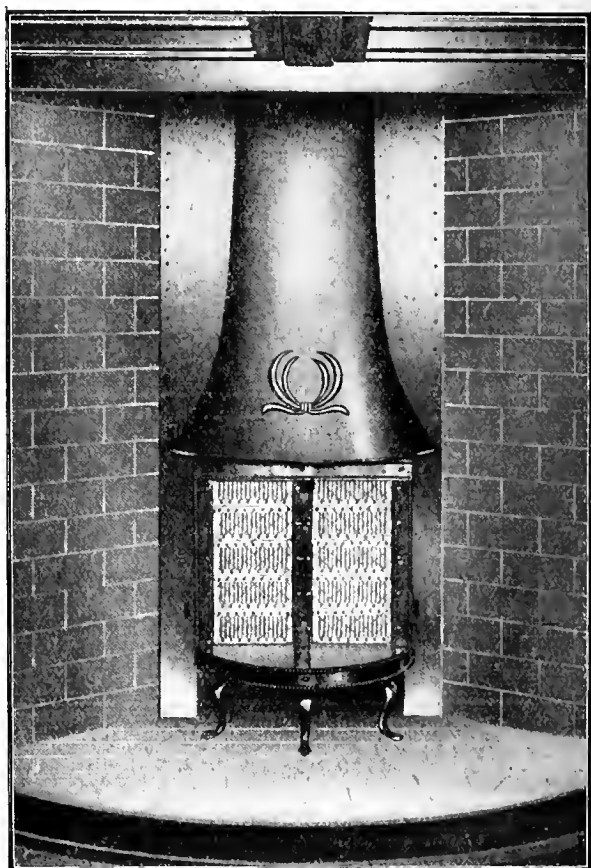


FIG. 4.—ARORA 75-KW. FIRE AT SALFORD TOWN HALL.

The makers have built up a special frame-work to match the existing fire-place, which is of antique brass, surrounded by tiles. The heating elements consist of ten of their standard 750-watt bars, arranged in two columns of five bars. Two separate circuits are taken to the fire, so as to balance the heating elements across the two sides of the three-wire system. Each side is worked at a pressure of 220 volts and controlled by two switches external to the fire. Probably there are few electric fires working under one frame on a 440-volt supply.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

A Static Electricity Phenomenon.

We think the following experience may be of interest to your readers.

One of our men working at a brewery was informed that our wires were leaking on to a boiler, and that their men were getting shocks from the valve. On examination, he found that there was no electric light in the boiler house, although some cables were carried through in steel pipes; these were earthed, and no leak was found on the wires. He came back and informed us that the packing of the boiler was charged, and we found this to be a fact.

We obtained a ½-in. spark by placing an iron rod from the packing to the valve, and the same from the packing to the top of the boiler after cutting away the packing.

There was a slight leak at a joint in a steam pipe above the boiler, and a small jet of steam played on the top of the boiler.

This we considered might be the cause, and we found it was so. On stopping this escape with a sack the discharge ceased; it returned, however, on taking the sack away. We tried this four or five times with the same result.

Perhaps some of your readers have experienced the same thing or a similar effect. The boiler is a Galloway type working at 120 lb. pressure, and is in a very confined space.

J. O. Grant & Taylor.

London, E.C., September 13th, 1917.

[No doubt the charge was generated by the friction of the slightly moist jet of steam on the boiler covering the effect discovered and investigated by the late Lord Armstrong. While the combination of circumstances necessary to enable a charge to accumulate is probably very rarely met with, it is worth noting that very high potentials may be attained by the charge, and sparks may occur, which, in the presence of inflammable gases or materials, may give rise to fires or explosions the cause of which remains a mystery.—
EDS. ELEC. REV.]

An Editorial Advisory Council.

Though we are far from desiring to see the British Government everywhere adopting or imitating the innovations of Allied or other Governments, we think the Premier might well take a leaf out of the book of Governor Whitman, of New York State. The Governor recently met in conference the editors of the various technical journals in the State, desiring to get reliable evidence upon questions of mechanical production, transport, coal and timber conservation, the provision of machinists and tool makers, and other vital factors essential to the successful prosecution of the war. As a result, the Governor has now a Committee of five editors acting in an advisory capacity.

Perhaps no class in the community has its fingers more completely upon the pulse of British industries than the men who so worthily and efficiently edit our Technical Press, and we feel sure they might with advantage be called in to the State Councils, where accurate information is, above all things, essential. At such a moment as this, when, to take only three important branches of public service—the air, agricultural, and marine departments—there is urgent need for the wisest and sanest counsels, as well as driving forces, we think nothing but good could come by the introduction of editorial assistance.

Barimar, Ltd.

(Scientific Welding Engineers).

C. W. BRETT,

Managing Director and General Manager.

London, W., September 14th, 1917.

Scale on Evaporative Condenser Tubes.

Could any of your readers inform me through the medium of your paper of some effective and expeditious method of removing hard scale deposited on the exterior of evaporative condenser tubes?

The circulating water, which is drawn from a well, contains 35° hardness, and the deposit is most difficult to remove with chipping hammers.

Central.

War Bonus for W.O. Station Engineers.

According to an advertisement in this week's REVIEW inserted by the "Northern Command," the question of a war bonus for the engineering staff is under consideration. It must have come as a great surprise to a large number of your readers that the "War Office" have, after over three years of war and high prices for food, decided to fall in line with private firms and other Government departments.

It seems, under the circumstances, that while other engineers in other power stations have been receiving from 5s. to 12s. per week war bonus, the War Office still lag behind those to whom they should show the way.

Now that a brain wave has at last reached the mighty ones, their engineering staffs all over the country will at last receive fair play (perhaps).

In one "War Office" power station of my acquaintance, certain members of the staff are receiving lower pay *now* than was paid in December, 1915.

Had Some.

Re the Fusing of an Electric Wire.

In the article headed as above in last week's ELECTRICAL REVIEW, your correspondent mentions an electric iron which had burnt $\frac{1}{2}$ in. into a table, and suggests how nearly there had been a fire. In an experience extending over 15 years, I have yet to see a single instance of an electric iron setting fire to a wood table top or wood floor, and am prepared to make a small bet that it is impossible.

Usually the trouble is discovered by the strong smell and smoke, but in one instance which came under my observation, a 200-volt 16-lb. goose iron was left on in the workroom of a lock-up shop, the iron standing on a bath brick on a 2-in. oak table; and when the shop was opened at 8.30 a.m. the following day the shop and workroom over were filled with a dense smoke (the smell lasted for weeks), and the iron was found still on. It and the brick had gone through the 2 in. of oak and left a hole large enough for two irons to go through. The brick and iron parted company on reaching the floor, the brick making a substantial mark where it settled; the iron, keeping busy, had landed exactly over a 9-in. x 3-in. joist, gone through the floor board and about $\frac{1}{2}$ in. into the joist when

found. The iron is still in use, and the shop is Mr. Gordon Kennett's, Oxford Road, Manchester.

The possibilities of fire being caused are very remote, provided that (I am speaking of domestic electric wiring) the gas pipes are disconnected or removed altogether. I know of a dozen instances where, due to trouble occurring in the wiring, a spark from a tube or metal sheathing to a gas pipe has burnt a small hole in the pipe, lit the gas, and as the lead was melted so the flame ran back under the floor the whole width of a room. The spark which started the trouble would not have ignited a piece of tissue paper, much less a floor board.

E. O. Walker & Co.

Manchester, September 17th, 1917.

STANDARD CLAUSES FOR STREET LIGHTING SPECIFICATIONS.*

In December, 1910, a Committee was appointed by the Institution to prepare a Standard Specification for Street Lighting. The Committee was subsequently enlarged by the addition of representatives of the Institution of Gas Engineers, the Institution of Municipal and County Engineers, and the Illuminating Engineering Society.

After certain preliminary clauses had been agreed upon, selected London streets were classified by municipal surveyors serving on the Committee, and photometric measurements were taken in each of them.

The results obtained were embodied in further clauses which appeared to be generally acceptable to all the members of the Committee, subject to the settlement of a fundamental difference of opinion between the gas engineers and the remaining members of the Committee as to the character of the illumination on which the specifications should be based.

The opinion of the majority was that the proper basis is to call for "minimum horizontal illumination," and this was incorporated in an interim draft for the consideration of the Councils concerned. Counter proposals that "candle power" should be the basis were received from the Institution of Gas Engineers, but the specification was substantially accepted by the Councils of the Institution of Municipal and County Engineers and of the Illuminating Engineering Society, and also by the electrical representatives on the Committee.

With the object of thoroughly ventilating the question, in the hope that some means might be found of reconciling the views of the majority with those of the minority, the specification was discussed at a general meeting of the Illuminating Engineering Society on April 15th, 1913, in the form of a paper by Mr. A. P. Trotter containing the draft.† The views there expressed were considered at subsequent meetings of the Committee, when it became evident that the two bases proposed were irreconcilable, and that unanimous adhesion to either basis would be unobtainable.

Further efforts have been made to frame such a clause as would be acceptable to the minority, but without result; and as the matter has now been under consideration for over six years, it has been decided to publish the specification as it now stands as a Majority Report. It is hoped that it may be found useful when the methods of street lighting are reviewed after the war.

In a statement by the minority of the Committee, the Council of the Institution of Gas Engineers formally express their opinion that contracts for street lighting should be based on the average candle power of light sources ascertained at two or three defined angles. This, in the opinion of the Council, is the simplest and most correct method, and, moreover, would avoid the possibility of disputes arising from the more or less uncertain measurement of minimum horizontal foot-candle values.

The standard clauses for inclusion in a specification for street lighting are printed in full in the *Journal*.

Clause 2 states that the specification is based on illumination, the unit of measurement being one foot-candle.

Clause 4, the subject of disagreement, states that the "minimum illumination" of a street means the minimum illumination on a horizontal plane at a height of 3 ft. 3 in. above the ground level, and may be measured by means of:—

- (a) Any suitable illumination photometer, or
- (b) Any suitable photometer adapted for use in the street which will measure the candle power of the lamps in those directions which meet at the point of minimum illumination. In this case the minimum illumination will be calculated by adding together the values of the illumination received from each lamp that materially contributes to the result.

Clause 13 includes the following definition:—

"When a minimum illumination or candle power of lighting unit is specified it shall be held that such minimum is obtained if the average of the measurements of any three minima between consecutive lighting units of the same type does not fall below it."

In an appendix a table is given, which was originally calculated by Mr. Haydn T. Harrison to show the candle power required to produce a minimum illumination of 0.01 foot-candle on a horizontal plane 3 ft. from the ground, midway between two lamps of a given height and distance apart, and which has been recalculated by Mr.

* From the *Journal* of the Institution of Electrical Engineers. Abstract.

† See ELECTRICAL REVIEW, April 25th—May 16th, 1913.

M. Wilson, of the Board of Trade, for a height of 3'28 ft. instead of 3 ft. 3 in. referred to in Clause 1, thus approximating more closely to the metre. The difference in the result, less than half of 1 per cent., is inappreciable.

WAR ITEMS.

Trading with the Enemy.—In the "London Gazette" for September 11th, further lists appear of persons and bodies in the following countries with whom trading is prohibited: Argentina, Paraguay and Uruguay, Bolivia, Brazil, Central America, Chile, Ecuador, Greece, Morocco, Netherlands, Netherlands East Indies, Norway, Peru, Spain, and Sweden.

St. Dunstan's Scheme Extended.—Sir Arthur Pearson is setting on foot a scheme for raising £250,000 for extending the splendid work that has been done at St. Dunstan's for blinded soldiers, so that a provision of 5s. per week may be made for present and future children (up to the age of 16) of these blinded heroes. Donations may be sent to Sir Arthur at 221, Great Portland Street, London, W.1, marked "Blinded Soldiers' Children Fund."

Electric Supply Restrictions in Germany.—The "Times" states that now that "summer-time" has come to an end, Germany is organising new schemes of "daylight saving" for the winter, in order to economise fuel and artificial light. Notice has been given by the General in Command of the Münster Army Corps District that the consumption of gas and electric power in shops, restaurants, and so on must this winter not exceed one-half of the consumption in the winter of 1915-16. All the military and civil authorities, businesses, and other private undertakings are required to alter their office hours, from October 1st onwards, to the time between 8 a.m. and 4 p.m. Schools will keep the same hours. The lighting of shop windows and the use of passenger lifts are forbidden, and all restaurants are to be closed at 9 p.m.

Glow Lamp Cards in Germany.—According to reports from Germany, the manufacture and sale of glow lamps are to be placed under restrictions by the Government, and the export trade in particular is to be limited. The exports are stated to be of considerable amount, and lower prices are obtained abroad than can be demanded in Germany itself. At the same time, the suspicion exists that German lamps find their way *en* neutral to hostile countries. The business in Germany is to be regulated by the introduction of lamp cards. Since the recent establishment of a general understanding in the lamp trade prices have again been advanced by 20 per cent., and are now higher by 40 per cent. than prior to the war, wire lamps having remained the only department in the electrical industry that had been compelled through competition to adhere to pre-war prices until the new agreement was brought into operation.

The Germans in Belgium.—We are indebted to the *Ironmonger* for the following interesting paragraphs received from our contemporary's correspondent serving with the Belgian Army:—

"An enormous stock of agricultural implements, sewing machines, and other articles has been amassed at the electrical works of Duhait, at Charleroi. All this material, which has been collected in Northern France, and is locally known as the 'industrial bazaar,' makes a dump three-quarters of a mile long. It is reported that trains full of the stuff, which is first put in a state of repair, are being sent to Germany."

"As long ago as May 25th the Germans dismantled the plant of the Angleur Steelworks, and announced their intention of removing the travelling cranes. By order of the invaders, the blast furnaces of Ougrée had to stop work on May 24th, and the Germans are now dismantling the plant there also to send it to Germany. The Cockerill works at Seraing had in some measure been spared, but several hundreds of German workmen recently arrived there from Westphalia and proceeded to strip the place. Other industrial works which are reported to have been wholly or partly stripped are the Usines Boël (La Louvière), La Providence, Monceau St. Eloi, Société de Thy le Château, Usines Métallurgiques du Hainaut, Usines Henriot, Usines de Sambre et Moselle, Aciéries de Charleroi, and Usines Bonehill (Houmpies). At these works the Germans are removing the rolling equipment (cylinders made of high-grade cast-ings), shafting, belting, and even the foundation plates! The Germans are breaking up the big cast-iron posts to be recast. The big blowing machines of the Usines Bonehill and the Usines Boël, the four-cylinder machine of the Providence, which was exhibited at Liège International Exhibition in 1905, and the blooming-mill of the Providence Works are reported to have been converted into scrap iron."

Exemption Applications.—At Newcastle-on-Tyne Local Tribunal, on the 13th inst., Mr. E. Hatton, general manager of the Corporation tramway, asked that the case of a large

number of men, which were being reviewed by the military authorities, might be adjourned until suitable substitutes had been found for them. The Army authorities already owed the tramways 18 men to take the places of some who were with the Colours, and if more men were taken they would have to curtail the present tram service. As it was, complaints had been made by workmen in local shipyards as to the insufficient number of cars running, and the men had threatened to cease work if there was not a better service for them during the winter. It was stated that 91 tramway-men were called up; of these 47 had entered the Army, and 20 held protection certificates. Mr. Hatton said the present system was being maintained with great difficulty, and it was impossible to put women on as drivers with the present system of brakes. As the bad weather came on, and they had more sickness to contend with, the services would have to be curtailed if he could not get men. It was suggested that an appeal might be made for auxiliary drivers under the National Service scheme, and Mr. Hatton said he had already 100 men doing auxiliary work very satisfactorily. The cases were adjourned for two months, the authorities to find suitable substitutes.

At Burnley Tribunal, last week, the Military Representative asked for the review of the exemptions granted to 14 drivers in the Corporation tramways department. Mr. Jobling asked for the cases to be adjourned so that the whole of the 90 or so exemptions to tramwaymen could be reviewed together. The Tribunal, however, heard the cases. In four cases the appeals were adjourned for re-examination, and the Military Representative's appeal was allowed in the other cases, with varying periods of grace.

Conditional exemption has been allowed to J. McDonald (32), electrical engineer, of Ramsey (Isle of Man).

At Hull, the following decisions were arrived at in appeals for Corporation tramway employees:—Driver (22, C3), conditional exemption; car washer and motorman (37, C1), to join up on October 1st; driver (37, general service), exemption refused; driver (23, C1), to November 1st; driver (34, C3), conditional exemption; driver (C2), traffic clerk (C3), conductor (C3), conditional exemption.

On the appeal of Earl Amherst, exemption until December 31st has been granted to A. Kemster (38, B2), electrician on the estate at Chevington, Sevenoaks.

At the Cheshire Appeal Court, the Chester Corporation Tramways Committee sought further exemption for the traffic inspector, the only one left. It was stated that the man understood electrical equipment, and in case of breakdowns was employed to put things right. He was granted until January 1st.

A further three months' exemption has been granted at Bromley (Kent) to A. E. H. Dussek (31, C2), manufacturer of electrical insulating materials.

Chertsey Tribunal has refused exemption to C. T. Church (31, B1), electrical engineer.

On a military appeal, Essex Tribunal has withdrawn conditional exemption held by J. W. Collis (30, Class A), electrician, of Leyton.

Before the County Tribunal, the Military Representative appealed against conditional exemption granted to the chief clerk in the Derby Corporation tramway offices. Appeal allowed; calling up fixed for January 1st.

At Chatham, a review was made of the cases of five members of the staff of the Tramway Co., four being motormen and the other a cashier. Conditional exemption granted in each case. Notice of appeal given by the Military Representative.

The East Surrey Traction Co. appealed at Reigate for the retention of W. P. MacAlpine (37), motor fitter and electrician, claimed to be in a certified occupation. Three months allowed.

At Reigate, exemption was sought for A. J. Pribble (39), stoker and driver at the Corporation electric light works. The engineer (Mr. Ross) stated that they now had only two drivers and two stokers, and Pribble was a skilled man. Owing to a breakdown of the Diesel engine they were now using steam power. Conditional exemption granted.

At Lye, a business appeal was made by C. H. Bromley (33, B1), electrician, who stated that four of his staff had enlisted, one brother had been killed, and he assisted in his father's business in addition to carrying on his own. Three months conceded.

At the West Kent Appeal Court, the Military Representative appealed against conditional exemption granted locally to W. A. M. Paton (19, A1), engineer in the electric light department of Gillingham T.C. The appeal was assented to, and six weeks' exemption substituted.

At Bermondsey, Messrs. W. & R. Jacobs, manufacturers of electrical apparatus, applied for the exemption of a man in charge of their warehouse and staff, 31 years of age, single, passed as fit for garrison duty at home. The claim was disallowed, not to be called up before October 17th.

At Southwark, the Military Representative said he had received the latest instructions with reference to men holding certificates of exemption under the protected trades schedule, which were that he was not to oppose any application to the Tribunal for the exemption of a man who had his protection certificate withdrawn, so long as the application was made within seven days after he had received his calling-up notice to join the Army.

REVIEWS.

Practical Costing. By ARTHUR H. GLEDHILL, A.M.I.M.E.
London: The Gledhill-Brook Time Recorders, Ltd. Price 3s. net.

The author deals with the subject in a thoroughly comprehensive manner, and covers the ground from "Alpha to Omega." The system advocated so far as labour is concerned is automatic time-recording, and the "Clipper" time recorder is the medium. This instrument must not be confused with the ordinary "in" and "out" recorder, but is so designed as to record job costing, repetition work, repair work, &c.

In the introduction the author gives a number of essential points which should be carefully considered when starting a new costing system, amongst which he states truly: (1) That different classes of work require different costing systems. (2) The costing system should be arranged to give a maximum of detail information with a minimum of clerical labour and expense. (3) The workman is the wrong person to enter the time records. (4) That it is more efficient and less costly to put the work in the hands of a cost clerk with the aid of a time-recording clock for printing the actual times to the exact minute when jobs are commenced, finished, or broken off. The diagram, "Building up of a Selling Price," shows clearly manufacturing costs, &c., including unproductive labour costs—which is a most important item—giving each cost as a percentage of the whole.

Chapter I details clearly the routine necessary to start a job. The author analyses to a degree, and his dissection to a point may be unnecessary, but he shows how, if required, costing can be detailed minutely. The works orders first set in motion at the commercial end are very clearly illustrated. One portion, however, is not by any means clear. The author states: "To firms who have always worked hand to mouth, this method would probably occasion a stoppage of output for a few months, but those who have made the change agree that the increased output afterwards secured has amply repaid them." The reviewer cannot for one moment see how the adoption of any new method should have the result the author states. If an existing system is brought up to the end of any period it is simply a question of managerial control to put into operation a new system. No doubt, for a few weeks the management would have to pay particular attention to the method of operation, and it might necessitate the costing clerks having to make a few early-morning starts. It brings to the reviewer's mind the following few lines:—

"IT COULDN'T BE DONE."

"Somebody scoffed, 'Oh, you'll never do that,
At least no one ever has done it';
But he took off his coat and he took off his hat,
And the first thing he knew he'd begun it.
With a lift of his chin and a bit of a grin,
Without any doubting or quidding,
He started to sing as he tackled the thing
That couldn't be done—and he did it."

Chapter II is devoted to time records, showing different systems.

Chapter III deals with general labour costs, and touches upon unproductive labour cost. The reviewer is pleased to see the importance the author attaches to this item in this and subsequent chapters. In the reviewer's opinion there are too many cases where this particular factor is dealt with in a slipshod manner, labour recorded on the job, machine hours, material, and managerial charges, &c., going to make up the cost. As a matter of fact, unproductive labour may be looked upon as stand-by labour; it certainly has to be paid for, and is thus a direct charge upon all output; moreover, it is a factor, if truly recorded, which indicates how far it is possible to increase output without additional labour costs, machine hours and raw material being additional, but no increase is incurred in managerial charges or capital.

Chapter IV deals with hourly machine rates, giving examples of how to arrive at them, and dealing with running time, idle time, productive hours, &c. What the reviewer stated about unproductive labour records applies practically to unproductive machine hours, depreciation, interest, floor space, rents, rates, taxes, &c., being a direct charge, even when the machines are idle; therefore all costs should bear a proportion of this charge. Chapter IV, "Hourly Rates for Labour," shows very clearly the fallacy of flat-rate overhead-charge on labour, and gives a very interesting hypothetical basis for fixing hourly rates.

Chapter V, "Stores and Materials," gives briefly the method of dealing with this important department. The author could in this case have augmented the information to some advantage if he had dealt with the method in detail from the receipt of the raw material to the collection and assembly of finished parts.

Chapter VI, "Overhead Manufacturing Expenses." This chapter, coupled with the illustration, is very concise indeed.

Chapters VII and VIII, "Selling Expenses" and "Final Summaries of Costs," are clearly set forth in a very interesting manner, and the illustration showing periodical average costs is well worthy of study and consideration.

Chapter IX is on "Balancing Cost Accounts and Commercial

Accounts." This is a most important item, and, briefly, means that for every item of expenditure, unproductive labour, recovery of hourly rates, &c., a corresponding charge is made somewhere or other. The illustrations showing total sales compared with material, wages, productive and unproductive, other expenses, and profit are self-explanatory.

Chapter X, "Weekly Department Report," gives a very interesting summary of expenditure.

Chapter XI, "Manufacturing in Multiples of 60," contains something new and worth some little consideration, the calculation of the factors, quantity and time being reduced to a minimum, thus:—

60 articles made in 14.75 hours = 14.75 minutes per piece.
600 articles made in 11.75 hours = 1.175 minutes per piece.
30 articles made in 11.75 hours = 29.5 minutes per piece.
300 articles made in 11.75 hours = 2.95 minutes per piece.
And so on.

The concluding chapters, "Costs and Estimates," "Bonuses for Increased Output," "Dead Charges," &c., are dealt with in a very lucid manner, and the illustrations, showing a series of standing order number job cards printed on coloured cards, also production job cards and a weekly time card ruled on the back for analysis of jobs worked upon each week, and the labour cost of each, make the subject very clear.

In conclusion, the reviewer can recommend this book to all those interested in manufacturing costs, irrespective of whether their existing system depends on clock recording instruments or otherwise, as the author has dealt with this subject both theoretically and practically.—J. C. P.

How to Lay-out Turret Lathe Tools. By ALFRED HERBERT, LTD. Coventry: Alfred Herbert, Ltd. Price 2s. 6d.

Though somewhat to the nature of a trade publication, this handbook "for those who design tools for use on turret and capstan lathes and automatic turning machines" constitutes a decidedly useful addition to the literature on the subject.

Very few firms engaged on munition work are now manufacturing without machine tools of this type, of which vast numbers have been built or imported since the commencement of the war. The laying-out of such tools is a highly skilled job, but many workers are being called upon to tackle it with little more than an average shop experience. To such the present work cannot fail to be of value. Even the expert will find in it some useful hints, and valuable suggestions will be received as a result of a careful study of the 115 reproductions of photographs and drawings that the volume contains. Various typical lay-outs are described, e.g., the tools actually used on gun-metal fuse adapters, aeroplane propeller bosses, and motor-car flywheels.

The author wisely insists on the importance of lay-outs being as simple as possible, and embodying standard tools and holders. "Ingenious" tools are usually a poor economy.—G. S. S.

Underground Transmission and Distribution for Electric Light and Power. By E. B. MEYER. London: Hill Publishing Co. Price 12s. 6d. net.

The manufacture and laying of underground cables is a specialised branch of electrical engineering which involves very large expenditure. As compared with other branches of electrical engineering the literature is scanty, but this book goes far to fill the gap.

The subject matter is mainly treated from the American view-point, but there is also a good deal of information concerning standard practice in Europe.

After describing various forms of duct, the author states that tile and fibre conduits are now used almost universally, by which he means in U.S.A.

The first is made from vitrified clay, and when free from iron has high insulation, giving an average puncture test of 25,000 volts dry and 21,000 volts after immersion in water for several days.

Fibre conduit has been in use for about 15 years, and some that the author had occasion to examine after it had been in moist soil for 10 years showed no signs of deterioration. It is made of wood pulp which has been thoroughly saturated with a bituminous compound containing about 6 per cent. of creosote. The latter prevents rotting by killing organisms which might act on vegetable matter in the pulp. It will stand a puncture test of 32,000 volts dry, and 24,000 volts after immersion in water for about 200 hours. It is made in 5-ft. lengths, which are convenient for transport and handling in the trenches. The ducts are laid in concrete, about one inch being left between adjacent ducts.

In reference to armoured cable, the author says that in Europe this class of cable is practically standard for all underground systems. What he refers to as a large installation is in Central Park, N.Y. City, where 500,000 ft. of steel-tape street-lighting armoured cable has been laid.

Rubber, paper, varnished cambric, and other forms of insulation are described, and under the heading "Graded Insulation," the author says:—"The potential gradient of insulated wire is much higher in that portion near the conductor than in the outer layers, and the fall of potential

across a series of insulators of varying specific inductive capacity is inversely proportional to those capacities." By taking advantage of this law, a smaller diameter of cable may be used with the same factor of safety.

Under the heading of "Lead," reference is made to the lead-boring insect found in Australia and in the south-eastern portion of U.S.A.; also to the fact that slight traces of arsenic, antimony, copper, tin, &c., in lead are a benefit rather than an objection, as they tend to slightly harden the metal.

Owing to the fact that alternating current in large cables has greater density on the surface, it has been found advisable on single-conductor cables of large area to strand the copper wires on to a central fibre core.

Sector cables are described, and it is pointed out that a larger portion of the periphery of each conductor is nearer the lead sheath than in an equivalent round conductor. This allows a greater radiation, with consequent higher current density.

The chapter on installation of cables is good, many quite small, but necessary, details being illustrated and described—for example, basket wire-grips and flexible duct cleaners.

From one figure it is a little surprising to find that the cities of Milwaukee, Newark, Boston, Detroit, New York, San Francisco, Chicago, and Brooklyn have each their own particular methods of drawing in cables, and the differences are quite appreciable. Jointing is, of course, dealt with.

A good tip that is mentioned, is the practice of a company in the States of "putting up" all the materials for a cable joint in unit packages. The author thoughtfully gives a picture of the contents of such a package.

There is some original information on cooling of duct lines, and it appears that the Niagara Falls Power Co. cools its underground cables by circulating water through vacant ducts adjacent to occupied ducts. At Baltimore it was found that cable burn-outs were more frequent in summer. Therefore, in 1915, a sprinkler system was installed to keep the ground moist where the burn-outs mostly occurred. The results at the time of writing are said to be interesting, but not conclusive.

The cooling of underground transformers is referred to in the chapter on distributing systems, and the author says that 8 watts of transformer losses may be allowed per sq. ft. of wall space. In moist soil, with ventilated chamber, 12 watts may be allowed. In wall surface he includes the roof and floor.

Current-limiting reactances are described, and it is stated that they should be of the air-core type, and their capacity correspond to the full-load capacity of the line which they are intended to protect. They are generally built in with wood and concrete or porcelain.

Seven pages deal with selective fault-localiser, arcing ground suppressor, grounded neutral systems, and the Merz system of cable protection.

Electrolysis has a chapter to itself, and it is admitted that when this began to be serious American engineers did not have as thorough a grasp of the situation as did engineers in Europe. American practice has not sought to remove the underlying causes of electrolysis, but has attempted merely to relieve acute conditions. The measures adopted in addition to track bonding, have consisted of "pipe drainage" or bonds to other systems.

The author states that the usual method of protecting cable sheaths is by use of a drainage system similar to that used for the protection of pipe lines. The object of draining the sheaths is to make them slightly lower in potential than the surrounding earth or neighbouring structures, thus preventing current flowing off the sheaths. Since there is danger of overdraining in making the sheath potential considerably lower than that of the ground or adjacent grounded structures, it is sometimes necessary to insert suitable resistances in the drainage leads.

As with nearly all the books of the Hill Publishing Co., numerous specifications are interpolated in the text. Also, a good deal of information is given as to construction costs, &c. Occasional references are made to papers in which further information on a particular point may be found.—E.K.S.

High-Speed Internal-Combustion Engines. By ARTHUR W. TRIGG, Wh.Sc., A.R.C.Sc. London: Whittaker & Co. Price 15s. net.

It might be thought that the work of describing the internal-combustion engine had almost become one of supererogation, so many are the authors who have given us books upon this subject. But few of them deal fully with the high-speed side of the subject, generally confining themselves to the heavier, slow-speed types of engine. Of course, the high-speed engine is now of the utmost importance in these days of motor cars and aeroplanes, hence Mr. Judge's justification in enlarging upon the subject. He deals with the question chiefly from the theoretical side, but also gives many experimental data, especially where experimental work has influenced design. The data are not necessarily always original; often they have been brought together from widely scattered sources. In fact, to some extent, the volume under review constitutes a compendium of the literature on the subject, and the author is to be congratulated on the thorough-

ness of his classification. He skilfully analyses and presents in order and sequence the more important of the available theoretical and experimental results.

A practical point that emerges from his consideration of the question of pressures and temperature relates to the use of alternative fuels to petrol—a matter very much to the front at the present time. He shows that though in benzole, paraffin, and in alcohol we have excellent petrol substitutes, efficient use of these liquids cannot be made with existing engines. They must be redesigned if they are to give the best results. The need for this will be seen from Mr. Judge's statement that "the compression pressures required for the best results with paraffin as a fuel are about 75 to 85 per cent. of those of petrol, whilst with benzole compression pressures of 110 to 120 per cent. of those used in petrol engines are necessary for higher mean pressures to be realised." Alcohol, he shows, works most satisfactorily with compression pressures "varying from 150 to 200 lb. per sq. in." Since these compression pressures are about 100 per cent. greater than those employed in petrol engines, we can readily admit that special alcohol engines will be needed in the future if the best results are to be obtained from a fuel that there is reason to suppose will be very much to the fore after the war.—G.S.S.

BUSINESS NOTES.

Feed-Water Regulators.—MESSRS. SCHOLEY & CO., LTD., inform us that their Copes feed-water regulator, which we described some time ago, has been very largely adopted by steam users, whose experience of its use, judging by the reports of prominent engineers, has been very satisfactory indeed. The importance of maintaining a constant water level has not been fully appreciated in the past, but, in reality, a good feed-water regulator plays a part in relation to a boiler analogous to that of the governor of an engine, and prolongs the life of the boiler and pumps by preventing sudden changes of temperature and load due to irregular feeding.

Fire.—The workshops of Messrs. Gilbert Bros., electrical engineers, Navan, Co. Meath, containing a quantity of electrical fittings, was destroyed by fire on Friday morning last. The firm's plant was saved.

German Industrial Activity in Spain.—At the beginning of 1914 it may be said that Spain languished, and, excepting some industrial activity in Catalonia (Barcelona) and Gascony (Bilbao), there was nothing in the rest of the country to call for interest. The war has awoke the slumbering energy, and under the stress of necessity, individual and collective, here a little and there a little, but leisurely, led to the realisation of some progress. In 1913, Spain exported iron and steel goods to the value of a million and a-half pesetas; in 1916 these figures had risen to 57 millions. In copper the advance was from 8 to 21; firearms from 10 to 25; chemical products from 5 to 28; woven cottons from 3 to 28; textiles, 33 to 68; leather and skins, 2 to 31; machinery and railway plant, 4 to 17. Taking account of the increase in prices, there is here an indication of the multiplication of the capacity of production which affords the most eloquent explanation of the fact that in 1916 new companies were founded with a total capital of 230 million pesetas. It is certain that many of these were promoted by Germans, and with German capital, for it cannot be denied that, notwithstanding the war and the blockade, Germany has completed every step to continue its business operations with the whole world, making use of countries now neutral. Another awakening which may have its own importance is that of the mining industry. Spain is rich in mineral deposits, has abundant labour and cheap. She is richer, perhaps, than Italy in water resources, and has good coalfields. According to approximate calculations, Spain might avail herself of 6,000,000 H.P. of electric energy, of which to-day she only makes use of 80,000 H.P., notwithstanding that concessions have been granted for 1,000,000 H.P. The Government has taken important measures to foster the industrial development of the country. New industries can enjoy the help of the State, which is specially shown by fiscal advantages and exceptions, by concessions and privileges from State or State-supported banks, by State grants and loans at low interest, and by State guarantees of a minimum interest on capital invested. Moreover, the industries already existing may avail themselves of like advantages by turning out ships of over 10,000 tons burden or colliers, or occupy themselves with the extraction and treatment of iron, copper, zinc, or the cultivation of the products of the ground and the manufacture of chemical manures and agricultural machinery. Similar, and even greater, facilities are accorded the hydro-electric works of 1,000 H.P. and above, the chemical industry (chiefly colouring materials), and the manufacture of electrical plant and scientific apparatus. The wealth created in Spain by the war, the expansion of its industries, the not negligible help of the Government, and the competition of the German invasion with industrial productions with a Spanish label, will carry Spain forward for a number of years to a higher industrial level than might have been expected, making of her a possible competitor with other neighbouring countries, like Italy, but also an available market for their products as also a good field for action for their electrical engineering talent.—*L'Electrotecnica*.

For Sale.—Rhondda U.D.C. invites tenders for the purchase of a complete up-to-date private generating plant, recently installed by the Westinghouse Co. For particulars see our advertising pages.

Technical Advertising.—In the September issue of *Cheap Steam*, Messrs. E. Bennis & Co.'s magazine, there is an entertaining article on "The Troubles of an Ad-Man," by Charles Brangwyn. In the course of the contribution the writer says:

"In the face of facts which scream at him from every turn, the technical man—and the salesman, too—often looks upon advertising as an expensive fad, a luxury, or something worse, but always a superfluity. Not that he will always say so in words, for back of his mind he has a feeling that to do so would expose him to ridicule. 'Of course, we must do a little,' he will, perhaps, admit regretfully, but he doesn't believe in it. There is no faith behind his admission.

"Grant him that no advertisement ever of itself sold a steam turbine or a mechanical stoker, but what would the world know of any commodity without advertising? The advertisement is at work when the salesman is at rest, preparing the mind of the prospect as he sits by his own fireside where no salesman ever penetrates, it is talking to him in his office even while the traveller is being told 'too busy to see you this morning.' It is ever smoothing out the stony ground over which the salesman may afterwards travel with ease, impressing the name of the firm and the merits of its manufactures on the mind, so that at the moment of his need the buyer involuntarily thinks of the firm whose advertisement he has most often seen."

Book Notices.—*Useful Engineers' Constants for the Slide Rule*. Second Edition. Glasgow: J. A. Burns. Price 1s. net.—This little book is intended to show how the slide rule may be used to the best advantage by the practical engineer in technical or commercial calculations, with special reference to the use of special constants for repetition work on the rule. After a brief explanation of the ordinary slide rule, the author illustrates its application to a variety of mechanical, electrical, and hydraulic calculations, his object being rather to assist the reader in working out time-saving constants for his own use than to compile a large number of examples. A few tables of weights and measures, conversion tables, &c., are appended; in some of these, we think, the author errs by giving values running, in some cases, to as many as eight significant figures, where four would suffice for the slide rule (and for almost all practical purposes). It is a useful little work, very lucid, and admirably arranged and printed.

"Science Abstracts, A and B." Vol. XX, Part 8. August 30th, 1917. London: E. & F. N. Spon, Ltd. Price 1s. 6d. each.

"Practical Electric Illumination." By T. Croft. London: Hill Publishing Co. Price 8s. 4d. net.

"Wayleaves." By C. Vernier, M.I.E.E. Reprint from the *Journal of the Institution of Electrical Engineers*, with discussion. From the author.

C.C. Motors and Control Apparatus. A new text-book with this title has just been published by Messrs. Whittaker & Co., the author being Mr. W. Perren Maycock, M.I.E.E. The work comprises 330 crown 8vo. pages, and has about 150 illustrations and diagrams. In its writing, Mr. Maycock has had the assistance of Mr. E. Hughes, B.Sc. (Lond.), of the Heriot-Watt College, Edinburgh.

We have received a folder relating to Messrs. A. P. Lundberg and Sons' examinations in electric light switching, and containing extracts from letters showing the keen interest with which men on Active Service, as well as in civilian life, regard these exercises.

"Proceedings of the Incorporated Municipal Electrical Association, 1917." London: Wyman & Sons. Price 5s.

Trade Announcement.—In order to centralise their business, the STANTON IRONWORKS CO., LTD., are removing their office, on October 1st, from 44, Coal Exchange, E.C. 3, to Maxwell House, Arundel Street, Strand, W.C. 2. New telegraphic address, "Cobbles Eaststrand London"; telephone number, "Central 6808." Mr. Arnold Longden, who has represented the company for some years on the London Coal Exchange, will continue to supervise the company's interests at Maxwell House.

Catalogues and Lists.—MESSRS. SCHOLEY & CO., LTD., 56, Victoria Street, London, S.W. 1.—Pamphlet giving illustrated description of the Copes feed water regulators.

OVERSEAS ENGINEERING CO., LTD., 75, Curtain Road, London, E.C. 2.—Two circulars giving description, prices, &c., of their "Overseas" self-contained electric lighting plants.

Aluminium Works in Austria.—It is reported from Vienna that the Hungarian Natural Gas Co. (Erdgas Gesellschaft) proposes to establish an aluminium factory for the purpose of working up the bauxite deposits which are said to be situated in the vicinity of the company's natural gas mines in Transylvania. A new aluminium works is also projected in the neighbourhood of Innsbruck, whilst three other schemes for similar works are proposed in connection with the utilisation of Alpine waterfalls.

charges to £647, leaving a deficit on the year's working of £10,151. To this must be added the deficit balance brought forward, making a total deficit balance at March 31st last of £11,521. As compared with the previous year, the costs of generation, &c., increased by more than £8,000, due to the extra price of coal and labour. Total units sold 7,180,755, as against 6,731,932 in 1915-16; average price obtained per unit sold, 110d.; works cost per unit sold, 114d.; total all-in costs per unit sold, 1516d.

At a meeting, last week, of the Accrington and District Trades and Labour Council, a resolution was moved on behalf of the Steam Engine Makers' Union, requesting the B. of T. to inquire into the working of the Corporation electricity works, with the object of presenting a report to the burgesses, and of assisting the Corporation officials to place the undertaking in a better financial position. The resolution was agreed to.

Alva.—The Town Council is co-operating with the leading manufacturers in the town with a view to having electric power introduced.

Batley.—WAR BONUS.—A Special Sub-Committee of the T.C., after consideration of an application by the Corporation employees for an advance in war bonus, has decided to recommend an all-round increase, bringing the bonus up to 19s. per week.

Buxton.—PRICE INCREASE.—The T.C. has decided upon a war-time increase of 20 per cent. in the charges for electricity to all consumers, from the end of the current quarter.

Carlisle.—PRICE INCREASE.—The City Council has decided that the charges for electricity shall be increased by 10 per cent. from October 1st, except in cases covered by special agreements.

Continental.—SPAIN.—The Sociedad Hidroeléctrica de Pindo has recently secured a concession to establish a plant to utilise the water power of the River Dobra, in the Angón Valley (Province of Oviedo), in the generation of electrical energy for power purposes.

Dewsbury.—LIGHTING RESTRICTIONS.—The local Chamber of Trade last week decided to urge upon the West Riding authorities that 7 p.m. should be definitely fixed as the time for shop-lighting restrictions throughout the winter, or, in the alternative, that a definite uniform time should be fixed for the different months. It was held that there would be no need for obscuring lights at all if satisfactory arrangements could be made for extinguishing them promptly if necessary, and a Sub-Committee was appointed to interview the Chief Constable of the town to see if better shop-lighting facilities could be arranged.

Doncaster.—STRIKE NOTICE.—With further reference to the paragraph on p. 253 of our issue of September 14th, the Corporation was at first inclined to take no action, but it was announced last week that the matter, which had been referred to the Committee on Production, would come before an arbitrator on Friday, September 14th, and consequently the employees'—those concerned number nearly 300—suspended their notices pending the result.

Harrogate.—STREET LIGHTING.—The acting chief constable of the West Riding has sanctioned the lighting of a number of electric street lamps in the town, leaving the question of a possible further number in abeyance. The local Lighting Committee has decided that these lamps shall remain lighted throughout the night as from September 6th.

Hove.—YEAR'S WORKING.—The statement of accounts of the Council's electricity undertaking for the year ended March 31st shows receipts £23,487, expenditure £11,573, and gross profit £11,914, which, with income-tax refunded, totals £12,081. Interest, sinking fund, and income-tax charges, &c., absorbed £11,336, leaving a net balance on the year's working of £745. On the Aldington section the revenue account shows income £2,236, expenditure £1,423, gross profit £813; loan charges, &c., absorb £687, leaving a credit balance of £126.—*Sussex Daily News*.

The Electricity Committee places on record its appreciation of the able manner in which Mr. C. B. Smith has managed and carried on the undertaking during the war under most difficult circumstances.

Keighley.—PRICE INCREASE.—At the T.C. meeting, last week, the Electricity Committee recommended that in future sealed agreements for electricity supply entered into by the Corporation the price per unit be increased, as follows:—D.C. system (minimum annual payment £40), from 7s. 6d. to 7s. 7½d. per unit; three-phase high-pressure system, from 3d. to 3s. 7½d.; the present charge of £3 per kW. of maximum demand to continue. Mr. Sellers, moving the adoption of the Committee's accounts, said that the department's output had doubled since the beginning of the war, and coping with doubled business under war conditions was no light task. The lighting restrictions had caused a falling-off in units. Last year £5,612 had been paid out of revenue for repayment of capital, whilst the interest on loan charges had amounted to £3,194. The average price obtained for the whole supply had been 7s. 5d. per unit, which was 10d. less than last year; this was due to the larger output being given for power uses, whilst lighting units had shown a reduction. There was a net profit of £223.

Kilmarnock.—PROPOSED LOAN.—The T.C. is applying to the Scottish Office for power to borrow £80,000 for electricity purposes.

Launceston.—SUGGESTED PRICE INCREASE.—The Electric Supply Co. Ltd., has applied to the B. of T. for consent to increase the price of electricity for lighting from 6d. to 8d. per

LIGHTING AND POWER NOTES.

Accrington.—YEAR'S WORKING.—The annual statement of accounts of the Corporation electricity department shows gross revenue £35,775, expenditure £34,064, leaving a gross profit of £1,711, which, with interest on investment, totals £1,735; capital and income-tax charges, &c., amounted to £11,242, and special

unit, and for power and heating from 3d. to 4d. The directors have promised the consumers not to raise the price beyond 7d. unless special circumstances warrant it, and to consult the consumers before increasing the charges beyond 7d.

Leeds.—**SHOP LIGHTING.**—The Leeds Chamber of Trade last week unanimously decided to urge the Home Office to appoint a definite time for subduing shop lights during each month of the autumn and winter, in order to avoid the lack of uniformity and consequent trouble both to shopkeepers and authorities, which was experienced last winter.

Lye.—**STREET LIGHTING.**—The U.D.C. has decided to give the gas company six months' notice to terminate the public lighting contract, the idea being to substitute electricity.

London.—**ST. PANCRAS.**—**YEAR'S WORKING.**—The accounts of the electricity undertaking for the year ended March 31st last show a net profit for the year of £26,828. In anticipation of this balance, £5,000 was transferred in aid of the rates for the current half-year, and the Finance Committee holds that a further sum of £14,000 should be used during the ensuing half-year to meet the lighting portion of the Council's requirements, and to relieve the rates. This will leave a credit balance on the electricity revenue account of £7,828. The Electricity Committee considers that the increase in the price of electricity of 10 per cent. made at the June quarter, 1915, should be reduced to 2½ per cent., and that the resolution of the Council of June, 1916, respecting meter rents being charged on a sliding scale should be rescinded. It is estimated that these concessions will affect the revenue for the current financial year by about £8,000 in respect of the six winter months, during which the alteration will be in operation, and in subsequent full years by about £12,000 per annum.

POPULAR.—**YEAR'S WORKING.**—The annual report of the electrical engineer and manager, Mr. J. H. Bowden, shows that the energy sold amounted to 23,477,042 units, an increase of 1,970,128 units, or 9 per cent.; the net income from the sale of energy amounted to £103,878, an increase of 17½ per cent., and the working expenditure was £67,069, an increase of 28½ per cent. The gross profit was £36,808, an increase of £497 on the previous year; and, after deducting interest £11,382, repayment of loans £13,143, and sundry charges £899, there remains a surplus of £12,011, a slight increase over 1916. With the unappropriated balance of £8,596, there was a total surplus of £20,607; a sum of £3,393 was transferred to the rates, about £9,000 was applied to items of capital expenditure, alterations, &c., £1,262 to the staff as a bonus, and £686 was transferred to the superannuation and pension fund, leaving an unappropriated balance of £6,137 to be carried forward. The average price of coal rose from 17s. 11½d. per ton in the previous year to 20s. 5d., a difference of 2s. 5½d. per ton, which on a consumption of 37,247 tons is equal to £4,578; works costs rose from 0'58d. to 0'69d.; the average price obtained per unit sold was 1'062d., and if the bulk supply is deducted the price for energy sold in the Poplar area becomes 1'194d. The capital employed per kW. of plant installed is £324; the load factor was 30'11 per cent. compared with 30'2 per cent. in the previous year. The sale of energy for private lighting was 1,210,331 units, for domestic supply 935,414, for power 17,832,739, for bulk supply 3,294,711, and for public lighting 203,644 units.

Pinner.—**NEW MAINS.**—The Electric Light Co. has informed the Hendon R.D.C. that it intends to lay mains in various parts of the district.

Portsmouth.—**YEAR'S WORKING.**—The accounts of the Corporation electricity department to March 31st last show total revenue £53,301, an increase of £2,696; works costs £40,445, an increase of £4,625; gross profit £12,856, as compared with £14,784. Repayment and loan charges amount to £21,110, and income-tax and special charges to £854, making a total of £21,964, leaving a deficit on the year's working of £9,108, which has been taken from the reserve. The reserve fund now stands at £10,789. The cost of coal per unit generated has increased since the war began from '36d. to 1'65d., and the total works cost from 1'4d. to 2'6d. Total capital expenditure to date, £375,427; amount repaid, £225,744; a mount outstanding, £149,683.

Salford.—**STREET LIGHTING.**—The Lighting Committee proposes to make arrangements with the Electricity and Tramways Committee of the borough for the better lighting of the streets during the coming winter. It is intended to have a number of electric lamps, shaded from above, and suspended from the cross wires between the tramway standards. These lamps could be easily extinguished in the event of a warning.

Southend-on-Sea.—**SLOT METERS.**—With reference to a decision of the Electricity Committee that consumers of electricity through slot meters should be required to pay a minimum of 1s. per annum, the borough accountant has been instructed to require payment of a deposit of 15s. from all persons using slot meters who have not, during the last 12 months, consumed energy to the value of 18s., and that on and after October 1st it be a condition precedent to the hiring of slot meters that a deposit of 15s. be paid. The L.G.B. is to hold an inquiry into the application of the Council for sanction to borrow £45,520 for the provision of additional generating plant at the electricity works at the termination of the war.

Southport.—**WAGES AND SALARIES.**—The Corporation Electricity Committee has decided to increase the wages of the stokers from 4s. 8d. to 5s. 8d. per shift, and of the drivers from 4s. 8d. to 5s. 10d., exclusive of war bonus. It has been decided to

increase the salaries of the track superintendent, the mains superintendent, the two engineers in charge, and the chief clerk, these officials, it is stated, having had no increase for 10 years.

Weymouth.—**YEAR'S WORKING.**—The statement of accounts of the electricity department for the year ended March 31st last shows gross receipts £12,725, and expenditure £9,397, leaving a gross profit of £3,328; after making provision for repayment and interest charges of £4,393, there is a deficit on the year's working of £1,065; total capital liability £67,164, of which £23,719 has been repaid, leaving £43,444 outstanding. The Electricity Committee hopes that as the increased charges did not operate for the whole of the year, the augmentation of revenue during the present year may have further beneficial results. Units sold, 926,918; maximum load, 500 kW.; load factor, 21'16 per cent.

TRAMWAY AND RAILWAY NOTES.

Argentina.—According to a Buenos Aires telegram, the tramway employés at Rosario have gone on strike. Many of the tramcars have been set on fire.

Blackburn.—**WAGES.**—The Corporation Tramways Committee, last week, considered an application from the Lancashire and Cheshire District Council of the Amalgamated Association of Tramway Workers for an additional increase in wages of 7s. 6d. a week for all tramway workers (male and female) over 18 years of age, and 3s. 3d. per week for all under that age. It was decided to allow the matter to go to arbitration.

Bradford.—**TRAMCAR LIGHTING.**—In view of the proposed improved street lighting during the coming winter, efforts are being made to obtain better tramcar lighting also. The matter has been taken before the authorities concerned, but has not yet been settled.

Continental.—**SPAIN.**—The constructional works have been started of the electric railway from Santa Coloma de Farnés to Sils, which the company of the same name has in hand. The line is important as being the first stage in a network 245 km. in extent, which is destined to cover a great part of the province of Catalana. The network will cross the provinces of Barcelona and Gerona from Manoesa, on the shores of the Levant, to Maya, Vich, San Hilario, Santa Coloma, Sils, and Llagostera, with branches to the most important population centres of these territories, which will be linked together by three main and two secondary railway services. The network will open up the rich forest and mineral regions of Las Guilleras, and bring life and movement to communities, many of which are now shut out from outside communication.—*Industria e Invenções.*

Application has been made for a concession for the construction and working of an electric tramway in Guadálajara between the railway station and the centre of the town.

GERMANY.—It is reported from Krefeld that the German War Office has decided to stop the tramway service and place the tramway material at the disposal of the army. Similar measures are contemplated in other industrial centres in Western Germany.

Droylsden.—**FARES.**—At a meeting of the D.C. held last week, a protest was raised against the increased fares between Droylsden and Ashton-under-Lyne on the Manchester to Ashton system. From Droylsden to Ashton the fare is 2½d., and from Droylsden to Manchester, nearly three times the distance, it is only 1½d.

Farnworth.—**THROUGH RUNNING.**—A working arrangement has been arrived at between the Bolton Corporation and the South Lancashire Tramways Co. whereby cars now run through from the Black Horse, Farnworth, to the terminus at Bolton, only one ticket instead of two being issued.

Liverpool.—**Southport Railway.**—**STOPPAGE.**—A breakdown on the Liverpool-Southport Electric Railway line on Friday morning, last week, caused considerable delay to business men and visitors. As one of the electric trains was travelling between Seaförth and Liverpool something went wrong with the motors, and the train stopped, blocking the line. Eventually a steam locomotive was requisitioned, but the service was interrupted for the better part of an hour.

London.—**COLLISION.**—A collision occurred between two L.C.C. tramcars, on Sunday evening last, and resulted in 12 persons being injured. A tramcar standing at the junction of New North Road and Essex Road was run into by one coming from the north, owing to the failure of the brakes to act, the front of the runaway car being completely smashed; the injured were treated at the local hospitals, but none were detained except the driver of the runaway car, who was rather severely injured.

Rawtenstall.—**STRIKE SETTLED.**—The trouble on the Corporation tramways, which resulted in a five-days' strike on the part of the employés, has been settled. The dispute arose because the male workers were offered a war bonus of 4s. a week and the females one of 2s. 6d., to date from September 1st, and the employés wanted a 4s. bonus all round, to date from July 1st. The Town Council has now agreed to the all-round bonus of 4s., but it is to date from September 1st, and the employés have accepted the offer.

South Africa.—**BLOEMFONTEIN.**—In connection with the railless tramway service the Town Council has decided to employ tractors in order to cope with the traffic on certain routes. As an experiment, an order for one tractor has been placed with the Griffin Engineering Co., of Johannesburg.

Wallasey.—**STRIKE.**—The Corporation tramway drivers and conductors came out on strike on Wednesday last, after giving 48 hours' notice of their intention, failing an undertaking from the Tramways Committee to cease training women as drivers. The employees' contention that the object of training women as drivers was to displace men and to release more men for the Army, was met by the assurance of Colonel R. R. Greene, the general manager, that women employed as drivers would receive the same wages as men. Although it was further pointed out that such a strike was illegal, both men and women came out. A curtailed service was run with the help of the office staff, 15 cars being out against the usual 45, and considerable inconvenience was caused to business people. On Thursday, however, the strike collapsed, the employees returning to work on the understanding that their grievances would be considered by the Committee.

TELEGRAPH AND TELEPHONE NOTES.

Argentina.—The Government has withdrawn the permission granted to a German wireless telegraph company to make experiments with a view to recording the wireless communications sent out from Nauén, the big wireless telegraph station near Berlin.

The New York *World* publishes a dispatch from Buenos Ayres revealing the existence of a vast German spy system in Argentina, and disclosing the bureau which directed all espionage in South America. A secret wireless apparatus was discovered, and messages concerning ships were traced. The Argentine Government has proof that Germans collected facts relative to the departure of cargoes and the destination of vessels, the place of embarkation of troops, and the movements of neutral ships. The dispatch says that German spies in Argentina were in direct communication with Berlin—by cable to Madrid, and thence by wireless to Berlin.—*The Times*.

South Africa.—Owing to the approaching exhaustion of stocks and the impossibility of obtaining supplies, the Postmaster-General announces that the extension of the telephone service must be restricted to the minimum until the stock of materials can be replenished.

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—**MELBOURNE.**—October 10th. Department of the Navy. Pumping plant and equipment for the Commonwealth Naval Dockyard, Cockatoo Island, Sydney. Specifications from the Director of Navy Contracts, Melbourne.

Kirkcaldy.—October 2nd. Corporation. Converting plant and switchgear. See "Official Notices" September 14th.

Liverpool.—September 24th. Electrical supplies for three months, for Toxteth Park B. of G. Mr. R. A. James, Clerk. 15, High Park Street.

London.—**KENSINGTON.**—September 27th. B. of G. Six months' supply of electric fittings and lamps. Mr. W. R. Stephens, Clerk to the Board, Guardians' Offices, Marloes Road, W. 8.

Manchester.—September 25th. Corporation Tramways. Pitch. Mr. J. M. McElroy, General Manager.

September 27th. Lancashire and Yorkshire Railway. Various stores, including (39) signal and telegraph wires. Mr. Waring, Stores Department, Osborne Street, Manchester.

Merthyr Tydfil.—September 24th. B. of G. Electrical accessories for six months. Mr. F. T. James, Clerk. 134, High Street.

CLOSED.

Glasgow.—The Electricity Committee reported to the T.C. that it had considered the tenders received for the reinforced concrete superstructure for one boiler house, turbine room, and workshop at the new generating station, Dalmarnock, and recommended acceptance of the offer of Messrs. Train and Taylor, at £64,539, it being the lowest.

The engineer reported on the tenders received for (1) boiler-house plant and (2) E.H.T. switchgear for the new generating station at Dalmarnock, and the Sub-committee, after consideration, agreed to recommend acceptance of (a) an offer by Messrs. Babcock and Wilcox, Ltd., for eight boilers, stokers with forced and induced draught, economisers, chimneys, feed pumps,

and piping, for £140,282; and (b) an offer by Messrs. A. Reyrolle and Co., Ltd., to supply and erect 12 sets of E.H.T. switchgear for the power-house there, for £33,985. At a subsequent meeting it was reported that there had been considered a letter from Messrs. Babcock & Wilcox, Ltd., stating that the cost of labour and material in connection with their contract for providing and erecting a coal conveyor and transporter at the new works at Dalmarnock had increased by at least £5,700, and asking that they should be allowed an additional sum of £5,000 on their contract price of £21,000. Having heard the engineer, the Committee was of opinion that the increased price asked for was reasonable in the circumstances, and agreed to recommend that the same be granted.

The engineer reported that additional switchgear would be required at the various sub-stations, and the Sub-committee authorised him to order from Messrs. A. Reyrolle & Co., Ltd., 27 panels, at £14,210.

Government Contracts.—List of new contracts placed during August, 1917:—

WAR OFFICE.

Dry batteries.—Houghton-Butcher Manufacturing Co., Ltd.
Battery boxes.—T. & J. Hughes; F. Restall, Ltd.
Insulator brackets.—Bullers, Ltd.; Butterworth & Dickinson, Ltd.; Douglass Bros., Ltd.; G. Wilson & Co., Ltd.
Electric cable and wire.—B.I. & Helsby Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; W. T. Glover & Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Hooper's Telegraph & India-Rubber Works, Ltd.
Dynamoes.—General Electric Co., Ltd.
Ebonite rod.—St. Helens Cable & Rubber Co.; Siemens Bros. & Co., Ltd.
X-ray equipment.—Cavendish Electrical Co., Ltd.
Electric light fittings and accessories.—Elm Works, Ltd.; Evesson Bros., Ltd.; E. Stevens, Ltd.; J. Stevens, Ltd.
Electric lamps.—British Thomson-Houston Co., Ltd.
Electric motors.—Electric Construction Co., Ltd.
Electrical plant.—Harland Engineering Co.
Iron and steel wire.—R. Johnson & Nephew, Ltd.; Shropshire Iron Co., Ltd.
Switches.—General Electric Co., Ltd.

INDIA OFFICE STORE DEPARTMENT.

Copper plates.—Williams, Foster & Co.; Pascoe, Grenfell & Sons.
Copper wire.—T. Locker & Co.
Wire.—R. Johnson & Nephew, Ltd.; Whitecross Co.; B.I. & Helsby Cables, Ltd.

POST OFFICE.

Telegraph apparatus.—British L. M. Ericsson Mfg. Co., Ltd.; Siemens Bros. & Co., Ltd.
Telephone apparatus.—Automatic Telephone Mfg. Co., Ltd.; B.I. and Helsby Cables, Ltd.; British L. M. Ericsson Mfg. Co., Ltd.; Peel-Comer Telephone Works, Ltd.; Siemens Bros. & Co., Ltd.; Thornton-Pickard Mfg. Co., Ltd.; Waltham Cross Jeinery Co.
Submarine cables.—Siemens Bros. & Co., Ltd.; Telegraph Construction and Maintenance Co., Ltd.
Telegraph cables.—B.I. & Helsby Cables, Ltd.; Hackbridge Cable Co., Ltd.; I.R., G.P. & Telegraph Works Co., Ltd.; Telegraph Construction and Maintenance Co., Ltd.
Telephone cables.—B.I. & Helsby Cables, Ltd.; Johnson & Phillips; New Gutta-Percha Co., Ltd.; Telegraph Construction & Maintenance Co., Ltd.; Union Cable Co., Ltd.; Western Electric Co., Ltd.
Dry cells.—British Ever-Ready Co., Ltd.
Plates for stay-rods.—Walker Bros., Ltd.
Insulator rings.—C. Macintosh & Co., Ltd.
Pole steps.—Gnest, Keen & Nettlefolds, Ltd.
Stay swivels.—Bullers, Ltd.
Bronze wire.—T. Bolton & Sons, Ltd.; Shropshire Iron Co., Ltd.; F. Smith and Co. (incorporated in the London Electric Wire Co. & Smiths, Ltd.).
Copper wire.—T. Bolton & Sons, Ltd.; Elliott's Metal Co., Ltd.; Johnson and Nephew, Ltd.; F. Smith & Co. (incorporated in the London Electric Wire Co. & Smiths, Ltd.); Wilkes, Son & Mapplebeck, Ltd.
Enamelled and flameproof wire.—Fuller's Wire & Cable Co., Ltd.
Galvanised-iron strand wire.—Rylands Bros., Ltd.; Whitecross Co., Ltd.
Steel wire.—Rylands Bros., Ltd.
Switchboard wire.—B.I. & Helsby Cables, Ltd.

London.—**ST. PANCRAS.**—B.C. New air-pump for the converted 1,500-KW. Ljungstrom turbine at the King's Road station. £300: Brush Electrical Engineering Co., Ltd.

POPULAR.—Electricity Committee. Recommended:—

Overhead crane for High Street sub-station.—Herbert Morris, Ltd., £447.
Steam piping.—Aiton & Co., £224.

Southend-on-Sea.—T.C. Electricity Department:—

Callender's Cable & Construction Co., Ltd.—100 service boxes, 11s. 6d. each.
Belliss & Morcom, Ltd.—Piston and piston rings, £20 14s.

FORTHCOMING EVENTS.

Association of Supervising Electricians.—Tuesday, September 25th. At 7.15 p.m. At St. Bride's Institute, Bride Lane, E.C. Presidential address by Mr. J. S. Highfield.

NOTES.

Foreign Trade.—**THE AUGUST FIGURES.**—The official returns of imports and exports during last month contain the following electrical and machinery figures:—

	August, 1917.	Inc. or dec.	8 months, 1917	Inc. or dec.
IMPORTS.				
Electrical goods ...	97,318	— 12,137	— 151,919	
Machinery ...	817,910	+ 199,475	— 278,158	
EXPORTS.				
Electrical goods ...	257,172	— 152,337	— 645,600	
Machinery ...	1,644,351	— 289,359	+ 717,211	

Volunteer Notes.—COUNTY OF LONDON VOLUNTEER ENGINEERS (FIELD COMPANIES).—Headquarters, Balderton Street, Oxford Street, W. 1.

Orders for the week, by Lieut.-Colonel C. B. Clay, V.D., commanding:—
Officer for the Week.—Second Lieut. C. E. Campbell.

Monday, September 24th.—Technical instruction (searchlight) for No. 3 Company, Right Half Company, at Regency Street. Drill, No. 3 Company, Left Half Company. Signalling Class, 6.30. Recruits' Drill, 6.30.

Tuesday, September 25th.—Physical drill and bayonet fighting.
Wednesday, September 26th.—Drill and elementary bridge construction for No. 1 Company, Right Half Company.

Thursday, September 27th.—Drill and elementary bridge construction for No. 2 Company, Right Half Company. Signalling Class, 6.30. Ambulance Class, 6.30.

Friday, September 28th.—Technical instruction (searchlight) for No. 3 Company, Left Half Company, at Regency Street. Drill, No. 3 Company, Right Half Company. Recruits' Drill, 6.30.

Saturday, September 29th.—Commandant's Parade for route march and drill. Parade at Headquarters, 2.45 p.m. Uniform. Recruits' drill, 2.30.

(By order) MACLEOD YEARLEY, Capt. and Adjutant.

Nitrolim.—In a recent lecture on the manufacture of cyanamide and kalkstickstoff (nitrolim), delivered in May last at Vienna, M. Doleh had remarked that the Swedish process of making the cyanamide in vertical shaft furnaces was not profitable, because the electrode consumption was high, and the nitrogen percentage of the final product rather low. Mr. P. Carlsson, of the Aktiebolaget Nitrogenium, Ljungaverk, replies to this remark in a recent number of the *Chemiker Zeitung*, refuting the statement and giving some interesting particulars. The carbon electrodes, he says, are Plania or Högans electrodes, 350 mm. in diameter, which is not at all an exceptional size. There is no loss of pieces of the electrodes, which are constantly being lengthened. The electrode consumption is 3.75 kg. per ton of kalkstickstoff, which is supplied in a porous ground mass containing 19 per cent. or 20 per cent. of nitrogen. The product is said to be very uniform just because the carbide gradually descends in the shaft furnace: 725 kg. of carbide yield one ton of kalkstickstoff. The furnace process is continuous, and it does not take so long as with other furnaces to start operations again after some breakdown in the power house. In short, the process is described as both reliable and economical.—*Engineering*.

Tar Oil as Fuel for Diesel Engines.—In view of the recent Orders made by the Ministry of Munitions regulating the use of creosote and other oils produced from the distillation of coal, the DIESEL ENGINE USERS' ASSOCIATION has taken action to assist as far as possible in making arrangements for the necessary supplies of tar oils for its members. The present difficulty of obtaining a sufficient supply of petroleum residual oil as fuel for Diesel engines has led a large number of users to adopt tar oil.

At the present time, "Creosote Licences" are only being granted for a period of two months, but the Association is hopeful that its members may shortly be able to obtain licences for the use of tar oil for longer periods, so as to facilitate arrangements in making contracts for regular supplies. The honorary secretary of the Association has collected particulars of the requirements of the various members who use, or who contemplate using, tar oil, and these, together with other information, have been submitted to the Director of Munitions Petroleum Supplies.

Cast Iron as a Bearing Metal.—When one considers the suitability of cast iron as a bearing material, it is a matter for wonder why it is not more generally used. Designers are so used to the usual run of bearing material that they appear unable to accept the evidence of their own eyes. Let any engineer look round his plant, and he will find plenty of evidence of the successful use of cast-iron. Personally, the writer is prepared to use cast-iron in practically every case where the copper alloys are at present used. In his present shop are dozens of shafts running in cast-iron bushes up to 3 in. in diameter, and up to 1,000 R.P.M., and they give very little trouble—certainly no more than brass. Strange to say, most of these are on American and Continental machines. When the comparative costs of the copper alloys and cast-iron are taken into consideration, it will be seen that considerable economy can be effected by the use of the latter in preference to the former, with no reduction in efficiency. This fact will have to be taken into account at no distant date, and it behoves British designers to give the matter serious consideration. One little hint may be of use. When using cast-iron as a bearing material, provision should be made for renewable bushes, as is usual when brass is used. Most makers, when using cast-iron, simply bore holes in the castings composing the machine. When it is required to re-bush the holes, considerable trouble and expense are incurred by having to re-bore them to admit bushes. G. B., in the *Mechanical World*.

The Engineering Council of the United Engineering Societies, U.S.A. On June 27th was held the first meeting of the Engineering Council. This body is a department of the United Engineering Society, and has recently come into being as a medium of co-operation among the four national engineering societies. The function of the Council may, perhaps, best be described by the following extract from the by-laws of the United Engineering Society: "The Council may speak authoritatively for all member societies on all public questions of a common interest or concern to engineers." The Council is composed of 24 members, five being appointed by each of the four founder societies and four by the United Engineering Society. At the organisation meeting the following officers were elected: President, I. N. Hollis; vice-presidents, H. W. Buck, George F. Swain; secretary, Calvert Townley; Executive Committee, the four officers named, with J. Parke Channing and D. S. Jacobus.

The Council discussed at length ways and means by which the founder societies, through the Council, might be of use to the nation. The unanimous desire to help the Government in the prosecution of the war resulted in a resolution instructing the Executive Committee to co-operate with the Government in procuring the services of engineers, also the appointment of a Committee of three to consider the best means of utilising the inventive ability of members.

The secretary was instructed to inform all Government bureaux that might be interested in the organisation of the Engineering Council and its desire to be of assistance.—*American Machinist*.

A New Permanent-Magnet Steel.—A new steel of considerable importance has been made in the United States for the last year or so, directly the outcome of war conditions. It is a new permanent-magnet steel, a substitute for the older steel, known as tungsten magnet steel, which was used exclusively for this purpose before the war.

The new steel, which is reported to be not less than 90 per cent. as efficient as the old permanent-magnet steel, is a 0.90 per cent. carbon steel containing about 2 per cent. of chromium, and is now being made in electric furnaces in the U.S.A. and extensively used by many consumers.

This new type of steel is based on investigations made by Dr. John A. Mathews, of Syracuse, N.Y., and published by the American Society for Testing Materials about three years ago, in which it was pointed out for the first time that certain types of steel were better magnetically when quenched in oil than when quenched in water. This statement was entirely contrary to all previous ideas regarding the hardening of steel for permanent magnets.

Magnetically this new chromium steel is equal to tungsten magnet steel in permanence, but somewhat lower in residual density. Users have found it possible to substitute this steel for the older steel, without making any change whatever in their windings or in the cross sections of the magnets used.

Practically chrome magnet steel, as the new steel is called, is not as good as the tungsten magnet steel, because it requires oil hardening, which is not as convenient as water hardening, and also because chrome steel in its natural state is much harder to drill or machine, and the steel itself must be handled with greater care and uniformity in heat treatment than is necessary with tungsten steel.—*Scientific American*.

Revamping the Central Station.—The change in generating practice brought about by the introduction of the steam turbine some 15 years ago has been very startling in its results, and particularly so in the case of big city plants, in which economy of space may become nearly or quite as important as economy of coal. A very excellent example of what has happened will be found in the remodelling of the St. Louis generating station, which in its first stage of existence some 14 years ago happened to be one of the last big plants with reciprocating engines. The great cross-compound reciprocating engines of the original plant had scarcely more than settled down to their bearings before it was necessary to increase the station capacity, and four 5,000-kw. turbine generators were added. The original boiler plant consisted of 28 Scotch boilers. To take care of the new units 40 water-tube boilers were added on an upper deck. Three years later more output was required, and the four turbines were replaced, after only three years' service, by 12,000-kw. turbines. Again more steam was needed, and 12 of the Scotch boilers were replaced by water-tube boilers. So far as the turbine plant was concerned, it now had 52 boiler units to provide steam for 48,000 kw., as against 40 boilers for the 20,000 kw. The generating equipment remained in this stage of evolution for seven years, and then there was another forward movement. This time one of the original 3,000-kw. reciprocating engine sets was removed, and in its place was installed a 20,000-kw. horizontal turbine. For this unit the remaining 16 Scotch boilers came out and 10 water-tube boilers went in, with 2,000-kw. capacity per boiler. With the greatly increased output two of the reciprocating sets were removed and their room was utilised for the extension of the switchboard space. Finally, plans are now under way for abolishing the remaining two old units and putting two 20,000-kw. turbines in their place. One rarely sees a more striking example of the very radical changes in practice wrought by a few years' development. It would not be unsafe to prophesy that when the two new units go into place they will not require 10 boilers apiece.—*Electrical World*.

The Decimal System.—Recently a "questionnaire" was circulated among the members of the Chartered Institute of Secretaries for the purpose of obtaining opinions in regard to the adoption of a decimal system of coinage in the United Kingdom and the substitution of the metric system for the existing United Kingdom weights and measures. Of the replies received, 85 per cent. considered that a change to a decimal system of coinage would be favourable to the business in which they were engaged, and 66 per cent. favoured a £ basis of coinage in preference to the "Imperial Crown" or dollar basis.

With regard to weights and measures, 86 per cent. favoured a change to the metric system, 53 per cent. of whom already used that system in their businesses. The large majority were of opinion that the metric system not only facilitated their internal office work, but had led to extended business relations with other countries, including France, the United States, Russia, and the Argentine. In 61 per cent. of the replies the business of the company was stated to be hindered by the use of the existing system of weights and measures.—*Financier*.

Training Apprentices for the Electrical Trades.—The need for technical instruction of a specialised nature for apprentices in the electrical trades has long been felt, and it will be remembered that some time ago Mr. R. W. Paul in particular endeavoured to bring about a reform in this respect, with especial reference to the requirements of electrical instrument makers. The teaching institutions, we believe, held that their ordinary classes adequately met the case, but manufacturers considered that these courses were of too general a character, and Mr. Paul organised a special instruction department in his own works to provide the training which he thought necessary. The whole subject will be dealt with, no doubt, by the Ministry of Education in connection with its new schemes, but in the meantime we are glad to learn that the Northampton Polytechnic Institute has led the way by inaugurating day and evening courses for apprentices and others in the electrical trades, which will open shortly.

It is recognised that evening instruction alone is unsuitable for boys from 14 to 17 years of age: in the announcement issued by the Principal, Dr. R. M. Walmsley, it is urged that at least a part of the training should be given in the daytime, not less than one whole afternoon a week being devoted to technical instruction. In addition, the general education of the boys leaving the elementary schools should be continued, and for this purpose evening classes will be held at the Junior Technical Institutes of the L.C.C., affiliated to the Northampton Institute, on two nights a week in English, calculations, general subjects, and gymnastics, the work of the elementary schools being thus continued, with a technical bias directed towards the industry in which the boys are engaged. In future sessions, as the scheme develops, the courses will be elaborated. Provision is made in the day courses at the Northampton Polytechnic Institute for three grades of apprentices, and the evening classes there, as well as at the Junior Technical Institutes, will be co-ordinated with the day work. The courses can only be held if a sufficient number of enrolments is received by Friday, September 28th, and it is to be hoped that employers will take immediate action to induce their apprentices to apply for admission.

Messrs. Marryat & Place, who for some years have been deeply interested in this question, and are entirely satisfied with the proposals of the Institute, are sending some 20 students, and are anxious to have the support of other members of the trade. The importance of the matter in these days can hardly be exaggerated, and we hope that the opportunity to assist in this movement will be seized by the electrical manufacturers in the London area.

Fatality.—A verdict of "Accidental death" was returned at an inquest held at Derby to inquire into the death of Harold Canham, 24, who was killed while following his employment as an engineer at Messrs. Newton Bros.' Electrical Works. According to the *Nottingham Guardian*, the deceased was connecting a motor to the supply for testing purposes, and was holding a copper bar with one hand and the framework of the switchboard with the other, when apparently he slipped, and one of his hands came in contact with a live wire, and he was held until the current was cut off by an apprentice; he then dropped. Attempts at resuscitation proved unavailing.

The test-bed foreman, John Husbands, said it was the rule that the current should be cut off before such an operation was commenced, and he thought that deceased must have turned it on unthinkingly. The voltage was 400.

Metropolitan Power Station Engineers.—A meeting was held at St. Bride's Institute, on September 14th, of the London A.E.S.E. Committee and other representatives of the engineering staffs of London electricity supply stations. The Press report of the conference between the Electrical Trades Union and the Associated Municipal Electrical Engineers, under the auspices of Sir G. R. Askwith, dealing with the rates of pay, &c., of charge engineers, was discussed. It was decided that the secretaries of kindred Associations should be approached, with a view to a joint protest being made to Mr. G. R. Askwith to the effect that the E.T.U. does not represent the central station engineers of the London area, and that a joint conference should be held at St. Bride's Institute on September 25th, at 7 p.m., to decide the action to be taken in the matter.

South African Municipal Electrical Engineers in Conference.—The second annual Conference of the Association of Municipal Electrical Engineers (Union of South Africa), which was founded in 1915, was to take place at Durban from August 27th to September 1st. We have received an advance copy of the programme, but, under the prevailing conditions, the report of the proceedings will probably not come to hand for a while.

Owing to the war and depleted staffs many of the Association's 31 members were unable to attend, and one at least was on Active Service. It was, however, anticipated that some 16 engineer members and about 8 Councillor delegates would attend. The Natal Society for the Advancement of Science and Art (Engineering Section) was also taking part, and a useful and instructive week was anticipated. One of the most important subjects to be considered was that of "Standardisation," in connection with which a Standards Committee has been meeting regularly at Johannesburg, consisting of representatives of the following bodies:—S.A. Institute of Electrical Engineers, S.A. Institute of Engineers, Association of Municipal Electrical Engineers (S.A.), Engineering Section Natal Society for the Advancement of Science and Art, British Electrical and Allied Manufacturers' Association, Institution of Electrical Engineers (England), and Government Departments, Union of S.A.

It was anticipated that some important representations and proposals would be forthcoming from the Convention regarding electrical standardisation as affecting municipalities.

The opening meeting was to take place at the Town Hall, Durban, on Monday, August 27th. The official welcome by the Mayor was to be followed by the annual general meeting for the receipt of reports, election of president, secretary, and other officers. After the official luncheon a visit was to be paid to Messrs. Lever Bros.' Soap Works. On Tuesday the presidential address was to be delivered by Prof. J. H. Dobson, and a discussion on "Tariffs," led by Mr. John Roberts, was to follow. Other events of the day included a visit to the Harbour Works and cooling plant, and, in the evening, a paper on "South African Municipal Electrical Undertakings," by Mr. Poole, assistant electrical engineer, Durban. On Wednesday the party was to meet at Pietermaritzburg, and the events included a visit to the municipal power station there, an official luncheon by the Mayor, and a paper on "Gas Plants," by Mr. F. Castle, municipal electrical engineer, Oudtshoorn. Thursday, back at Durban, a paper by Mr. J. Roberts, on "Standardisation," was down for discussion, followed by a visit to the municipal power station and dinner at the Royal Hotel. On Friday, Mr. J. Hamlin, municipal electrical engineer, of Stellenbosch, was to introduce "The Design and Management of Small Power Installations," followed by an afternoon visit to the Explosives Works of the Sugar Factory. Saturday, September 1st, was left free for any business meetings or adjourned discussions that might be arranged.

Board of Trade Urges British Manufacturers to Combine.—At a meeting of the Birmingham Brass Masters' Association, held on Monday, important addresses were delivered by Mr. L. A. Paish, of the Commercial Intelligence Department of the Board of Trade, and Mr. C. Hamilton Wickes, H.M. Trade Commissioner for Canada. Mr. Paish said that the Board of Trade had closely followed the syndicating efforts of German industry, and they were convinced that it was absolutely essential for British manufacturers to get together into some sort of trading combination if they were to regain lost trade and to increase their export trade after the war. Combination would have to meet combination. The speaker went on to show that Birmingham brass masters could in combination systematically investigate a market, whereas an individual firm would be unable to do so. By means of an Association of the whole of the products of the brass industry, a man could be put into any market thoroughly to study the changes that had taken place during the war. The Board of Trade Commercial Intelligence Department was prepared to co-operate in every possible way to that end, even, says the *Times* report, to the extent of financial assistance in the sending out of such a representative. The Department was out to give manufacturers and traders all the assistance they could reasonably expect. He was instructed to take steps to get the formation of a trading Association for the brass industries actually going; if they did not combine, they would go under. Mr. Hamilton Wickes, who followed, said that what German manufacturers had done in the past in certain lines would be done by the German nation—namely, it would purchase as one body the raw material required from outside countries for its vital industries. Was it not time that British manufacturers got together?

American Lumbermen for France.—The regiment of Lumbermen, for service with the United States Army in France, has been recruited to full strength. The "lumber-jack regiment," as this is known, is for service in the woods of France, getting out material for the use of the Army. The enlistments were secured through the Forest Service, and the men comprise practical lumbermen and foresters. For this work the regiment will go thoroughly equipped with portable and stationary electrically-driven sawmills, lighting outfits and transportation facilities. *Electrical Review*, U.S.A.

The A.S.E.—The Amalgamated Society of Engineers reports that at June, 1917, its general fund and superannuation reserve fund stood at £1,952,786, an increase of £210,999 for the quarter. £730,000 of the total is due to the superannuation reserve fund.

Educational Notice.—CITY OF LONDON COLLEGE, MOORFIELDS.—The new session for Business and Commercial courses commences on October 1st. Prospectuses can be obtained from the Secretary.

The Electrodeposition of Zinc.—"Borodising" is the name given by the Deptford Steel and Iron Works, Ltd., to a system of electrodeposition of zinc which they have introduced as a preventive against corrosion of the steel fittings of aeroplanes and seaplanes. It is described as a method of cold electrogalvanising carried out in such a way that the zinc so unites with the underlying metal that only by extreme wear can the surface of the steel be exposed. As the metal is not subjected to the usual pickling bath prior to the galvanising, it is claimed that there is no reduction in the strength of the metal after treatment. We understand that the process has been approved by the Air Department, the Admiralty, and the War Office, and that the company has installed a large plant to deal primarily with all steel fittings employed in the manufacture of aircraft.

Engineering Congress.—The *Globe* gives further particulars of the "First General Congress of Civil Engineering," which is to be held for the study and inauguration of "After-the-War Programmes." The first seven sections are styled "technical"; three other sections have now been constituted to deal with economics. The Congress will discuss methods of reorganising French industries on the most modern lines, and the various sections and sub-sections have already made substantial progress in preparing their agendas.

Legal.—At Nuneaton, Wm. Docking (18), miner, was charged with stealing 11s., the moneys of the Nuneaton Corporation. The town clerk stated that for some time past the electric lighting slot meters had been tampered with and money extracted. Prisoner had procured a key and gone about emptying slot meters. There were 18 cases altogether against him, but he only proposed to go into three, the amounts involved being £1 15s., for which defendant's solicitor had sent a cheque. Mr. Clay said prisoner's parents had offered to refund the whole of the money, £8 4s. Prisoner was sent to prison for three months.

LIABILITY FOR SAMPLES.—In the City of London Court, on September 18th, before his Honour Judge Rentoul, K.C., an action was brought by William Whitehouse & Co., Ltd., Empire Works, Brulton Street, Birmingham, electric light and gas fitting manufacturers, against Messrs. Lyall Willis & Co., electric light and gas fittings merchants, Billiter House, Billiter Street, E.C., to recover the sum of £34 19s. 9d., as damages for breach of contract, dated July 17th, in which the defendants agreed to return certain electric light and gas fittings at the expiration of the agreement. Mr. Goodman, plaintiffs' counsel, said alternatively the claim was for the return of the goods wrongfully detained, or £39 19s. 9d. their value. Defendant said he had done everything in his power to hasten the return of the samples from India. The non-return was largely due to restrictions and shipping conditions imposed by the Board of Trade. Judge Rentoul thought it was quite reasonable of plaintiffs to ask that they should be paid the value of the samples, and, of course, costs, and plaintiffs would return the money if the goods came to hand within a certain time—say, six months. Mr. Goodman said the plaintiffs were willing to agree to these terms, subject to the goods being returned before March 1st. Judge Rentoul said he would give judgment for the plaintiffs for the amount claimed, with costs, and they would refund the money if the defendant returned the goods before March.

CAFE TOWN.—The manager of the Southern Cross Cold Storage Co. was recently charged with abstracting 30 units of electrical energy from the installation in premises occupied by Chiat & Co. Mr. J. Power, installation superintendent for the City Corporation, deposed that two circuits, which supplied light to the premises occupied by the Southern Cross Co., had been connected to Chiat's meter without the authority of the Corporation. Charles Zion, manager for Chiat & Co., stated that no permission had been given to the Southern Cross Co. to make the connection. The Magistrate, however, came to the conclusion that the accused had not acted with any criminal intent, and discharged him.

A DUNDALK CONSUMER PROSECUTED.—The Dundalk magistrates sent for trial at Quarter Sessions, Dominica Mezza, prosecuted by the local Urban Council, for alleged fraudulent consumption of electricity. Mr. P. A. Spalding, the Council's electrical engineer, stated that one of the seals on Mezza's meter came off the sealing wire easily, and the other had disappeared. The jointer removed one of the wires, and when the lights were switched on every lamp in the place lit up, which showed that the current went direct to the lamps without going near the meter. He estimated the value of the electricity abstracted at £2 at least. The jointer, Frank Wilson, said he did not think it possible that a Council official could have diverted the current while regulating the meter.

Institution and Lecture Notes.—Electrical Association of Australia (N.S.W. Section).—At the monthly meeting held in Sydney, on June 8th, an illustrated lecture was delivered by Mr. Russell Sinclair, dealing with munition work and developments in England.—*Commonwealth Engineer.*

South Australian Institute of Engineers.—At the annual meeting, some notes were given by a member on the Bille-Creed automatic telegraph system.—*Commonwealth Engineer.*

Association of Supervising Electricians. The first meeting of the new session is to be held on Tuesday next, September 25th, at 7.15 p.m., at the St. Bride's Institute, E.C. The President, Mr. J. S. Highfield, will deliver his inaugural address. Other arrangements for the session are as follow (all meetings are on Tuesdays):—

October 30th.—"Switchboard Telephone Equipments," by Mr. T. F. Lee.
December 4th.—"Transformers" (author to be appointed by Westinghouse Co.).
January 15th, 1918.—Half-yearly meeting and informal discussions.
February 19th.—"Cable-laying," by Mr. E. S. Byng.
March 26th.—Paper by Mr. F. H. Taylor.
April 30th.—"A.C. Motors," by Mr. E. F. Butler.
June 25th.—Annual meeting.

S.A. Institution of Engineers.—At the adjourned annual general meeting of the Institution, on July 14th, Mr. Bernard Price, President, announced that Mr. G. M. Clark had been elected President for the 1917-18 session, and installed him in the chair.

Canal Transport.—The reorganisation of the English canals under the Canal Control Committee has now attained a stage at which the Committee is able to invite traders to send their goods by canal instead of by rail, in order to relieve the traffic on the railways.

Appointments Vacant.—Charge engineer for the Walsall Corporation Electric Supply Department; meter and mains assistant (50s.), for the Loughborough Corporation electricity department. For particulars see our advertisement pages to-day.

Old Lamp Tops.—A correspondent inquires as to the best method of recovering platinum from old electric lamp tops, and also how to test the metal and distinguish it from substitutes.

Wages Increase at Melbourne.—"Threatening to strike and thus paralyse city industries, and practically envelop the city in darkness if the demands were not acceded to, the employees of the Melbourne City Council undertaking have been granted increased wages. The rates agreed upon and those paid by the Melbourne Electric Supply Co. are as follows:—Engine drivers, 13s. 6d., increase 10d. (M.E.S. 13s.); assistant engine drivers, 12s. 6d., increase 10d. (M.E.S. 11s.); leading firemen, 12s. 6d., increase 4d. (M.E.S. 12s. 6d.); firemen, 11s. 6d., increase 10d. (M.E.S. 11s.); trimmers, 10s. 6d., increase 10d. (M.E.S. 10s.); coal conveyor attendants, 11s., increase 10d.; switchboard attendants, increase 1s. 4d.; sub-station attendants, 12s. 6d., increase 1s. 4d.; dynamo attendants, 10s. 6d., increase 10d."—*Commonwealth Engineer.*

British Ignition Apparatus Association.—The address of Mr. Ernest Garton, honorary secretary of this Association, is now 9, Northumberland Road, Leamington Spa, where all letters and communications in connection with the Association should be sent.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station Officials.—A commission in the Royal Engineers has been granted to Mr. HERBERT PURSEY, who held a position as an electrical engineer at Calcutta, and left India to volunteer for active service.

In a reply to criticisms at a meeting of the Dublin Corporation, Mr. MARK RUDDE, city electrical engineer, informed the Electricity Supply Committee that he was not a member of any Lodge—Masonic, Orange, Hibernian, or Sinn Fein—and denied that he had ever been threatened by any member of his staff.

Exeter City Council, at Tuesday's meeting, approved of the electrical engineer, Mr. MUNRO, acting as the local representative of the Coal Controller, subject to the work not interfering with the performance of his ordinary duties. The engineer's task will include visits to the principal local authorities in Devon and Cornwall, and is honorary. The Controller desires to promote the use of electricity, gas, and coke from local supplies in place of coal, wherever possible, and to facilitate the interconnection of electrical stations.

General.—It is stated in the newspaper Press that Sir A. STEEL-MAITLAND, the present Under-Secretary at the Colonial Office, has been offered, and has accepted, the position of Chief of the new Commercial Intelligence Service of the Foreign Office and the Board of Trade.

Communications for Mr. J. WILKINSON, tramway electrical engineer, Hull, should in future be addressed:—Tramway Power Station Buildings, Osborne Street, Hull.

Mr. JAMES LIVINGSTON, for the past five years assistant postmaster at Leeds, retires at the end of September, after 47 years' service. He commenced in Glasgow in 1870, being transferred to Leeds in 1906, as chief inspector of telegraphs, and five years ago became assistant postmaster. He entered the service about the time of the nationalisation of the telegraph, and took part in the work of co-ordination following on the change from the widely differing methods of the companies taken over. In Glasgow he was a lecturer in the electrical engineering department of the West of Scotland Technical College.

The *Daily Telegraph* states that Sir ARTHUR WHITELEGGE, K.C.B., who has held the appointment of His Majesty's Chief Inspector of Factories and Workshops at the Home Office for more than 21 years, will retire in the course of next month on reaching the age limit of 65, and the Home Secretary has appointed Mr. H. M. ROBINSON, the senior Deputy Chief Inspector, to succeed him. Sir Arthur will continue to give his services to the Factory Department in an advisory capacity on questions of a technical and scientific character. Mr. R. E. GRAVES, the junior Deputy Chief Inspector, will now become senior Deputy Chief Inspector, and Mr. GERALD BELLHOUSE, Superintending Inspector of Factories, has been appointed junior Deputy Chief Inspector.

It is stated that the Deputy-Controller for Auxiliary Shipbuilding, Admiralty, has appointed Lieut.-Colonel J. MITCHELL MONCRIEFF, R.E., M.Inst.C.E., to be Director of Engineering Work, to deal generally with all civil engineering matters which may arise in connection with his department.

Mr. G. M. CLARK, formerly of the engineering staff of the Victoria Falls Power Co., has, according to the *South African Mining Journal*, been elected President of the S.A. Institution of Engineers for the year 1917-18.

At the Midland Hotel, Manchester, on Thursday last week, the staff of Mr. L. E. Wilson, of Manchester, welcomed the

safe return of Mr. D. G. SUMNER, the chief engineer, after carrying out some important work for the firm in Persia. Those present, especially the telephone engineers, were interested in his account of the difficulties experienced in carrying out technical work in the Far East.

Roll of Honour.—We regret to record that Rifleman W. H. BECK, Rifle Brigade, was killed in action on July 31st, aged 34. Rifleman Beck was a member of the staff of the ELECTRICAL REVIEW Printing Department, which he entered as an apprentice 20 years ago. He will be remembered by his associates for his quiet and unassuming disposition, and will be greatly missed. We also regret to learn that Company Sergt.-Major H. CHILDE, an assistant in the Editorial Department of the ELECTRICAL REVIEW, has been wounded, and is in hospital in France. Both Rifleman Beck and Company Sergt.-Major Childe were members of the ELECTRICAL REVIEW Rifle Club.

The following employes of the County of London Electricity Supply Co. have been killed in action:—Private F. H. Bent, 3rd S. Wales Borderers; Private A. Goldsworth, 23rd County of London Regiment; Private L. W. King, 4/2 County of London Royal Fusiliers; Lance-Corporal E. A. Price, 1st Battalion Essex Regiment; Driver James E. W. Purcey, R.F.A.; Private G. White, R.A.M.C.; Gunner W. Whapshott, R.G.A.

Lieutenant LEWIS PEAKE, late sub-station attendant in the Poplar B.C. electricity department, has been killed in action. Lance-Corporal W. HENDERSON, K.O. Royal Lancaster Regiment, who has been wounded, was employed at the Bispham District Council electricity works.

Private H. DAVENPORT, Gordon Highlanders, who was employed at the British Westinghouse Works, Trafford Park, has been killed in action.

Private W. LOWE, S. Lancashire Regiment, reported killed in action, after being missing since October last, was employed by the St. Helens Cable & Rubber Co., Ltd.

Sergeant A. CLARKSON, R.F.C., aged 23, reported killed after a raid over the enemy's lines, was employed by Messrs. Calverley & Co., electrical engineers, Burnley.

Sapper W. WILLIAMSON, R.E., who has been dangerously wounded, aged 40, was employed by Mr. F. G. Waters, electrical engineer, Leeds.

Corporal C. CARPENTER, R.E., awarded the Military Medal for rescuing wounded under fire, was engaged at the Charlton works of Messrs. Siemens Bros.

Private M. O'CONNOR, Cheshire Regiment, reported killed, was employed by Messrs. Charles Macintosh & Co., Ltd., Manchester.

Private A. H. CAMPION, Essex Regiment, who has died of wounds, was in the electrical department of Messrs. S. Pearson & Sons, West Thurrock, Grays.

Private F. DIMMOCK, London Regiment, who was with the Telegraph Construction & Maintenance Co., of East Greenwich, has been killed in action.

Gunner C. HUGHES, R.F.A., who was with Henley's Telegraph Works Co., Ltd., North Woolwich, has been killed in action.

Wireless Operator A. C. TRUMAN, reported missing (aged 31) after the torpedoing of a merchant steamer, had been for 15 years with the Marconi Co.

Gunner W. D. DUNCOMBE, for some years at the Rugby works of the B.T.H. Co., has been killed in action.

Private TOM WHITHAM, of the Coldstream Guards, who has been awarded the Victoria Cross, was employed in the Burnley Corporation tramways department. In a letter to Mrs. Witham, Mr. H. Mozley, tramways manager, has sent his congratulations.

Private J. J. WALKER, Cameronians, killed in action, was an electrician engaged with a firm at Dornoch, Annan.

Private GEO. RAWSON, Royal Berks. Regiment, who has been killed in action, was with Messrs. Thompson, electrical engineers, Kettering.

Sapper J. E. WEST, W. Lane. Sign. Section, who has been awarded the Military Medal, was employed as a wineman at the United Electric Car Co.'s works, Preston.

The Military Cross has been awarded to Lieutenant N. F. HAWES, Machine Gun Corps, of the County of London Co.'s mains department, for bravery in action on the French front on June 21st, 1917.

Obituary.—Mr. J. E. TONGUE.—The death is reported of Mr. J. E. Tongue, Ash Mount, Rotherham, partner in the Rotherham Electrical Engineering Co., Ltd.

Mr. T. MITCHELL, SEN.—Mr. Thomas Mitchell, sen., passed away, in his 76th year, on September 16th at his residence near Bolton. Until a few years ago the deceased gentleman was senior partner in the firm of Messrs. Thomas Mitchell and Sons, engineers and merchants, Bolton. The business is being continued by his sons.

Will.—According to the *Times*, Mrs. ELIZABETH DACK DENNING, of South Norwood, widow of the late Ald. Denning, of Croydon, has left estate of the gross value of £169,719, the net personality being £78,581. The testatrix bequeathed to the Public Trustee all her freehold property in trust for a "Frank Denning Memorial" for the advancement and propagation of education in mechanical science in any part of the United Kingdom, with preference to those persons who reside in the Borough of Croydon.

NEW COMPANIES REGISTERED.

British Automobile Equipment Co., Ltd. (148,441).—

Private company. Registered September 11th by Elvey, Robb & Welch, 19, Bedford Row, W.C. Capital, £100,000 in £1 shares (50,000 7 per cent. cum. pref.). Objects: (1) To acquire certain patents and rights (a) from Accurate Magnetics, Ltd., and H. D. Grant, and (b) from H. D. Grant, (2) to acquire from F. Lamplough the business of an aviation, motor, and general engineer carried on at 106 Highfield Works, Feltham, Middlesex, as Lamplough & Co., and certain freehold lands, plant, buildings, &c., (3) to enter into an agreement appointing G. F. Cooke electrical engineer. The subscribers (each with one pref. share) are: J. J. Sneddon, Finsbury Pavement House, E.C., chartered secretary; S. Fortescue, Finsbury Pavement House, E.C., company director; B. Hedley, 7, Great Elms Road, Bromley, Kent, clerk; A. T. Pendey, 11, Heathland Road, Stoke Newington, N., company director; A. W. Comer, 5, Cawley Road, E.9, accountant; J. E. Cater, 45, Arabin Road, Brockley, S.E., clerk; F. W. Ramsey, 32, Westbury Road, Barking, Essex, clerk. Minimum cash subscription, £7. Registered office: Finsbury Pavement House, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Lancashire Electrical Engineering Co., Ltd.—Debenture dated August 22nd, 1917, to secure £200, charged on freehold works at Ashton-under-Lyne, and the company's general assets. Holder: A. Seymour, Ashton-under-Lyne.

Clevedon, Portishead & District Electric Supply Co.—Particulars of £5,000 debentures created August 14th, 1917, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

British Westinghouse Electric & Manufacturing Co., Ltd.—Particulars of £500,000 second mortgage debentures created May 7th, and secured by trust deed dated August 22nd, 1917, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908. None of the debentures are issued at present. Property charged: Certain lands and buildings at Stratford, Lancs., and the company's undertaking and property, present and future, including uncalled capital. Trustees: Trustees Corporation, Ltd.

Wright & Wood, Ltd.—Mortgage dated August 29th, 1917, to secure £520 16s., charged on land at Halifax. Holders: Halifax Permanent Benefit Building Society.

Foster Construction Co., Ltd.—Charge on proceeds of Government contract for steel work (total amount £4,320), dated August 18th, 1917, to secure all moneys due or to become due from company to London and South-Western Bank.

Electric Construction Co., Ltd. (39,292).—Capital, £400,000 in 300,000 ord. and 100,000 pref. shares of £1 each. Return dated June 14th, 1917. 224,200 ord. and 62,780 pref. shares taken up; £40,690 paid on 4,200 ord. and 36,490 pref.; £246,290 considered as paid on 220,000 ord. and 26,290 pref. Mortgages and charges: £165,000.

Electric & General Investment Co., Ltd. (31,506).—Capital, £201,500 in 19,900 pref. and 20,000 ord. shares of £5 each, and 40,000 def. shares of 1s. each. Return dated July 17th, 1917. All shares taken up. £5 per share called up on the pref., £1 per share on the ord., and 1s. per share on the def.; £121,500 paid. Mortgages and charges: £26,681.

Evershed & Vignoles, Ltd. (43,206).—Capital, £30,000 in £10 shares. Return dated July 6th, 1917. All shares taken up. £30,000 paid. Mortgages and charges: £15,000.

D.P. Battery Co., Ltd. (44,084).—Capital, £10,000 in 4,996 "A," 4,996 "B," and eight other shares of £1 each. Return dated July 26th, 1917. 10,000 shares taken up; £10,000 paid. Mortgages and charges: £18,000.

Electrical Engineering & Equipment Co., Ltd. (115,089).—Capital, £10,000 in £1 shares. Return dated July 20th, 1917. 4,002 shares taken up; £4,002 paid. Mortgages and charges: Nil.

CITY NOTES.

County of Dorset Electric Supply Co., Ltd.

At the annual meeting, held in July, Dr. J. A. HOSKER, who presided, said that there had been during the year a setback in the development of the undertaking. The gross profit at £937 showed a decrease of £334, and after allowing for interest on loan and hire-purchase agreement there was a net deficit of £72. Cost of fuel and all materials had enormously advanced, and the use of lighting current was restricted. It was impossible to obtain materials for extensions, so that additional customers could only be connected to the mains already laid. Thirty new consumers had been added, bringing the lamps connected up from 15,448 to 20,426. The units sold were 207,252, against 193,458. The Swanage and Lyme Regis companies showed a profit on working, and Blandford a small loss. When times became normal again the rate of progress would become considerably accelerated. The estimated receipts for the first six months of this year were £1,871, against £1,664 in the corresponding period of last year. Lieut.-Col. W. H. Baxter, a director, had been killed on active service, and three other directors were engaged on military duties, and upwards of a third of the staff were with the Colours.

Globe Telegraph & Trust Co., Ltd.—Interim dividend of 2s. per share on ordinary shares, free of tax, for the past quarter.

Direct Spanish Telegraph Co., Ltd.—In addition to the dividend at the rate of 10 per cent. per annum on the preference shares, an interim dividend at the rate of 4 per cent. per annum, free of income-tax, on the ordinary shares is announced, both for the half-year ended June 30th.

British Insulated & Helsby Cables, Ltd.—Interim dividend of 7½ per cent. (7s. 6d. per share), less income-tax, on ordinary shares, as compared with 5 per cent. for the corresponding period of last year.

Manila Electric Railroad & Lighting Corporation.—Dividend of 1½ per cent. for the quarter ending September 30th on the common capital stock.

British Aluminium Co., Ltd.—Dividends at the rate of 8 per cent. per annum on the ordinary and 6 per cent. on the preference shares, both less income-tax, for the half-year ended June.

Eastern Telegraph Co., Ltd.—Dividend at the rate of 3½ per cent. per annum, less tax, on the preference shares for the quarter ended September 30th; second quarterly dividend of 1½ per cent. on the ordinary, free of tax.

Eastern Extension, Australasia & China Telegraph Co., Ltd.—Second quarterly dividend 3s. per share, free of tax.

STOCKS AND SHARES.

TUESDAY EVENING.

Stock Exchange markets have recovered their balance, thanks to the better news from Russia. Moreover, the Swedish incident has ceased to be any pronounced factor for the time being. All stocks and shares connected with Russia have improved sensibly, and this has had a decided effect upon the investment departments more particularly.

Money continues to pour into the Stock Exchange from the provinces. Possibly there is less speculation for the time being amongst industrial shares; but the rubber market furnishes conclusive evidence of the way in which buyers in the North and the West of England are ready to look at anything which promises a reasonable hope of a rise in price.

The Home Railway market continues to be one of the few glum parts of the House. There is a slightly better tone about the stocks, and the latest settlement of the Labour dispute in Scotland was declared to have a steadying effect upon prices. All the same, people decline to look at stocks in this section; and the Undergrounds have once more relapsed into their customary condition of quietude. Underground incomes remain at 8½ ex dividend.

About half-a-dozen of the leading shares in the home electricity list are quoted ex dividend, amongst them being the ordinary and preference of the City of London and the County of London companies. There is not much change in the quotations, allowing for these markings, but Bromptons at 6½ are 5s. up, and Westminster have again advanced, this time to 6½. There is a noticeable demand for all the shares in the group; and the reversion once more to Greenwich time has quickened, as we were pointing out last week, the interest taken in illumination companies.

The manufacturing market is decidedly good. Callenders have risen to 14½, General Electric ordinary to 17, and India-Rubber shares to 13½. So far as the last-named are concerned, there are buyers about at the price, but holders are retaining their shares, and seem perfectly content to keep them, notwithstanding the sustained rise which has occurred during the past two or three months. Business continues active in the various Edison Swan shares, though there has been something of a reaction from the best, due to profit-taking. Moreover, in the absence of more detailed information, the tendency is to go a little slowly. The 7 per cent. preference shares are changing hands on the basis of 1 1/16, and those 10s. paid at 11s. 3d.

The Mexican group is again dull. Mexico Trams and Mexican Light & Power issues are both rather lower, with the exception of the 6 per cent. bonds of the former company, which have risen to 40. Brazil Tractions went back to 46, most issues connected with the Republic having eased off because of the continued dullness in the rate of exchange. The 1½ per cent. debenture stock of the British Columbia Electric Railway is quoted ex dividend, and at the present price of 52 the yield once more looks tempting.

Globe Telegraph & Trust shares of both classes are better, the ordinary rising to 13 and the preference to 10½, these showing rises of 5s. and 2s. 6d. respectively. The attraction in the ordinary shares is, of course, the fact that the dividends are still paid free of tax. The Eastern group is steady,

and Anglo-American preferred at 98½ shows a rise of the fraction. Marconis at their nominal price of 3½ are not quite so good as they look, there being sellers about in the market at this figure. Oriental Telephones eased off to 3½, and United River Plates to 6½, which is not very surprising considering the way in which the prices of both have been rising of late. West India and Panama also are a little easier at 28s. 9d.

The Direct Spanish Telegraph Co. has declared its usual interim dividend at the rate of 4 per cent., free of income-tax, on the ordinary shares, and the price keeps very firm at 5½; while the 10 per cent. cumulative preference changed hands about a month ago at 7½. Business has been done this week in Direct United States Cable shares at 6½; and the demand for these stocks has reached the prior-charge issues, Eastern 3½ per cent. preference being done lately at 61, and the 4 per cent. mortgage debenture stock at 72. These prices, it may be added, compare with 77½ and 96½ respectively at the outbreak of war, when, it may be superfluous to recall, the value of money was very different from what it is to-day. Western 4 per cent. debenture stock stands at 73, and Eastern Extension 4 per cent. debenture stock at the same price.

The activity in the rubber market has already been mentioned, and prices are forced up by the persistence of the buying from the provinces. The armament group, too, is good, with Armstrongs up to all but 40s. There is more doing in the tin section, and the big rise which has taken place in the price of silver is having its due effect upon the shares in companies connected with the metal.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.					
	Dividend		Price Sept. 18, 1917.	Rise or fall this week.	Yield p.o.
	1916.	1916.			
Brompton Ordinary	10	9	6½	+ ½	26 18 6
Charing Cross Ordinary ..	6	5	84	—	6 9 0
do. do. do. 4½ Pref..	4½	4½	88	—	6 13 4
Chelsea	4	3	23½d	—	6 9 1
City of London	8	8	124½d	—	6 4 8
do. do. 6 per cent. Pref.	6	6	104½d	—	5 18 5
County of London	7	7	114½d	—	6 5 10
do. do. 6 per cent. Pref.	6	6	104½d	—	6 0 0
Kensington Ordinary	7	6	62	—	6 14 3
London Electric	8	8	1	—	NIL
do. do. 6 per cent. Pref.	6	4	82	—	5 6 8
Metropolitan	8	8	8	—	5 0 0
do. do. 4½ per cent. Pref.	4½	4½	88	—	7 4 0
St. James' and Pall Mall ..	8	8	7	—	5 14 6
South London	5	5	23	—	7 5 6
South Metropolitan Pref. ..	7	7	21½	—	8 10 3
Westminster Ordinary	7	7	68	+ ½	6 5 8
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	98½	+ ½	6 1 10
do. Def.	8½	1½	28	—	6 10 5
Chile Telephone	8	8	7½	—	6 11 4
Cuba Sub. Ord.	6	5	8½	—	6 14 3
Eastern Extension	8	8	142	—	5 8 4
Eastern Tel. Ord.	8	8	148½	—	5 7 9
Globe Tel. and T. Ord.	7	7	19	+ ½	5 7 8
do. Pref.	6	6	104	+ ½	5 14 3
Great Northern Tel.	22	24	87	+ 1	6 9 9
Indo-European	18	13	54½	—	5 19 8
Marconi	10	15	3½	—	4 15 10
Oriental Telephone Ord. ..	10	10	9½	—	3 4 0
United R. Plate Tel.	8	8	62	—	5 16 4
West India and Pan.	8d.	6d.	1½	—	8 9 5
Western Telegraph	8	8	142	—	5 10 4
HOME RAILS.					
Central London, Ord. Assented	4	4	58½	—	6 16 9
Metropolitan	1	1	284	—	4 5 1
do. District	NIL	NIL	16½	—	NIL
Underground Electric Ordinary	NIL	NIL	12	—	NIL
do. do. "A"	NIL	NIL	6½	—	NIL
do. do. Income	6	4	82½	—	4 17 0
FOREIGN TRAMS, &c.					
	Dividend				
	1915.	1916.			
Adelaide Sup. 6 per cent. Pref.	6	8	47	—	6 8 1
Anglo-Arg. Trams, First Pref.	5½	5½	28½	—	8 19 6
do. 2nd Pref.	5½	—	24	—	—
do. 5 Deb.	5	6	67½	—	7 8 3
Brazil Tractions	4	4	46	—1	—
Bombay Electric Pref.	6	6	98	—	6 4 8
British Columbia Elec. Ry. Pfc.	5	5	42½	—	11 15 4
do. do. Preferred	NIL	NIL	81	—	NIL
do. do. Deferred	NIL	NIL	29	—	NIL
do. do. Deb.	4½	4½	62½d	—	8 3 6
Mexico Trams 5 per cent. Bonds	NIL	NIL	46½	—1	NIL
do. 6 per cent. Bonds	NIL	NIL	40	+ 1½	NIL
Mexican Light Common	NIL	NIL	22½	—	NIL
do. Pref.	NIL	NIL	91	—	NIL
do. 1st Bonds	NIL	NIL	46½	—2	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	34	—	4 15 10
British Aluminium Ord. ..	7	10	14½	—	5 16 8
British Insulated Ord.	17½	20	14	—	7 2 10
British Westinghouse Pref.	7½	7½	22	—	5 9 1
Callenders	20	20	114	+ ½	6 18 0
do. 5 Pref.	5	6	44	—	6 1 8
Castner-Kellner	22	22	8½	—	6 8 0
Edison Swan, fully paid ..	—	—	1	—	NIL
do. do. 4 per cent. Deb. ..	4	4	72½	—	5 10 4
Electric Construction	7½	7½	4½	—	8 0 0
Gen. Elec. Pref.	6	5	104	—	5 17 1
do. Ord.	10	10	17	+ ½	5 17 8
Henley	25	25	16	—	7 16 8
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	132	—	7 5 6
Telegraph Con.	20	20	88½	—	6 5 2

* Dividends paid free of income-tax.

ELECTRODES FOR ELECTRIC FURNACES: THEIR MANUFACTURE, PROPERTIES, AND UTILISATION.

(Continued from page 246.)

Life of Electrodes; Consumption and Protection.—The rate of consumption of electrodes is very variable, depending as it does on the quality of carbons, type of furnace, method of protecting electrodes, and on the manufacturing process concerned. Consumption is due principally to:—(1) Dissociation by the current; the working voltage may be either too high or too low; (2) chemical combination of the electrode with oxygen from oxides in the charge treated, oxidising slags are particularly injurious; (3) solution of carbon in the metal, to form carbides, silico-carbides, &c.; (4) direct oxidation by atmospheric oxygen; this action may be very rapid, owing to the high working temperature. Fig. 7 shows two

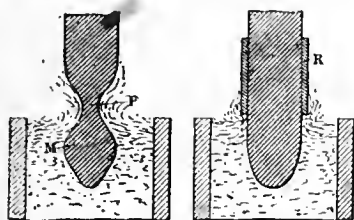


FIG. 7.—UNPROTECTED AND PROTECTED ELECTRODES.

electrodes, one unprotected and one protected by an incombustible insulating sleeve R. That part M of the electrode which is plunged into the charge is protected against oxidation by the oxides of carbon liberated in the furnace. The exposed portion P, on the other hand, is intensely hot and subject to rapid oxidation by the air. A "neck" is formed in the electrode, and the increased electrical resistance at this section causes intense local heating and still more rapid reduction of section, until finally M breaks away—wasting material and possibly spoiling the charge.

One must not burn electrodes too close to the terminal clamps for fear of injuring the latter; but the loss in rejected stumps is a serious item. New electrodes may cost £16 per ton, and stumps may be worth 32s. per ton as raw material for fresh electrodes. The scrap value is thus only 10 per cent. of the value new, and a 5-ft. electrode may have to be rejected when the stump is 2½ ft. long—i.e., there is a waste of nearly 50 per cent. It is now usual to reduce the actual loss by utilising stumps in one way or another. The stumps themselves may be tapped and threaded so as to be screwed together, this process being particularly applicable to



FIG. 8.



FIG. 9.

cylindrical graphite electrodes. Alternatively a copper screw may be used (fig. 8), or a number of pieces may be held together, as in fig. 9, by metal rods *m*; the junction between the pieces is then one of simple contact. In any case, however, trimming the irregular ends of stumps involves more or less waste.

The most effective protection for electrodes consists of a sheath of incombustible material. Mixtures which have been proposed for this purpose are:—Retort coke and sodium silicate; lime and limestone with carbon; and potassium or sodium silicate with chalk. These mixtures applied cold form a covering which is a good resistant to heat. Other protective coatings used are asbestos wool with silicates; milk of white clay; and silundum. The last is an amorphous compound resembling carborundum; it is refractory, incombustible, and (being a compound of carbon and silicon) it is useful for protecting electrodes in ferro-silicon furnaces. An iron netting may be used to support a paste of sodium silicate and clay or of kaolin and asbestos. Sometimes granular material unaffected by oxidising gases is embedded in the surface of the electrode; quartz, alumina, or carborundum may be used according to the nature of the products made in the furnace. Rigid envelopes of asbestos board or sheet-iron have also their uses, though care is required to prevent air circulating between electrode and sheath, which then forms a draught chimney and intensifies the damage.

In this connection, M. Ch. Louis recommends that the electrode be protected by an agglomerate of magnesia or dolomite, 3 to 5 cm. in thickness, inside a jacket of 1-mm. sheet iron. The agglomerate is heated for mixing, and contains 6 to 7 per cent. of pitch and 5 to 8 per cent. of tar. Adherence on the electrode is increased by chipping its surface and painting it with tar. The sheath being held in place by an external mould, the agglomerate is packed tightly between it and the electrode. The mould is then withdrawn and a joint is made at the top, between sheath and electrode, by a paste of silicate or refractory earth. It is not essential to re-bake an electrode thus protected.

The Gin process is to embed the electrodes in a carbon agglomerate. With this end in view, the electrodes are formed of

several cores (say, eight or ten), and the agglomerate is a mixture of coke or ground electrode stumps with pitch or tar. The agglomerate forms simply a mechanical bond between the electrodes; it is not traversed by any considerable fraction of the current, and is, therefore, at a much lower temperature than the cores, and is less exposed to oxidation. Its protective action endures beyond the point in the furnace at which iron sheathing would be melted away.

Important though it is to reduce wasteful consumption of electrodes, it is evident that a protective coating of any sort carries its impurities into the manufactured product, and for this reason it is sometimes better to do without the coating and simply modify the shape of the electrodes. In several aluminium works, for instance, very short electrodes are used in the shape of truncated pyramids with the larger end above. The use of short electrodes is undoubtedly the best policy when protection against oxidation cannot be obtained effectively and acceptably.

The rate of electrode consumption referred to unit weight of product manufactured varies widely with the product concerned, and with the type of furnace employed. For instance, in the manufacture of 25 per cent. ferro-silicon, the electrode consumption is about 3 mm. per hour, increasing to 4 mm. per hour when a 58 per cent. silicon alloy is made. Manganese-silicon alloys involve a mean consumption of 3 mm., and calcium carbide of 2 mm. per hour. All these figures refer to covered furnaces charged continuously, in which consumption is always a minimum.

In aluminium manufacture the electrode acts not only as current conductor, but also as comburent, and its consumption is generally proportional to the quantity of metal produced—say, 700 gm. per kg. (1,560 lb. per ton) of metal produced.

In steel furnaces of direct-production type, with electrodes about 2 metres long, consumption varies with the process. The following table shows the net weight of electrodes burned effectively* in various works:—

Furnace.	Electrode consumption per ton of steel.		Remarks.
	Kg.	Lb.	
Stassano, Turin ...	7 to 10	15½ to 22	charged cold
Girod, Uguine ...	11·4	25	—
Chapelet, Allevard ...	11·3	24·8	—
Heroult, Le Praz ...	17·5	38·5	—
Lindenburg, Remscheid	2·68	5·9	fluid charge.

Allowing for stumps capable of utilisation and starting directly from ore, the average net consumption of electrodes is now 4 to 5 kg. (8½ to 11 lb.) per ton of steel. In some cases, electrodes have lasted for 1,200 working hours, corresponding to more than six weeks of continuous operation.

Electrode Carriers and Terminals; Cooling Arrangements.—The manner in which electrodes are supported, whilst being left free for up and down adjustment at will, and the manner in which connection is made to the electric supply mains, play an important part in the maintenance and durability of electrodes. Bad fitting

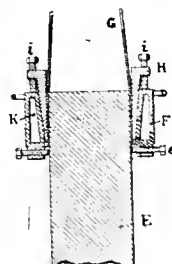


FIG. 10.

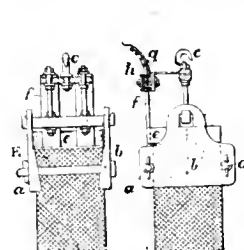


FIG. 11.

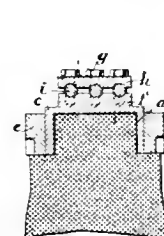


FIG. 12.

may cause the electrode to become red hot at places, and this in turn leads to breakage or excessive combustion; the damage is cumulative, because the resistance of carbon decreases with increasing temperature, hence current passes by preference through the overheated parts, aggravating their state and exposing them to yet more rapid depreciation.

Defective connections involve serious expense. In one works the maintenance cost for electrode connections alone used to amount to 6s. 6d. per ton of metal produced; subsequently this figure was reduced to 1s. 7d. per ton by various improvements. A saving of £950 per annum was thus effected in this single expense, on an annual production of 4,000 tons.

There are several methods available for the attachment of carriers to electrodes, but the two types at present in use are clamp connections and central connections. Examples of these types are illustrated in figs. 10-14 and figs. 15-18 respectively.

Clamp Connections.—The head clamp shown in fig. 10 consists of a hollow annular piece F, the cavity K in which serves for the circulation of cooling water under pressure. The copper pieces G serve at once for the suspension of the electrode, and for its connection to the supply cables; they are held against the electrode by bronze or cast-iron wedges H, the latter being drawn tight by bolts *i*. The ring R is held in place by set screws *e*, and flexible metal tubing is used to carry water to and from the jacket.

The dovetail clamp illustrated in fig. 11 is used in certain carbide furnaces, the head E of the electrode being dovetailed to fit the cast-iron clamps *b*, which are held by cotter bolts *a*. An iron framework engages with the side pieces *b*, and is provided with an

* That is to say, allowing for stumps capable of being utilised either by fixing them to new electrodes, or by using them in alloy furnaces for producing ferro-silicon, &c.

electrically-insulated suspending hook *c*. Copper plates *e* and *f* are clamped at *h* to the supply cable *g*, and the weight of the electrode ensures firm contact.

Fig. 12 shows an electrode cut back to accommodate a copper cap *c*; good contact is secured by filling with liquid aluminium *d*, or with some other metal of comparatively high melting point. The cap *c* is clamped by an iron shrink-ring *e*, which just slides into place at red heat, and is applied whilst the joint metal *d* is still liquid. The contraction which occurs as the joint cools, ensures excellent contact between the cap, the joint-metal and the electrode. Supply leads *i* are held in machined grooves on the head *f* of the cap by a cover plate *h* and studs *g*. This arrangement gives very good results in service.

Cooling may be secured in all these cases by a water basin near the connection or by a trough of water *m* (fig. 13) surrounding the

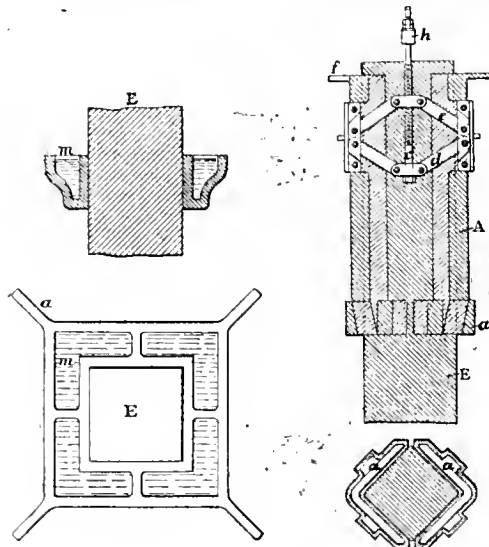


FIG. 13.

FIG. 14.

electrode E, and provided, if necessary, with radiating ribs or wings *a*.

The lateral connection shown in elevation and section in fig. 14 was devised by Louis for use in certain steel-smelting furnaces. The electrode is clamped between two hollow jaws of V-shape by a pincer mechanism. The clamps are carried from a horizontal beam *h* by two rods *c*, screwed for part of their length and connected to the jaws by jointed rods *e d*. The jaws are opened or closed by turning *c* in the appropriate direction. When closed, the toggle mechanism exerts a very powerful grip on the electrode. It is convenient and economical to feed the electrode through the clamps (which are slackened temporarily for the purpose), as it is consumed. A connector of this type can be used efficiently for electrodes of slightly different sizes. The supply cables or strips are attached to the pieces *f*, and a padding of copper gauze between jaws and electrode ensures intimate contact even though the corners of the carbon are not quite square. Water is circulated under pressure through the jaws for cooling purposes.

Central Attachment.—Several means for effecting central connections to the ends of electrodes are illustrated in figs. 15–18. In fig. 15 the rod *A* has a screwed portion *m*, which engages

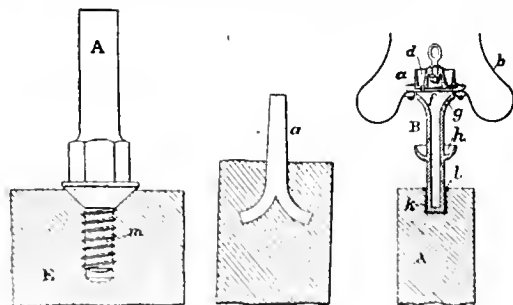


FIG. 15.

FIG. 16.

FIG. 17.

directly in the electrode. Several electrodes (generally four) may be grouped on a single supply cable and supported and adjusted by a rack, with hand or motor-driven gear.

Central axial connection is particularly convenient in certain classes of manufacture and in aluminium works; for instance, the electrodes are often carried by a simple piece of iron—*a*, fig. 16—split and bent to hook shape and embedded in the electrode, before or after baking.

The bronze connector shown in fig. 17 is made hollow for water cooling. Fresh water is supplied at *d* in the basin *a*, and runs into the hollow stem *f*. Overflow runs into the annular reservoir *h*, whence it evaporates; no water reaches the joint between connector and electrode. The recess in the latter for the reception of the connector is larger at the bottom than at the top, and is made with such clearance that molten bronze *k* can be poured in, to

effect connection between B and A, both of which are heated before casting the joint. The bronze used for the joint should be an alloy with fairly low melting point and small contraction. An ingenious means is used to remedy any imperfection in contact due to contraction of the bronze; this consists in running molten tin round the joint at *l*, after cooling. Should the joint become hot in service, owing to imperfect initial contact, the tin melts, flows into the interstices, and effects thoroughly satisfactory contact. The whole of the joint metal may be retrieved when changing electrodes.

In small furnaces the electrodes may be supported and connected to the supply cable by a simple brass eye-bolt, such as that shown in fig. 18.

Hand or Motor Control.—The simplest method of adjusting the position of electrodes is to bring the suspending chain or cable to a winch which may be operated manually or by a hand-controlled motor. This control necessitates more or less continuous attention and loss of time both in control and in furnace operation. For this reason, automatic control is to be preferred. A Thury type D.C. or A.C. regulator may be used to control a starting and reversing switch, and thus start in one direction or the other, a servo-motor geared to the electrode mechanism (fig. 19).

The supply cables may be bolted or welded to the electrode terminals, but flexible conductors must be used in either case. In order to eliminate any appreciable restraint on the movement of

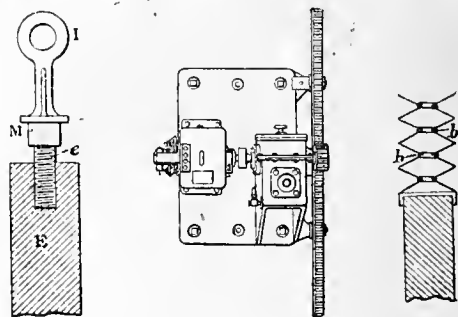


FIG. 18.

FIG. 19.

FIG. 20.

the electrodes and to reduce the risk of melting the flexible connections, Keller uses strips of thin, flexible copper attached to two symmetrical supports and bent to zig-zag form. Rings *b*, *b* (fig. 20) prevent the strips from sagging into the flames or causing short circuits.

Where several electrodes are used simultaneously in a single furnace, it must be possible to manipulate the electrodes separately or simultaneously. A variety of mechanisms and controls is available for this purpose.

(To be concluded.)

THE MUNICIPAL TRAMWAYS ASSOCIATION (INCORPORATED).—I.

ANNUAL CONFERENCE.

YESTERDAY the annual conference of the Association was opened at Blackpool, the reading of the Presidential Address by Mr. HENRY MOZLEY (general manager, Corporation Tramways, Burnley) being the first item on the agenda.

After referring to the circumstances which had compelled the suspension of new construction for the time being, Mr. Mozley said that ever since his introduction to municipal life he had felt it an absurdity to repay the whole capital, within very limited periods, of an industry like that of the tramways, which was ever growing in value. Why should the first generation of inhabitants make a present to the second generation of property bringing in thousands a year, when this could only be done by burdening themselves with heavy charges annually, instead of taking a legitimate toll or dividend for the moneys expended? He suggested that the policy of municipal authorities providing sinking funds for everything alike, whether for a pure business undertaking such as a tramway, or for works necessary for the conveniences of life, such as streets, sewerage, parks, &c., was wrong; although it might be law, it was the business of this Association to get the law altered. Certain undertakings had felt the inconvenience of the sinking fund especially during the war, but there did not appear to be any prospect of temporarily obtaining powers to suspend the charge, with the consequence that the rates had become liable, and this naturally led to the consideration of fares and their effect on the financial position. Unlike the railway companies, municipal authorities after securing certain statutory fares began to give very much cheaper fares, both for workpeople and ordinary passengers, and in some cases this policy was being continued with disastrous consequences to the financial stability of the undertaking. The Association should exert its influence to help such undertakings to remedy such errors, and secure more uniformity in charges. It was the common experience of all to have flung at them such remarks as

"such and such a tramway gives three miles for a penny, why can't you?" Probably it would be useless to tell the person that the cost of carrying a passenger three miles was considerably in excess of one penny, and that the loss was made up from the shorter journey passenger. It would be better, before taking any steps to secure legislation, for the undertakings concerned to put into operation the power they already possessed of increasing fares, and by open discussion at their meetings healthier and more reasonable views might be created.

In recent years the tramway industry had benefited by standardisation of material used in common, but local standardisation was also desirable; for convenient and economical working all cars should be alike in design and dimension on separate undertakings, and in the case of those having connections with neighbouring tramways and light railways, not only would more economical working be secured, but interchange of rolling stock would be facilitated, and neighbouring tramways might thus assist each other in ordinary development and emergencies. If the Association could do anything to ascertain the best type and most economical car to use, it would confer a great benefit on the industry in the way of cheaper working and convenience in operation. As time went on, and intercommunication was developed, this question would become very important.

From time to time they heard of difficulties and inconveniences arising owing to the long period which had elapsed since the Tramway Act of 1870 became law, and he suggested that it should be made the business of the Association, in combination with the Association representing company undertakings, to take up the revision of the conditions brought about by that Act, and secure more liberty in carrying on the tramway business. There should be one tramway authority in combined areas to control all traffic problems and developments, with representative boards. Every one must be conscious of the incomplete effect of a number of small undertakings operating in what was practically the same district, whereas, if combined, the result would not only be more economical working, but a greatly increased convenience to the public. In these days of manufacturing syndicates what an advantage it would be if combined tramway undertakings could buy their material in bulk. Why should there be any restriction as regards manufacturing for one's own requirements—either cars, working parts, or other material in daily use? The power to do this should be secured by law.

In common with the rest of the business community, it behoved them to prepare for the great changes which were bound to come after the war. Amongst other subjects the questions suggested by the Whitley Report, issued by the Reconstruction Committee, should receive the immediate attention of the Association. Here, at least, they were in a position to carry out without delay one of the principal recommendations, viz.: "The establishment for each industry of an organisation representative of employers and workpeople, to have as its object the regular consideration of matters affecting the progress and well-being of the trade from the point of view of all those engaged in it."

Their organisation being national, and areas being provided in most cases with local associations, they had only one step forward to take, that was to invite representatives of the workpeople to share their conferences and responsibilities. There must be some better way of arriving at agreements for working conditions, wages, &c., than the present inequitable and slow one. Agreements amongst themselves were better than the impositions of an outside and unsympathetic authority.

Tramway Finance.

Some notes on this subject were contributed by Messrs. J. BARNARD (Bolton), G. W. HOLFORD (Salford), and P. PRIESTLY (Oldham). The authors dealt with the main features of the income and expenditure sides of tramway undertakings.

INCOME.

Fares.—The usual rate stipulated in the Acts of Parliament was 1d. a mile, and in some cases this rate was in operation. How, then, could the revenue be increased? By lowering the rates more riders might be attracted, but this could only be done by reducing the penny stage to a half-penny one—a course to which the authors were most strongly opposed—or by lengthening the stages. In either case a considerable increase in the number of passengers carried had to take place before the previous revenue was obtainable, and local conditions must decide whether a sufficient increase would take place to ensure a larger revenue. The only alternative was to increase the rate chargeable per mile, which required the sanction of Parliament; this question was receiving the attention of the Executive Councils of the Association and the Tramways and Light Railways Association. Many undertakings which had been charging less than the statutory limit had increased their fares, with satisfactory results.

Workmen's fares were subject to a maximum of ½d. per mile, and undertakings which charged that rate could not increase the revenue from this source without statutory authority. Little benefit resulted from the introduction of return fares at a cheaper rate, as in most cases the passenger would return by car, even if he had to pay the single fare

for each journey. Even where a profit was shown on the whole, it might be found that the early morning passengers were being carried at a loss, and the passengers paying the usual fares were contributing to make up this loss.

In some instances children's fares were on too liberal a scale. Many concessions had been granted to various sections of the community, and the authors held that they should be withdrawn.

Parcels.—Additional revenue might be obtainable from this source with careful management, and under favourable conditions, but as the use of cars, &c., was not usually charged up against the parcels service, it was questionable whether the system was actually profitable, even where a credit balance was shown. Moreover, the parcels service might have a detrimental effect upon the passenger service.

Advertising.—In the authors' experience the value of a tramcar as an advertising medium was on the down grade, and they did not recommend the practice.

Investments.—The tramway fund should be credited with all the interest accruing from its investments, which in some cases was credited to the general fund account of the Corporation.

EXPENDITURE.

Power.—This was a very important item as regarded both the energy consumed per car-mile and the cost per unit. The consumption varied widely, owing to local conditions, and the price charged to the tramway department was in many cases unfair as compared with the terms offered to manufacturers. The authors held that as soon as the price of coal began to cheapen the price of electrical energy should be reduced in many undertakings, and that a sliding scale with regard to the price of coal should be provided for. Much energy could be saved by careful driving, and systematic inspection of the electrical equipment of the cars; directly things became more normal a thorough overhaul of all electrical and mechanical working parts of the car equipments should be carried out. Car meters, with careful examination of the records, were strongly recommended.

Traffic Expenses.—Some system of standardisation of wages, with a properly constituted authority to settle differences and disputes, was desirable. Labour and materials should be carefully economised, but not by the adoption of inferior quality.

Insurances.—The authors were of opinion that it would be found more economical and satisfactory for each undertaking to carry its own risks.

Repairs and Maintenance.—Here again the utmost economy was necessary, but provision should be made to repair the permanent way in the near future.

The authors concluded with a declaration that municipal tramway undertakings should at all times be regarded as commercial enterprises, and that provision should invariably be made for depreciation and renewals on a sound financial basis before contributions were demanded for the relief of rates or any other purpose.

Differentiation in Fares.

In his paper on this subject, Mr. W. MURRAY (tramway manager, Walthamstow U.D.C.) also dealt with the question of workmen's fares. He pointed out that tramways—at least, in London—were meeting with keen competition in respect of speed and fares, coupled with enormously increased expenses. Differentiation in fares in favour of bona-fide workmen was compulsory, although it meant running at a loss, and such services were kept down to the minimum by the companies which first took up tramway work as a business enterprise. Municipalities, however, had increased them and reduced the fares, so that in London there was a continuous stream of workmen's cars between 3.30 and 8 a.m., special cars between noon and 2 p.m., and again between 5 and 7 p.m., to cope with this traffic, and a rate of 10 miles for 2d. (in one case 19 miles for 2d.) seemed to be about the average. Temperate comment on this state of affairs was difficult. Moreover, many tramway systems allowed all passengers boarding cars before 8 a.m. to purchase return tickets at workmen's rates, which involved a loss to the undertakings. Other concessions had been granted, to school children, blind people, &c., and he submitted that the whole system of differential fares and free travelling was utterly wrong, the only true basis for the fixing of tramway fares being the cost of providing the service rendered, all who availed themselves of that service being required to pay on a uniform scale. There was no justification for carrying a highly-paid mechanic for less than a clerk or shop girl, nor should tramway employes be allowed to travel free. Travelling facilities cost money, like any article of commerce, and to overcharge some sections of the community in order to make good a loss on others was morally indefensible.

In the author's opinion, all municipal tramway undertakings ought to raise workmen's fares to the legal limit, cancel all free passes, and withdraw all special rates. If this could not be done, then the Council concerned should purchase from the tramway department tickets at face value, and distribute them at a reduced price, or entirely free, if thought desirable. This course would free the tramway department from a very serious and unfair handicap, would remove the injustice to ordinary passengers, and would bring home to the public and the council the cost of such conces-

sions. Further, the Executive of the Association should seriously consider what steps could be taken to secure an alteration in the law regarding workmen's fares. If, on the other hand, tramways must go on bearing this burden of preferential rates, in common fairness they ought to be protected from unnecessary and grossly unfair competition.

Other matters that were to be dealt with yesterday were the "Rule of Footpath," introduced for discussion by Mr. J. DALRYMPLE (general manager, Glasgow), and "Development of Tramways," introduced by Mr. ARTHUR ELLIS (city electrical engineer and tramways manager, Cardiff). To-day an extraordinary general meeting is to be held to confirm alterations to the Articles of Association, and the annual general meeting will follow.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

RUSSIA.—A Decree of the Provisional Government was promulgated on July 28th prohibiting, as a temporary measure, the importation of all goods except under licence issued by the "Foreign Supplies Department," or by the Minister of Commerce. The Decree was to come into force from the day that the Customs authorities received telegraphic notice to that effect, but it will not apply to consignments of goods which are shown by the bills of lading, way bills, or port permits, to have been dispatched within three weeks from the date of promulgation of the Decree. The Minister of Commerce is to draw up a list of goods which are not to be subject to this prohibition. Consignments which arrive in Russia, for which the necessary licence has not been obtained, are liable to confiscation.

SWEDEN.—The exportation of the following, among other articles, has been prohibited as from the dates mentioned:—
June 15th: Accumulator cells or batteries, wholly or partly mounted; also electrodes soldered together.

July 23rd: Mica, unmanufactured or pulverised; mica manufactures not specially mentioned in the Customs Tariff.

August 2nd: *Electrical machines, such as generators, motors, converters, transformers, and damping rollers; stators, rotors, current collectors, magnet coils, brush holders, and armature coils exported separately; also parts of all the foregoing—provided they are composed to any extent of non-precious metal other than iron, or are tinned to any extent; accumulators—unmounted cells; incandescent lamps; arc lamps, even if with the globes belonging to them; so-called *Nernst* lamps, and globes, luminous bodies and resistances for the same; searchlights; carbon filaments, even if metalised; metal filaments and bases for electric lamps; carbon brushes (weighing less than 3 kilograms, each), even if combined with other material; safety appliances mounted on porcelain insulators (not plates); starting, regulating, and reduction resistances; controls and other electric regulators; also fitted boards for electric apparatus and instruments; *switches, current interruptors and reverses, and incandescent lamp sockets with or without switches; telephone apparatus; telegraph apparatus, telephone switches and telephone switchboards, also unspecified parts of telegraph and telephone apparatus and of telephone switches and switchboards; *special apparatus for electrical purposes, not specially mentioned, such as apparatus for signalling or conveying messages, Röntgen ray apparatus, apparatus for wireless telegraphy and telephony not included elsewhere, ore separators, &c.; also jack panels for telephone switchboards.

MOROCCO.—The Board of Trade have received from H.M. Minister at Tangier a copy of a new Tariff of valuations of the principal articles of merchandise imported into Morocco. These valuations form the basis on which Customs duties are to be assessed during the second half of the current year. [Goods imported by sea are, with certain exceptions, subject to duty at the rate of 10 per cent. *ad val.*, and also to the special tax of 2½ per cent. *ad val.* imposed by the Algerias Act.]

The new valuation Tariff may be consulted at the Department of Commercial Intelligence, 73, Basinghall Street, E.C. 2.

TRANSIT OF GOODS TO SWITZERLAND *via* ITALY.—In connection with the regulations referred to in the preceding notice, the Board of Trade are informed that arrangements have been made for the issue by H.M. Customs of the "pink certificates," S. 45 A and S. 45 B, in respect of consignments of goods which are exported under licence from the United Kingdom to Switzerland *via* Italy.

JAPAN.—Under an Order of the Department of Agriculture and Commerce the exportation of the following articles from Japan is permitted as from July 1st, provided that the special authority of the Department is obtained:—Tin ore and chloride of tin; nickel ore, nickel, and ferro-nickel; manganese ore, spiegeleisen and ferro-manganese; cobalt ore, cobalt, and ferro-cobalt; molybdenum and ferro-molybdenum; tungsten and ferro-tungsten; antimony; graphite; and mica and manufactures of mica.

* Extension of existing prohibition.

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

- 12,615. "Sparking plugs." A. E. LAMKIN. September 3rd.
- 12,623. "Telegraphic relays." H. W. SULLIVAN. September 3rd.
- 12,629. "Sound filters applicable to telephone receivers, gramophones, &c." C. TEASDALE-BUCKELL. September 4th.
- 12,655. "Portable electric lamps." H. BRENNER, ROSS & Co. AND J. SMITH. September 4th.
- 12,712. "Receivers for wireless telegraphy." O. D. LUCAS. September 5th.
- 12,721. "Interrupters for electric circuits." H. W. F. IRELAND. September 5th.
- 12,724. "Electro-pneumatic braking systems." W. V. TURNER. September 5th. (U.S.A., March 20th.)
- 12,727. "Electro-pneumatic braking systems." W. V. TURNER. September 5th. (U.S.A., April 17th.)
- 12,787. "Flash lamp." C. J. HARVEY & H. W. HOOPER. September 6th.
- 12,789. "Magnétos." G. M. TURNER. September 6th.
- 12,796. "Device for indicating condition of secondary electric batteries or accumulators." W. E. BAIT, CHLORIDE ELECTRICAL STORAGE CO. & H. DEAN. September 6th.
- 12,814. "X-ray tube, stand, and table." E. E. GREVILLE. September 6th.
- 12,816. "Electric induction furnaces." H. CORNWHAITE & S. CORNWHAITE. September 7th.
- 12,819. "Electric vehicle or locomotive trolley-pole manipulating means." J. L. CARR. September 7th.
- 12,830. "Electric ignition, lighting, and starting of internal-combustion engine driven vehicles." E. HARRISON. September 7th.
- 12,854. "Controlling means for electrically-operated feed-reel brakes." H. V. JAMES. September 7th.
- 12,855. "Systems of control for electric motors operating cranes, &c." J. BENTLEY & W. H. SCOTT. September 7th.
- 12,857. "Electrical resistances." F. A. ROSS. September 7th.
- 12,858. "Automatic circuit-changing switches." L. POLINKOWSKY AND WESTERN ELECTRIC CO. (Western Electric Co. partly). September 7th.
- 12,911. "Wireless telegraph transmitters." C. S. FRANKLIN & MARCONI'S WIRELESS TELEGRAPH CO. September 8th.
- 12,916. "Stabilising guns, searchlights, &c., by gyroscopes." O. IMRAY (Schilowsky). September 8th.
- 12,917. "Apparatus for electrical transmission of rotary motion of signals." O. IMRAY (Schilowsky). September 8th.

PUBLISHED SPECIFICATIONS.

1915.

- 12,883. ELECTROMECHANICAL LOCKS FOR THE GATES OR DOORS OF ELECTRIC LIFTS OR THE LIKE. D. M. Scott. September 8th, 1915.

1916.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

- 2,375. COMBINED PLUG, SOCKET, AND SWITCH DEVICES FOR ELECTRIC CIRCUITS. V. Hope. August 17th, 1916. (108,685.)
- 6,702. ELECTROLYTIC DEPOSITION OF COPPER FROM ACID SOLUTION. F. E. Studt. May 10th, 1916. (Cognate application, 14,467/16.) (108,688.)
- 6,780. ELECTRIC HEAT RADIATORS. A. F. Berry. May 11th, 1916. (108,689.)
- 11,381. ELECTRIC KNIFE SWITCHES. R. Lister. August 11th, 1916. (108,703.)
- 11,393. ENGINE STARTING, LIGHTING, AND/OR HEATING APPARATUS FOR USE ON MOTOR AND OTHER VEHICLES. W. F. W. Rhodes & J. Firth. August 12th, 1916. (Addition to 9,203/16.) (108,704.)
- 11,429. BI-POLAR ELECTRODE ELECTROLYSERS. G. G. Hepburn. August 12th, 1916. (Cognate application, 12,903/16. Addition to 12,730/15.) (108,707.)
- 11,604. AUTOMATIC AND SEMI-AUTOMATIC TELEPHONE SYSTEMS. Relay Automatic Telephone Co. & W. Aitken. August 16th, 1916. (108,714.)
- 11,605. AUTOMATIC AND SEMI-AUTOMATIC TELEPHONE SYSTEMS. Relay Automatic Telephone Co. & W. Aitken. August 16th, 1916. (108,715.)
- 11,617. ELECTRICALLY-OPERATED INDICATOR MECHANISM. W. R. Sykes' Interlocking Signal Co. & R. W. Tarrant. August 16th, 1916. (108,717.)
- 11,710. APPARATUS FOR HEATING WATER AND OTHER LIQUIDS ELECTRICALLY. A. Charles. August 18th, 1916. (108,723.)
- 11,769. ELECTRIC MOTOR GYROSCOPES AND MEANS FOR MAKING ELECTRICAL CONNECTION THEREWITH. Crucible Steel Co. of America. November 3rd, 1915. (Addition to 11,752/16.) (102,044.)
- 11,789. ELECTRIC TRANSFORMERS. British Electric Transformer Co. & S. C. Mount. August 19th, 1916. (108,727.)
- 11,836. ELECTRICALLY-OPERATED CLOCKS AND THE LIKE. W. Alldis. August 21st, 1916. (108,729.)
- 12,299. IGNITION TERMINALS, MORE PARTICULARLY FOR USE IN AEROPLANE ENGINES. R. G. Booth. August 30th, 1916. (108,745.)
- 12,535. ELECTRIC SIGNALING LAMPS, PARTICULARLY FOR SHIPS. Davey & Co. and T. F. H. James. September 5th, 1916. (108,748.)
- 12,558. ELECTRO-MAGNETICALLY-OPERATED HORNS. H. Lucas & W. H. Edwards. September 5th, 1916. (108,749.)
- 12,624. SYSTEMS OF ELECTRIC MOTOR CONTROL. British Thomson-Houston Co. (General Electric Co., U.S.A.). September 6th, 1916. (108,752.)
- 12,845. STARTING SYSTEMS FOR INTERNAL-COMBUSTION ENGINES. W. A. Chryst. September 30th, 1915. (101,626.)
- 13,235. INCANDESCENT ELECTRIC LAMPS. C. E. J. Brandt. September 18th, 1915. (101,547.)
- 13,277. TELEGRAPHY. G. O. Squier, L. W. Austin & L. Cohen. September 19th, 1916. (108,763.)
- 13,665. IGNITION MECHANISM FOR INTERNAL-COMBUSTION ENGINES. H. R. van Deynster. October 28th, 1915. (101,965.)
- 13,758. DYNAMO-ELECTRIC MACHINES. M. Latour. September 7th, 1915. (107,193.)
- 13,825. PORTABLE ELECTRIC LAMPS. O. Hoffman & C. Wolter. September 25th, 1915. (101,637.)
- 13,984. MAGNETS FOR MAGNETO-IGNITION APPARATUS FOR EXPLOSION OR INTERNAL-COMBUSTION MOTORS. C. A. Hult & O. W. Holt. October 2nd, 1916. (108,768.)
- 14,921. RECORDING ATTACHMENT FOR ELECTRIC CURRENT MEASURING AND TESTING APPARATUS. C. E. Hunter & W. J. Davis. October 7th, 1916. (108,770.)
- 14,955. SOUND-OPERATED CIRCUIT CONTROLLER. Submarine Wireless Co. May 19th, 1916. (106,463.)
- 14,951. GYROSCOPES. S. Oulianine. October 20th, 1916. (108,776.)
- 16,661. ELECTRODES AS USED FOR WELDING PURPOSES. M. M. Irvine. November 21st, 1916. (108,789.)
- 17,507. ELECTRICAL DISCHARGE DEVICES. British Thomson-Houston Co. (General Electric Co., U.S.A.). December 6th, 1916. (108,793.)
- 17,516. ELECTRIC FISHES. W. E. Bradshaw and Callender's Cable & Construction Co. December 9th, 1916. (108,795.)

THE ELECTRICAL REVIEW.

Vol. LXXXI.

SEPTEMBER 28, 1917.

No. 2,079.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE 1-4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: "AERREKAY, LONDON." Code, A B C.

Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 8d.; Canada, £1 8s. 10d. (\$5.80). To all other countries, £1 10s.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.	MELBOURNE: The Mining & Engineering Review, 90, William Street; Gordon & Gotch, Queen Street.
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JOHANNESBURG, CAPE TOWN, BLOEMFONTEIN, DURBAN, PORT ELIZABETH, &c.: Central News Agency, Ltd.	ROME: Loescher & Co., Corso Umberto I° 307.
LAUNCESTON: Gordon & Gotch, Cimitiere Street.	SYDNEY: The Mining & Engineering Review, 273, George Street; Gordon and Gotch, Pitt Street.
	TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.
	WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

THE "ELECTRICAL REVIEW'S"

ELECTRICAL & ALLIED TRADES DIRECTORY
(THE RED BOOK),

1917 EDITION

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THE WAGES OF CENTRAL STATION WORKERS.

THOSE who have watched the course of the discussions of the last few years regarding the remuneration of central station employes have probably expected that sooner or later the matter would be brought to a head. Apart altogether from the question whether the Electrical Trades Union, the A.E.S.E., or any other organisation is the representative body, we may say that we have never supported niggardliness in the remuneration of this class of worker. The central station employe is worthy of his hire. In the past there has been want of organisation on the part of, and differences between, the men themselves, there has been no approach to uniformity of remuneration even for similar stations, and there has been in war-time little desire to treat the men as though they were performing a national service, which in a large number of cases they undoubtedly are. Our own pages have long contained abundant evidence that there has been continuous irritation and disappointment, and at times disaffection, because there appeared to be an unwillingness in certain directions to meet the men in the matter, and to adequately consider their claims. We have no desire to prejudge the case as it has developed under the changing conditions of war-time, conditions of which the Electrical Trades Union has not failed to take full advantage. Before the war broke out, that Union certainly did not represent the interests on behalf of which it now agitates. In those days, when the Union wanted to capture the central station men we attended a number of the meetings at which grievances were discussed. We do not hesitate to state that one of the things that then seemed to us to be throwing the employes right into the arms of the Union was the suspicion that the station chiefs and their authorities were disinclined to give a just hearing to complaints. The Union propaganda has been assisted by the A.E.S.E. policy of remaining inactive, on patriotic grounds, so as not to hamper the progress of the war. If there has been a disinclination to consider with reasonable generosity the war-time burdens of the men, it is easy to see that such dissatisfaction would materially assist the Electrical Trades Union in its propaganda, especially among what we may call the non-professional class of employes. Therefore, it is not surprising to learn from a report of the Hackney Municipal Electricity Committee that there "appears to be serious unrest prevailing throughout the electricity undertakings of Greater London at the present time." This unrest is "alleged to be mainly due to the delay on the part of various authorities in paying war wages awarded to the shipbuilding and engineering trades by the Committee on Production." Pressure is being brought to bear upon the Ministry of Labour with a view to securing a 48-hour week, increased normal pay to what is claimed to be paid in Government service, and the Committee on Production's awards in the engineering trades as war wages. As a result, the Associated Municipal Electrical Engineers (Greater London) have now decided to take steps to secure an agreement between the authorities and the Unions, and to introduce, as far as possible, uniformity throughout the London area. As stated elsewhere

in this issue, municipal authorities are now appointing delegates who will form a body to treat with the electrical and other Unions, and to secure the reference of the points to conciliation or arbitration if they fail to come to an agreement.

As we have said, it was, in our opinion, inevitable that something would have to be done sooner or later, and while we have no desire to prejudge the case, we cannot help regretting that it is only under pressure that there is now a prospect of matters being properly dealt with. We cannot regret that the whole subject has taken the present turn, whatever we may think of the past of the Electrical Trades Union, for it is a matter of which most of us have become weary. It is true that the new body now being appointed has relegated to it an investigation arising mainly out of war-time conditions, but it has a great opportunity of laying down a basis upon which the subject may be settled for some time ahead. Its task is not an easy one, even if limited to the war-time problem, but if it can so deal with that problem as to lay down principles regarding conditions and wages which may be applied at other times as well, it will have deserved well at the hands of everybody.

In war-time the nation has been trying to settle a hundred old controversies—sometimes it has succeeded. It is only right that we should, as far as possible, clear the way for the vast work of reconstruction that will occupy the serious thought of all of us for a long time to come. If the electrical industry can dispose of the irritating discussions and the fairly universal grievances that have attended employment of many classes engaged in central station operation it will have a clearer atmosphere in which to deal with the whole subject of national electricity supply. It will also have discharged an obligation towards station employes who are now away fighting, that legitimately rests upon it.

Protected Trades Certificates.

SIR AUCKLAND GEDDES, the new Minister of National Service, has lately delivered a speech in which he has shown a disposition to prefer older men behind the lines. The

Times has very rightly suggested to him that this might be desirable if we contemplated remaining practically where we are, whereas it would be a handicap if "movement" became the order of the day. Sir Auckland states that he expects to receive new demands from the War Cabinet for younger men for the Army, and in that connection he would be well-advised to watch what is taking place in the indiscriminate granting to young men of certificates under the Protected Trades Schedule. We report some more cases of this character to-day in our "War Items." It may be perfectly wise to leave some young men in civil life at home—presumably as a general leavening influence, though our own information shows that things would run more smoothly without that "influence" in some districts—but the nation as a whole will not approve of a readiness to leave single young men in unimportant civil positions just because their employers are "on the Government list," while men of years, and with families and businesses, have to be taken for the Army. We should have supposed, especially at this stage of the war, that financial considerations alone would carry weight, the cost of a young single man of energy and good physique being trifling compared with that of a married man, who requires separation allowance, civil liabilities allowance, too, in many cases, with prospective heavy burdens for pensions, &c. But, as in some other things, perhaps we have got to the point where a million or two more or less doesn't matter!

Tramway Finance.

THE Conference held by the Municipal Tramways Association at Blackpool, last week, was remarkably well attended, and proved highly successful; whether this was due to the attractiveness of the agenda or, at least in part, to the amenities of the place, is no doubt an open question, but, as we have remarked in another connection, there is no obvious necessity for all war-time conventions to be held in London, and we incline to the view that the choice of venue in this case was not without its effect on the attendance.

The *pièce de résistance* of the programme was the question how to make ends meet, a subject which is exercising the minds of a good many tramway managers in these extraordinary times, and in this connection the problem of securing an adequate income from passengers to cover the cost of their transportation, with a modest margin on the right side of the account, received the largest share of attention. Tramway undertakings labour under the burden of legislative restrictions even more irksome in some respects than those which hamper electricity supply, and in their case it is more difficult to obtain relief, as the Board of Trade has no power to authorise a variation in the statutory limit of fares; the direct intervention of Parliament is indispensable, and the attitude of that body on such a question is not likely to be sympathetic. So far as regards the ordinary passenger, a charge of one penny per mile does not appear to be unreasonable, and it seems to us that relief should be sought in other directions in which the injustice endured by the tramways under modern conditions is more readily demonstrable.

Prominent amongst these is the "workman's fare," the *bête noire* of many managers. The authors of the papers on tramway finance unanimously inveighed against the statutory requirement that workmen should be carried during certain hours at fares not exceeding a halfpenny per mile, and there is much to be said against the vicious practice of differentiating between different classes of the community, particularly when the concession bears so inequitably upon the public as in this case—for, as we have previously pointed out, it is a gross injustice that clerks, shop assistants, and other people who are often far less opulent than "workmen," should be deprived of the privilege enjoyed by the latter, simply because their working hours are not the same. A somewhat unexpected feature of the discussion, however, was the statement made by some of the speakers that owing to the density of the traffic, workmen's fares returned a profit in their districts. Presumably, therefore, it is rather the abuse than the use of the system that is to blame. The example quoted by Mr. Murray, and recently mentioned in our pages, of a journey of 19 miles for 2d. on the L.C.C. tramways can only be regarded as a monstrosity, but there are other instances of passengers travelling 10 miles for 2d., where 5d. would be the legal charge. The authorities who have sanctioned such fares, probably with political motives, have only themselves to blame if they result in a heavy annual loss, and the system cannot be justified on any ground. We strongly sympathise with Mr. Murray's suggestion that the tramway undertaking should be paid the full ordinary fare in respect of every passenger carried, without exception, and any concessions that the authorities desire to make should be paid for out of public funds, where their cost would be duly recorded and open to criticism. Under the existing conditions, the tramways are most unjustly taxed, not only in the interests of "workmen," a term which generally includes all classes who travel before 8 a.m., but also in respect of upkeep of the roadway which is used by their competitors, and in other ways.

SOME PRACTICAL EXPERIENCES WITH TOUGH RUBBER COMPOUND CABLES.

By W. ELLERD-STYLES, A.M.I.E.E.

WHenever a new commodity is introduced which tends to displace those already monopolising an industry, the inevitable result is a stalwart antagonism from the involved vested interests about to be displaced, irrespective of the virtues of the newcomer. The champions of an inferior commodity usually adopt an assumed name when attacking the new arrival, in order to conceal their identity. The introduction of tough rubber compound cables, hereafter alluded to as C.T.S., has been followed by the usual swarm of vindictive and defamatory letters to the various technical journals as a sequel to its growing popularity.

In reply to such, it is proposed in this article to quote the experience of several well-known contractors, together with details of some of the contracts carried out by each of them, appending their opinions in each instance in order to demonstrate that C.T.S. has been well tried and justifies its general adoption.

Contractors are now beginning to realise the advantages appertaining to the use of C.T.S. for lighting and heating installations, and it is with a view to giving information as to its suitability for power work that this article has been written.

The following are a few preliminary notes from the writer's experience of C.T.S. :—

The lay-out of a power installation is governed more or less by local conditions, but it is possible to adopt a somewhat uniform procedure in every situation; the only difficulty that has shown itself is the earthing of the apparatus. On one occasion a well-known contractor was called upon to install a motor in a position far removed from a suitable earth. It was, therefore, necessary to run the earth wire with the cables, and in doing so he made no attempt at concealment, with the result that the owner of the property made heated protests at seeing a bare copper wire run throughout the premises, as he presumed it to be a live wire. A simple remedy existed in threading the earth wire through the cleats at the back of the cable; a saw cut in the bottom of the groove is sufficient.

As to the kind of cable to be used for the heavy class of work, it is most suitable to use the circular section, twin or triple, as required, for the main runs, and single for connections between the motor and switchgear or control apparatus.

If it is necessary to run the C.T.S. cable underground, it can be laid without further protection, unless in a shallow trench, when warming bricks should be laid a few inches above it. For most situations the cable should be supported by cleats at frequent intervals to avoid sagging; for the lighter cables noncorrodible metal or ebonite saddles may be used. Where it is necessary to run the cable overhead, an auxiliary wire may be used to support the cable with the aid of suitable suspenders at frequent intervals.

Three reports have been selected for inclusion in this article from firms of high standing, and several useful hints are given which need no emphasis from the writer, as they are written by practical men.

Messrs. Bertram Thomas, electrical and mechanical engineers and contractors, Worsley Street, Hulme, Manchester, give the following report on C.T.S. wiring :—

"We would say that it gives us much pleasure to put forward jobs we have undertaken with C.T.S. cable. We instance four as follows, but would say that these jobs have practically been lighting jobs throughout. Of course, there has been a small amount of power work, but it has been very small considering the size of the jobs :—

"—— Sanatorium, for Manchester Corporation.—A hospital for soldiers. About 800 lights wired with approximately 10 miles of C.T.S. cable of various sizes.

"—— Mill, Failsworth, Manchester.—A cotton-spinning mill. About 350 lights wired with approximately 2½ miles of C.T.S. cable of various sizes.

"—— Mill, Failsworth, Manchester.—A cotton-

spinning mill. About 200 lights wired with approximately 2 miles of C.T.S. cable of various sizes.

"—— Co., Ltd., Trafford Park, Manchester.—A lard refinery. About 500 lights and some motors wired with approximately 4 miles of C.T.S. cable.

"From our experience of C.T.S., we have certainly found it quite satisfactory on these jobs up to the present. The method of running the cables has been fixing of same with suitable metal saddles, and in each instance we have only used single cable.

"With reference to the —— Co., we have run a considerable amount of the cable in the outbuildings there on cleats, and we find it very satisfactory from the *water-proof point of view*. The reason for using these cables in most instances has been that they are *waterproof*, and, as a consequence, we are getting little trouble from earthing or short circuits."

It is interesting to note that this report emphasises the waterproof qualities of C.T.S.

Messrs. Chas. Richardson & Sons, Romily, near Stockport, give an interesting description of power jobs, and they emphasise the great saving of labour over other wiring systems and the facility with which alterations and rearrangements can be carried out. Their report states :—

"We have pleasure in giving a rough outline of one or two of the installations we have carried out in C.T.S., viz. :—

"In a dye works, under particularly bad conditions, *V.I.R. cables both on cleats and in conduit had completely failed* on account of damp and acid fumes. We have wired some 200 lights and several motors of 1 to 6 h.p. in C.T.S. on 220 volts—the major part of it dating back some three or four years—and up to the present it has been a *complete success*. The *saving in labour* was found to be a very important consideration.

"In another case of a large felt works we recently cabled two motors of respectively 100 H.P. and 53 H.P. on a 400-volt three-phase supply, with three-core 600-megohm C.T.S., and it made a *very neat installation* saddled up with metal saddles. Here again was shown a considerable saving of labour when compared with other systems.

"In another instance we installed C.T.S. cables on a 250-volt D.C. installation in an asbestos process works. Some 250 lights, with a number of motors varying from 2 H.P. to 15 H.P. The saving of labour greatly influenced the use of C.T.S. in this work. We might mention another feature of this job, viz., that a considerable amount of alteration and re-arrangement has been done from time to time, and the open C.T.S. system has lent itself very well to work of this kind.

"Among other jobs we have used C.T.S. extensively in a leather works and tan yard for cabling to a large number of motors from 5 H.P. to 100 H.P., and it has given great satisfaction."

Messrs. P. Allman & Co., of 5, Queen Street, Manchester, have carried out many important installations with C.T.S. in situations of an extremely destructive nature, as shown in the following survey :—

"As you are aware, we have applied this under various conditions, and in almost every case without any other protection than its own sheathing, excepting where it might be subject to severe mechanical damage, in which case a short length of tube has been used, and, in our opinion, there are only three points to bear in mind, and if they have consideration, it is, without doubt, *the most perfect class of electrical cable ever installed*.

"No. 1.—Always use stranded cable.

"No. 2.—See that the cleats are of correct size for the diameter of the cable.

"No. 3.—Make sure that the ends of the cables are finished into the right type of fitting, and properly finished off.

"The following are details of a few of the contracts we have carried out in C.T.S. :—

"Ministry of Munitions : Steel Billet Breaking Plant.—1,400 B.H.P. In this instance, 50 per cent. of the wires were *installed in the ground*, and with no other protection than being surrounded by sand before filling in, and we have not had one fault on this job for 12 months.

"Messrs. Watson & Todd.—Underground main supplying

all light sheds, protected as above, installed *three years ago*, in perfect condition at present.

"Cresol-Pieric Acid Works.—300 lights and 200 B.H.P. All neat wiring on surface with switches outside of buildings. Carbolic, nitric, and sulphuric acid used in process, *without any detriment to the wiring*."

"Courtaulds Acid Plant.—300 lights and 180 B.H.P. All wiring on surface, protected from mechanical damage where necessary. Perfect test after nine months' running. Sulphuric manufactured at these works.

"We could, of course, go on with a longer list."

There is little doubt that the above experiences will be appreciated by those contractors who desire proof of the suitability of C.T.S. for hard service, and who require practical demonstrations before they venture to introduce new systems of wiring to their clients.

In conclusion, it is well to point out that the various classes of ironclad switchgear may be installed with C.T.S., using suitable brushes or nipples where the cables enter.

DIRECT-CURRENT BALANCERS.

By W. A. E. M.

It is well known that in approximating the maximum current rating of each machine composing a three-wire balancer set, we take rather more than half the maximum out-of-balance current to be passed through the middle wire.

In the case of balancer-booster combinations where the balancing unit is also required to act as prime mover to a pair of booster dynamos, such calculations are a little more complicated when something better than a rough approximation is desired. The following notes and formulae may provide information of some use to many who handle inquiries and estimates for plant of this kind.

When the boosters of a balancer-booster set are to give an output calling for a motoring current exceeding the out-of-balance current in the middle wire, both machines forming the balancing unit will operate as motors and will take between them all the current called for by such conditions from the bus-bars, the motor connected across the heavily loaded side of the system taking half the difference between the middle wire and booster-motoring currents, and the other balancer machine taking half the sum of the mid-wire and booster-motoring currents.

When the out-of-balance amperes in the middle wire exceed the booster driving current, the balancer machine on the heavier loaded side will act as a generating unit giving a current rather less than half the difference between the out-of-balance and booster-motoring currents and the other balancer machine will work as a motor, taking rather more than half the sum of the out-of-balance amperes and the driving current called for by the boosters.

The two machines forming the balancing unit will, of course, as in the case of the plain balancer arrangement, be identical, each being liable to act in its maximum current capacity, according to the specified conditions of out-of-balance and booster loads.

Neglecting balancer efficiency we get for the current values—

$$c_n = (c_b + c_m)/2, \\ c_o = (c_b - c_m)/2, \text{ or } (c_m - c_b)/2.$$

These are actual values when c_b is greater than c_m , under which conditions both sides of the balancer are motoring, but when c_m is greater than c_b , the actual current values are—

$$c_n = (100 c_m + c_b E)/(100 + E), \\ c_o = (c_m - c_b) E/(100 + E),$$

when—

- c_n = amperes in balancer machine on normally loaded side of neutral wire ;
- c_o = amperes in balancer on overloaded side of neutral wire ;
- c_b = motoring amperes in balancer absorbed by booster load ;
- c_m = out-of-balance amperes in neutral wire ; and
- E = efficiency of balancer $(100 c_o/c_n - c_b)$.

The value of c_b is, of course, $w_b/E_b E_m V_m \cdot 0001$, when—

- w_b = watts output of boosters ;
- E_b = per cent. booster efficiency ;
- E_m = per cent. balancer motor efficiency ; and
- V_m = voltage across balancer motor ;

and may be taken as approximately 5 to 6 amperes per kilowatt of booster output when the voltage either way of the middle wire is, say, 220 ; thus the motoring current in a balancer working across a 440-volt three-wire system will be for a booster load of 10 kw. about 50 to 60 amperes.

When the middle-wire and booster-motoring currents are respectively, say, 50 and 60 amperes, the currents in the balancer will be as shown in fig. 1, and, neglecting efficiency, the same current values exist with an out-of-balance of 60 amperes and a booster-motoring current of 50 amperes, the machine on the side carrying the out-of-balance load in this case acting as a dynamo, as shown in fig. 2.

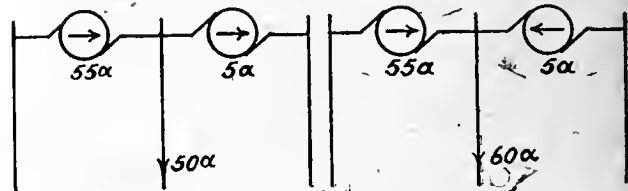


FIG. 1.

FIG. 2.

When the balancer principle is employed in motor-generator or auto-converter voltage reducer sets, as shown in the diagram, fig. 3, in which system of connection the secondary current is the sum of the motor and generator amperes, the input current through the motor from the high-voltage side will be—

$$c_m = 100 c_s v_d/v_p E_c \text{ or } 100 c_s v_d/(100 v_d + v_m E),$$

and the amperes given to the secondary circuit by the generator will be—

$$c_d = c_s (1 - 100 v_d/v_p E_c), \text{ or } c_s v_m E/(100 v_d + v_m E),$$

when—

- c_m = amperes in motor ;
- c_d = amperes in dynamo ;
- v_m = volts across motor ;
- v_d = volts across dynamo ;
- v_p = primary supply voltage $(v_m + v_d)$;
- c_s = secondary current $(c_m + c_d)$;
- E = combined machine efficiency $(100 c_d v_d/c_m v_m)$; and
- E_c = conversion efficiency $(100 c_s v_d/c_m v_p)$.

Neglecting efficiency, it will be seen that the current through the motor equals $c_s v_d/v_p$ and that the dynamo current is $c_s v_m/v_p$; thus, in the case of a motor-generator working off a 220-volt supply and giving out 50 amperes at 100 volts, the machine currents will be as shown in fig. 3.

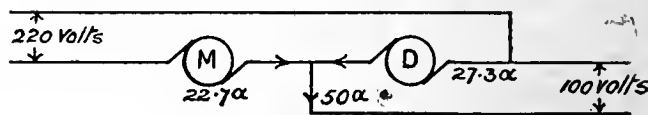


FIG. 3.

And if we assume a combined machine efficiency of 70 per cent., the motor current will be—

$$\frac{100 \times 50 \times 100}{(100 \times 100) + (120 \times 70)} \text{ equals } 27.2 \text{ amperes,}$$

and the dynamo current will be—

$$\frac{50 \times 120 \times 70}{(100 \times 100) + (120 \times 70)} \text{ equals } 22.8 \text{ amperes.}$$

It will be found that the actual commercial efficiency—i.e., the efficiency of conversion—works out in the example taken as 83½ per cent.

The balancer system of connection of course offers an advantage only when the voltage reduction ratio is a low one (the advantage being that smaller machines may be used than with the ordinary arrangement of motor-generator having independent high and low voltage circuits) as, on the higher ratios of voltage, the conversion efficiency is low and the current supplied through the motor to the secondary circuit is too small to be of any value.

CURIOSITIES OF EARLY MAINS WORK.

By G. W. STUBBINGS.

MAINS work was not always carried out with the thoroughness that obtains at the present time. This was due not so much, perhaps, to a desire to cut down prices, or necessarily to careless workmanship, but rather, it would seem, to the lack of a general understanding of the reasons that make the various precautions required with paper-insulated and lead-covered cables necessary. As from time to time ancient specimens of cable work are unearthed in the course of renewals or fault repairs, the modern mains engineer gets some little amusement: but the pioneers should not, perhaps, be unduly criticised, for, after all, they were pioneers, and had not the accumulated experience of years to guide them.

Curiosities of early bonding are familiar to all: the prevailing ignorance of the principles underlying this precaution was really remarkable, and has only of late years been dispelled. The most noteworthy case of this kind in the writer's experience occurred at a straight-through box on a .75 C.C. L.T. feeder. The bond was composed of a single strand of 18 s.w.g. copper wire, which had originally been stuck on to the lead of the cable by means of a drop of hard solder. On a fault occurring at another box on the feeder the bond-wire of the box referred to had burnt away, and the fault current burnt a large hole in the lead of the cable in the gland of the box. It is remarkable that this incipient fault never really developed, and it was discovered some four years afterwards during a systematic inspection of the boxes on the feeder in question.

The principle underlying the use of sealing chambers and pot ends does not seem to have been very thoroughly grasped by certain of the old school of jointers. The writer has in mind several examples of lamp services which terminate in a large lead pot end at the top of the post near the cut-outs. It was intended that the two cores of the twin cable should be sweated solid above the compound level, covered with a short length of rubber tube, and taken direct into the cut-outs, to save the jointing of rubber tails. In the particular cases which the writer has in mind, not only had the jointer neglected to sweat the cores solid, but he had allowed the paper insulation to protrude some $\frac{1}{2}$ in. above the level of the compound in the pot end. The most amusing case of this kind, however, occurred in connection with quite a modern job. An underground cable was laid by the supply company for the consumer to connect a subsidiary building with the main building at a certain factory. To supply a single light in a small shed situated between these two buildings, a tapping was taken off the main, the branch cable being a twin $\frac{3}{8}$ in. rubber, lead-covered and armoured. The job was inspected some weeks after completion, and it was found that the end of the V.I.R. cable in the shed had been adorned by the addition of a very large sealing chamber filled with compound. This must have been the gratuitous work of the wiring contractor. The finest feature of the job, however, was the fact that the end of the lead sheathing was a good $\frac{1}{2}$ in. above the compound level in the sealing chamber.

The necessity of a thorough system of cable records, like that of bonding, was not always recognised as well as at the present time. It is certainly a fact that many of the early mains foremen had a remarkable memory, and the early tendency was to rely unduly on this memory, very much as if it were a standard barometer or current balance that could be retained and preserved by the undertaking. A case occurred in the experience of the writer that shows that even an excellent memory is not infallible. In a certain road the east side was cabled throughout and the west side only partly. It became necessary to examine the service box for a house on the west side, past which the distributors were running. Considerable trouble was experienced in locating the service box, which was ultimately found on the east side of the street. It was thought that, as the east-side mains were known to have been laid before those on the west side, the service was connected before the latter mains were laid. A subsequent search through the old stores records revealed the fact that the service had been connected after the west-side mains had

been laid, and the service cable had actually been laid over the west-side distributors, across the road to the east side. The only explanation of so remarkable a piece of work is that no record had been kept of the termination of the distributor on the west side, and that the person then in charge had, relying on his memory, thought that the west-side mains did not extend as far as the house in question. It may be added that subsequently a further similar example was found in the same road.

The fusing of distributors in disconnecting boxes is a matter requiring careful study and consideration in each particular case, and much trouble and inconvenience can be caused by the adoption of a careless and ill-thought-out system. The writer has come across more than one case of fuses, all of equal size, in the three branch distributors of a D.C. three-wire system in a T box supplying a dead end. Fortunately the fuses had never been called upon to operate.

Mention has been made of the circumstance that the defects of old mains works are not always due to a desire to reduce expenditure. This certainly applies to the early practice in a particular system for large consumers. Such practice was to lay two twin services with two service boxes, the result, of course, being that the neutral was double the cross section of the outers. It might be thought that two boxes were used because boxes for two branch cables were not manufactured by the firm supplying the cable accessories; but this was not the case, as boxes for two branch cables were in use for street lamps having both arc and incandescent lighting on the one column. It is difficult to see a reason for the costly proceeding mentioned: it may have been thought that two independent services would give a greater certainty of supply. The additional expenditure for large and long services was hardly justified. This idea calls to mind a system of distribution lately proposed, in which the live main is looped into each consumer's premises, in order that the distributor may, in case of need, be sectionised in each service cut-out box. Such a system sounds very inviting till the cost of a service—say 20 yards long—supplying a demand of 3 amperes off a .2 distributor is considered. As in this case a .2 — .2 — .012 three-core service cable would be required, the advantage of the system is rather expensive. The most futile example of supposed security occurred in the case of a 480-volt service supplying four circuits of 9.5-ampere arc lamps, fed two each way from a switch pillar. The service burnt out and the box was opened up. It was found that four $\frac{1}{8}$ in. lead-covered single cables had been run, two on each pole, and also that there were two fittings on each of the outer mains. As all the cables were taken into an unbonded piece of 1½-in. barrel, the extent of the additional security can easily be estimated. The remarks of the jointer who removed the compound from the service box, and gradually discovered four fittings when he expected to find two, were not lacking in force and character, and, had they not been unsuitable in certain other particulars, they might have been recorded here.

A further curious piece of work occurred in connection with several circuits of street lamps originally intended to work two in series across 440 volts. There was one switch wire only, and each pair of lamps was connected to the switch wire and one outer main. The original idea of the 440-volt system was, presumably, to assist to preserve the balance. Some two years after these lamps had been connected it was decided that a 220-volt system would be more suitable—mainly, the writer believes, on account of the fact that with the original system the lamp and wiring in the bracket were always alive. The change-over was in one or two cases accomplished by altering the polarity of the switch wire from negative to neutral. The original objection, of course, remained, and the lamps were always alive, and the further curious circumstance arose that a fault on the switch wire would not, as a rule, blow the fuse, but would light the whole circuit of lamps.

The foregoing list of curiosities could, doubtless, be supplemented by scores of others that have been observed by various mains engineers. Indeed, it is singular how short a time ago the general ignorance of the principles of cable laying and maintenance began to be dispelled. It is only fairly recently that scientific methods of fault localisation became general, and there are still undertakings in which

such methods are not used, presumably because they are not understood. Such ignorance is, happily, fast dying out, and the average mains engineer of to-day is well equipped with the knowledge necessary for carrying out his duties with efficiency and thoroughness.

A FAULT IN ELECTRIC FURNACE CONTROL WIRING.

In the *Electrical World* of August 18th an account is given of an unsuitable system of control connections and of the method adopted for rectifying it. When the first of a recently-installed battery of Héroult steel furnaces was placed in service, great difficulties were experienced in its regulation, and the maintenance of a balanced current, either by hand or automatic regulation, was found almost

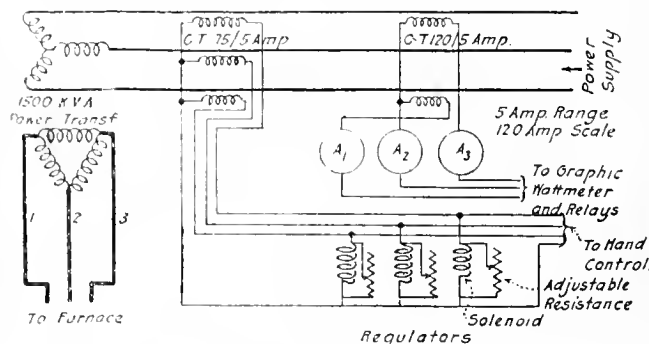


FIG. 1.—WIRING BEFORE CHANGE WAS MADE.

impossible. A balanced reading being obtained on the ammeter, the condition was most unstable, and an increase of current in one line was as likely as not to be further increased by raising the corresponding electrode out of the bath.

The arrangement of the wiring was as shown in fig. 1. The ammeter readings were found to be proportional to the currents in the regulator coils, and the graphic wattmeter circuits were

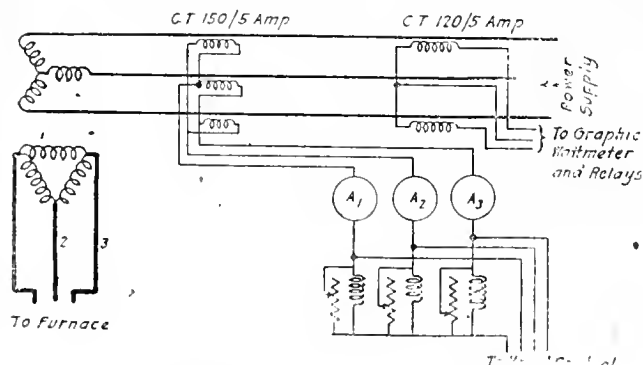


FIG. 2.—WIRING AFTER CHANGE WAS MADE.

normal. The connections of the 1,500-K.V.A., three-phase transformer were found to be star-delta. With such an arrangement the currents in the ammeters and regulators will not of necessity be proportional to those in the electrodes, for the current in each electrode is the resultant of the currents in two secondary windings of the transformer, which are in turn proportional to those in two of the primary lines.

A reconnection of the power transformers was out of the question. Series transformers for the secondaries were suggested, but such transformers suitable for 10,000 amperes could not be purchased or made at short notice.

The problem had a simple solution: The three 75/5 current transformers on the regulator circuits were replaced by 120/5; the secondaries of these were connected in delta, thus duplicating the power wiring; the ammeters were placed in series with the regulators, and the wiring was left as in fig. 2. With these changes made, the furnace was found to operate normally, whether on hand or automatic regulation, and the arrangement was adopted for the other furnaces which were being installed, though it was found desirable to replace the 120/5 current transformers by 150/5 ratio, to get more suitable currents in the ammeter and regulator windings.

Coal Production.—Last year, 998,063 persons were employed in the coal mines of the United Kingdom, as compared with 953,612 in the previous year. The output of coal was 256,318,999 tons, as compared with 253,179,000 tons.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Prospects of the Central-Station Engineer.

It would be illuminating to prospective electrical engineers if you would open your columns to a discussion of the remuneration offered to, and the technical education expected of, a much-exploited profession.

Your article on "The Staff," I feel sure, ventilates the opinions of many excellent junior engineers who have been given the go-by for money and influence.

Staff Electrician.

[Our correspondent is, perhaps, not aware that this subject has on many occasions been discussed at length in our "Correspondence" columns. Its importance cannot be denied, but the obstacles in the way of reform are many and great. Under existing circumstances we cannot recommend young men of ability and ambition to join the staffs of power stations unless it be for the purpose of acquiring a first-hand knowledge of the organisation and working conditions of such stations, as part of their technical training, and not as a career. Of course, in war-time they have no choice in the matter.—EDS. ELEC. REV.]

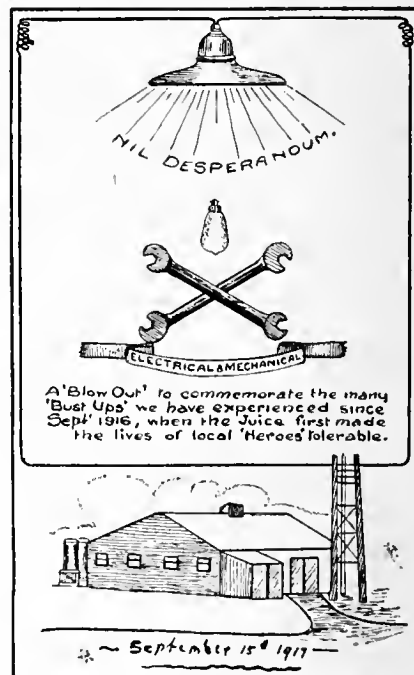
A "European Concert."

Although I am afraid you will be unable to be present, I venture to send you an invitation and card of the first (pessimistic) anniversary dinner of the "Somewhere in France" electricity supply department.

We complete the 12 months' running this week, so thought it a reasonable excuse for forming a local branch of the Electro-Harmonic Society, for, in the words of George Robey, the restoration of "convivial nights."

I am not quite sure that the Censor will pass the "drawing" of the generating station, which may be considered of military importance to the enemy, for, as someone suggested, it might be identified from the cloud in the background.

It is getting quite an interesting little installation, consisting of slow-speed horizontal paraffin and high-speed vertical petrol sets,



at 2,000 volts, with aerial distribution. At present there are three stations turning out about 150,000 units per year, comparable, I suppose, with Exmouth, Falmouth, Sandown, Ventnor, and undertakings of that size. Of course, our working costs are hopeless, owing to the cost of fuel—portability, simplicity, and ease of erection being the principal factors. Still, we feel that we are keeping our hand in for "after the war" and the return to civil life—whenever that may come.

Ronald Grlerson,

Captain (356 E. and M. Co.), R.E., D.O.E.S.

France, September 16th, 1917.

The City Guilds' Subject—"Electrical Installation Work."

This fundamentally important subject, which, until a year ago, suffered from the entirely inadequate name of electric wiremen's work, is once more under a cloud; and we wonder what the newly-appointed examiner, Mr. W. R. Rawlings, thinks of the matter.

In the new session's "Programme" of the City and Guilds of London Institute there is a prefatory red-ink notice to the effect

that the 1918 Exams. in the above subject will not be held if the war continues. A few non-electrical subjects are in the same boat, and there is a final threat that other Exams. may have to be suspended or modified.

Right up to the present time the fundamental electrical subject has suffered from neglect at the hands of principals of Institutes and heads of electrical engineering departments, who have consistently starved it, while spending money lavishly in other directions. In some Institutions the subject is considered an outside one, and its teacher a temporary member of the staff.

To make matters worse, the C. G. Examination authorities fenced the subject round with absurd barriers tending to discourage or render impossible attendance at the Exams. The various kinds of people who are concerned with electrical installation work cannot, by reason of their employment, always make the stipulated number of attendances; while no provision at all exists for private students to sit for examination. The introduction of this concession would have had surprising results in past years. Our own Exams. make us feel certain on this point.

The final blow, the threat of "no Exam.," is the more serious, as other classes will promptly be dropped. We say "other classes," because right at the beginning of the war some authorities straightway "put the lid on."

To discourage this particular Exam., at a time when recruits to the ranks of electrical workers are badly wanted, seems excessively feeble. It can hardly be a question of expense, for the latter must be very nearly proportional to the number of examinees.

We notice that the subject of gas fitting has not received a similar set-back. What have the I.E.E. and the E.C.A. to say to this?

Up to the session 1915-16 the prizes offered for "Electric Wiremen's (now Installation) Work," depended on the generosity of the Goldsmiths' Company. Now there are none at all. Should this discontinuance of prizes be permanent, so far as the Goldsmiths' Company is concerned, an excellent opportunity will be afforded the I.E.E., the B.E.A.M.A., or the E.C.A. of stepping into the breach.

The Society of British Gas Industries, the Institute of Builders, the Institute of Plumbers, &c., do their best to foster their respective industries in this way.

While the war is bringing home to millions of people the indispensability of electricity in various directions at the Front and in munitions works, it would almost seem that the authorities were bent on discouraging the study of fundamental electrical work otherwise "electrical installation work."

A. P. Lundberg & Sons.

London, N., September 20th, 1917.

The Fusing of an Electric Wire.

As wiring contractors, may we have the opportunity of supplementing your contributor's remarks after criticising the concluding paragraph.

Your contributor: "An electrical installation should be so good that after completion it can be left entirely to itself and almost forgotten."

I.E.E. Wiring Rules 1916, 130: "The value of systematically inspecting and testing apparatus and circuits cannot be too strongly urged. Records should be kept of all tests, so that any gradual deterioration of the system may be detected. Cleanliness of all parts of the apparatus and fittings is essential."

We think you will find that wiring contractors would like the latter rule to read as follows:—"Systematic inspection and tests must be carried out periodically by qualified electrical engineers."

Before an installation is connected up, the authorities and the insurance companies concerned will, perhaps, be most exacting; but afterwards the "budding" electrical engineer fuses up with door keys and wire nails. In large installations, before the contractor has completed his work, invariably one of his wiremen or a labourer is approached, and in due course installed as the firm's electrical engineer; a good man no doubt under supervision, but not fitted for the post.

Whilst the authorities assume their present attitude, this method is of more advantage to the customer until an accident or a fire occurs which calls in an Inspector. He is able to buy electrical material at a cheaper rate than the contractor can sell it to him, and, therefore, the customer receives the support and advice of travellers of some wholesale house, who, in turn, have had no experience of installation work.

This, we submit, is the root of the evil which brings the industry into disgrace, and a remedy should be adopted.

L. E. Wilson.

Manchester, September 18th, 1917.

The E.T.U. and the A.E.S.E.

I should feel obliged if you could find space for the following correspondence that has passed between Sir Geo. Askwith and myself in reference to the Association known as the A.E.S.E.

This Association, as the readers of your valuable paper well know, decided, at the outbreak of hostilities, to suspend operations during the period of the war. They, forsooth, were going to make no effort to benefit the men employed in central and sub-stations: as a consequence, the great bulk of their membership left them and joined the E.T.U. Now that our efforts are beginning to fructify, certain men want to resurrect this dead concern, and, of course, want to be represented before Sir Geo. Askwith. If they were so anxious for the welfare of this section of the industry, why did not they prepare working rules and conditions, and get into communication with Sir Geo. Askwith, &c.? Oh, no. But now that the

spade work has been done, now that an effort is being made by the E.T.U. to improve, not only the status of these men, but also to improve them materially, the A.E.S.E. suddenly appears on the scene, and one can see the hand of the capitalist behind it all.

The E.T.U. recognises no other body as catering for these men. In London alone we have over 700 of them in our ranks to-day, with an ever-increasing membership, and we are not going to rest content until every central-station engineer, be he chief or switchboard attendant, is within our ranks.

W. J. Webb.

London, September 24th, 1917.

"September 20th, 1917.

"Dear Sir,—A large number of replies are being received from borough and supply companies, intimating that they are consulting their Committees or directors, &c.

"Can you give me any information as to the Association of Electrical Station Engineers, 26, Little Park Gardens, Enfield (W. J. Ebben, hon. general secretary), claiming to write on behalf of the executive staff of the central electrical and sub-stations—that is, the charge engineers—and requesting that facilities be given them to be represented at any conference?"

"I am.

"Yours faithfully,

"(Signed) G. R. ASKWITH.

"W. J. Webb, Esq.,

"Electrical Trades Union."

"September 21st, 1917.

"Sir Geo. Askwith.

"Dear Sir,—Your letter of the 20th to hand; and in reply, my Committee would like the result of consultations as rapidly as possible. My Committee are aware that most of the Councils are in recess at the present moment, but the matter from our members' point of view is very urgent.

In respect to the Society you mention, my Committee do not recognise the Association as catering for the men concerned. They are not a Trade Union, and, until a fortnight ago, were dead, but evidently have been resurrected, either for the sake of kudos for certain individuals, or the benefit of the employers.

"Yours faithfully,

"(Signed) W. J. WEBB,

"London District Secretary."

[In our opinion, no investigation made by Sir George Askwith can be complete without a hearing being given to the A.E.S.E. The suggestion that the "capitalist" has anything to do with the A.E.S.E. is grotesque; in suspending its campaign at the outbreak of war, the Association adopted the same patriotic policy as the E.T.U., which, with equal loyalty, abandoned the fight with the wiring contractors which was then in progress, and to misrepresent its motives at this time is unfair and in bad taste.—EDS. ELEC. REV.]

A Static Electricity Phenomenon.

The correspondence on this subject reminds me of a similar experience I had some years ago, when long sparks were drawn from a steam leak at a joint on a Lancashire boiler stop-valve.

The phenomenon is explained in the text-books of electricity and magnetism.

By friction the particles of condensed water in the jet become charged, and, as Sir W. Armstrong found in his investigation with his hydro-electrical machine, he could produce sparks 5 ft. long.

Wm. Frisby.

Electricity Supply Department, Colchester.

September 24th, 1917.

Magnets and Magnetos.

Will any reader kindly answer the following inquiries?—

1. Permanent magnets: Where to obtain best steel for same, average value of B_{residual} and max. value of B (sq. in.) when under process of magnetisation.

Also given B (sq. in.) = 1,000 for a certain steel, what will be value of flux in a path of reluctance Z ?

2. Publisher's name of a book on magnetos dealing fully with theory from a scientific standpoint, and giving all types, past and present.

3. Details of most instructive works dealing with wireless telegraphy and telephony.

B. E. F.

Electrical Rain-Making in Australia.

—In the course of his tour of the east-west railway the Minister of Works and Railways, Mr. Watt, inspected the rain-making device set up by Mr. J. G. Balsillie, late Commonwealth wireless expert, at Bookaloo, and, upon the evidence placed before him, decided that the experiments should be continued. Comparisons made and data collected over some 15 or 16 years indicated that Mr. Balsillie's scheme had induced an increased rainfall of between 50 and 70 per cent. in the Bookaloo area, about 50 miles west of Port Augusta. The Bookaloo apparatus had been shifted to Wynbrong for further trials, which would be continued for a considerable period. The Government proposed to obtain two more plants from Mr. Balsillie, and, after consultation with the Government Meteorologist, use one in New South Wales, and, possibly, one in Victoria, in grazing and wheat growing areas respectively. The cost of each plant, with a full year's upkeep, was about £800.—*Melbourne Age*.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The Stansiphon.

During the Christmas meetings of the American Association for the Advancement of Science a self-starting siphon was shown, the trade name for which is the Stansiphon.

The self-starting device is shown in fig. 1, and consists of a bulb (1) sealed into the lower end of the tube (2) and an inner tube (5) sealed into the base of the bulb and reaching into the opening of the bulb at the top. Here the end is somewhat constricted, and its size and position with respect to the top of the bulb are so adjusted that an "air trap" is produced at (6). A small opening (7) is made at the lower part of the bulb.

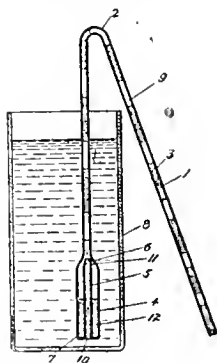


FIG. 1.—A SELF-STARTING SIPHON.

If the bulb be inserted to a considerable depth into the liquid to be siphoned, the liquid flows into the bulb through (7) and displaces the air, which with the water passing through the inner tube (5) rises in a broken column in tube (2) and flows out through the delivery tube (1).

To operate successfully on ordinary liquids the Stansiphon should be immersed to a depth at least two or three times the length of the bulb.

A design has been made which successfully siphons acids from carboys, but owing to the heavy density of these acids it works relatively slowly as compared with water. Light oils such as kerosene and gasoline are readily siphoned by this method, but as yet a suitable design depending on this principle has not been found for the heavier oils.

The wide application of the Stansiphon is apparent especially in chemical laboratories, drug stores, manufacturing and other establishments where liquids and various solutions are in constant use. In transferring corrosive poisons or valuable liquids it obviates liability to accident or waste. It should also have a wide application in the filling and emptying of all sizes of storage-battery jars. When a solution is to be kept "on tap" for instant use, a stopcock may be provided. These siphons in addition to glass are being made of brass, copper, zinc, lead, iron, hard rubber, &c.

Application for patent rights has been made in the name of the inventor, GUSTAVUS A. STORM, but all rights, title and interest in the same have been assigned to the Standard Scientific Co. of New York.—P. B. Perkins, in *Science*.

The "Autofrigor" Small Refrigerating Machine.

Hitherto, the equipment available for producing cold—or rather, extracting heat—on a small scale by mechanical means has involved a good deal of skilled supervision and attendance in respect of belt drives, valves, manometers, and stuffing boxes, &c. A set designed to eliminate the necessity for any skilled attention, and hence to be suitable for use in private houses, has been placed on the market by the Elektrofrigor Gesell. (Berlin), and is described in a recent issue of *E.T.Z.* The working parts are extremely simple, and are assembled in the form of a vertical cylindrical unit. On top there is a squirrel-cage, three-phase, induction motor with vertical spindle and ventilated stator housing. This machine is mounted on, and coupled directly to, a compressor, the cylindrical casing of which is mounted on top and at one end of the refrigerator chamber. The latter is in the form of a rectangular chest, and access to it is obtained by a lid in the remainder of the top. Below the compressor, and entirely within the refrigerator chest, is the vaporising chamber, which is cylindrical in form but of corrugated metal, in order to give maximum cooling surface. The condenser is placed round the compressor housing, and is itself surrounded by a water jacket, through which water is circulated continuously.

Methyl chloride is used as the cooling medium. Vapour is drawn from the vaporising chamber by the compressor, and forced into the condenser. Thence, the now liquid refrigerant passes into the vaporising chamber through a reducing nozzle, and by its evaporation and expansion extracts heat from the surroundings. The expanded vapour is again drawn into the compressor and the cycle repeated. The whole vapour circuit is said to be sealed hermetically, so that the cooling medium needs no replenishing. The cold box can, of course, be used for cold storage or for ice making. No particulars are available as to the power of the motor used, or the

heat-extracting capabilities of the machine beyond the statement that "a temperature of -5° is reached after a few hours' working." The only manipulation required is to open the cooling-water valve and close the motor switch when it is desired to start the machine. The advantage of the squirrel-cage motor in point of simplicity and absence of brush gear is obvious, but one fails to see the point of the recommendation (made by *E.T.Z.*) that a converter be installed to secure this advantage in the refrigerator motor, if three-phase supply be not already available.

A Highly Sensitive Electrometer.

Mr. A. L. PARSON, Chemical Laboratory, University of California, has devised an instrument in which the principle of working in a condition approaching instability is used to increase greatly the sensitiveness of the quadrant electrometer. The box-shaped quadrants are replaced by flat sectors subtending about 70° each at the centre and arranged as shown in fig. 2. Because of the two large gaps between A and B', and between A' and B, the needle hangs stably, as shown by the dotted lines, by virtue of electric forces quite apart from the torsion of the suspension. (Incidentally, this makes it possible to use a torsionless suspension or a float for the needle, which latter has been tried with some success.) If now a potential difference is set up between A and B, the needle is deflected, at first nearly proportionately to the potential difference, and then less and less as the large gaps are approached.

The approach to instability, and hence an increase in sensitiveness, is brought about by means of a mechanical device, which on turning a micrometer screw can be made to widen the small gaps between A and B and between A' and B', thus making the needle

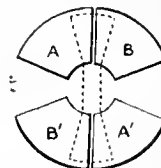


FIG. 2.—QUADRANTS AND NEEDLE OF SENSITIVE ELECTROMETER.

less and less stable in its central symmetrical position. In this way the sensitivity, which in the least sensitive condition is about 3 mm. per millivolt at a scale distance of 5 metres, can be raised to as much as 60 mm. per millivolt easily, and with some care even to 150 mm. per millivolt.

A most important feature of the instrument is that, on account of the relative unimportance of the thickness of the quartz suspension, the sensitivity to potential differences is practically independent of the size of the instrument. The last model made, with a needle 1.8 cm. long, has a capacity of 9 cm., but this could without difficulty be halved by reducing the size of the instrument; and it might be halved again by omitting one end of the needle and the pair of sectors below it.

Although the sensitivity of the electrometer (with the very efficient optical system used) is theoretically great enough to detect 10^{-6} volt, it has not as yet been made steady enough to detect an isolated potential difference of less than about 3×10^{-5} volt. The device was described in a paper presented to the National Academy of Sciences.—*Scientific American Suppl.*

A New British Magneto.

THE BRITISH LIGHTING AND IGNITION CO., LTD., of Tottenham Court Road, London, W.C., have lately brought out a new type of ignition magneto, the B.L.I.C. H.L.S type, specially designed for 8-cylinder engines. Instead of being of the usual rotary armature pattern, the armature has a stationary winding, and an iron sleeve, the latter revolving between the armature core and the pole shoes. Among the advantages claimed for the new machine are that it gives four sparks per revolution as compared with only two in machines with rotating armatures, and that the windings, being stationary, are not subjected to any centrifugal strains.

New Accumulator Plate Separator.

A new accumulator plate separator, which is claimed to be a great advance on wooden separators, has lately been adopted in the batteries made by the WILLARD STORAGE BATTERY CO., of Cleveland, O., U.S.A. The new separator is stated to consist of a rubber composition containing a very large number of threads, which act as wicks. The threads are about $\frac{1}{32}$ in. long, and when wetted by the acid offer, it is claimed, little resistance to the passage of current.

Emergency Storage of Coal.—In the *Electrical World*

of August 18th, a simple and inexpensive method of unloading coal on open ground is described. The railway wagons, with hopper bottoms, are run on to a track, and the coal is deposited on the track and between the sleepers by opening the doors. The coal is pushed off the rails when the wagon is withdrawn by a balk of timber inserted in front of the rear wheels. When the whole length of track has thus been covered with coal, the track is jacked up and rests on the coal, and the process is repeated until the pile is 10 or 15 ft. high, when the track is relaid on the ground and a second pile is begun. To remove the coal, the track is laid on the ground alongside of the pile, and the coal is loaded into wagons by a locomotive crane.

THE MUNICIPAL TRAMWAYS ASSOCIATION (INCORPORATED).—II.

THE decision of the Executive Council to hold the 16th annual conference of the MUNICIPAL TRAMWAYS ASSOCIATION (INCORPORATED) at Blackpool, on Thursday and Friday of last week, was justified by an excellent attendance. Nearly 100 delegates, principally tramway managers, and chairmen and vice-chairmen of tramway committees, were present from all parts of the Kingdom. In addition, there were present as guests, amongst others, Mr. H. E. Blain, of the London General Omnibus Co., Ltd., and Mr. W. G. T. Goodman, general manager of the Adelaide Municipal Tramway Trust, and President of the Tramways Association of Australia.

Mr. Henry Mozley (general manager, Burnley Corporation Tramways), the President, was in the chair, and he was supported by Ald. S. Flint, J.P. (Leicester), the Vice-President, past presidents in Mr. P. Fisher (Dundee), Ald. H. Linsley, J.P. (Salford), and Mr. A. R. Fearnley (Sheffield), the hon. treasurer and secretary *pro tem.*, and by Sir J. W. Courtis, J.P. (Cardiff), and Ald. C. F. Spencer (Halifax), Members of the Council.

The Mayor of Blackpool, Coun. A. L. PARKINSON, J.P., extended a civic welcome to the conference, and remarked that the time had arrived when the tramway committees of the country would have to take into consideration the question of obtaining powers for the revision of fares. The railway companies and gas and electrical undertakings had had that power, and it was necessary in their case, when he found that 16 tramway systems in the country were not able to turn the corner financially, and when 20 systems only made a profit equal to no more than 6d. per 100 passengers. In Blackpool they had a good surplus profit, due to the large number of visitors, but their position was exceptional. One route, Marton, which they opened out some years ago, resulted in a big loss for several years, but the development of property and the increased rateable value had repaid the town many times over.

Thanks to the Mayor were heartily given, after which Mr. MOZLEY gave the presidential address, reported in our last issue.

Tramway Finance.

Mr. G. W. HOLFORD (Salford) read a synopsis of the paper on "Notes on Tramway Finance," of which we gave an abstract last week.

Ald. C. F. SPENCER (Halifax), who opened the discussion in a lengthy speech, said the paper was of a more provocative character than usual, and he welcomed it on that account. He thought the question might be summed up under eight heads: (1) The question of national finance and its effect on municipal finance, (2) the rising cost of wages, (3) the increase in the cost of materials, (4) the increase in fare revenue, (5) the reduction of electrical power consumption, (6) the costliness of Parliamentary procedure, (7) the weakness and strength of municipal administration, and (8) a new adoptive policy. The question of finance was an exceedingly complex one to-day. Before the war, local authorities in Lancashire and Yorkshire were able to borrow at about 3½ per cent. Now, owing to the great cost of the war and other causes, the money rate had advanced, and as, after the war, the demands were likely to be very heavy, the rate of interest would mount still higher. They did not want the local authorities to be competing with the Government afterwards, thus forcing up the rate, and he thought the municipal authorities ought to go as a united body to the Chancellor of the Exchequer, and suggest that it would be far better if the Government borrowed for the whole lot, and then lent the money to the local authorities at a uniform rate. He was sorry to see the reference to the suspension of sinking funds. The suggestion was made in a Manchester paper some time ago, and within 10 days he received 500 letters in reference to the matter. The popular idea of suspension was repudiation, and it would be better if they asked Parliament to remove restrictions, and to enable tramway authorities to raise the fares. He did not believe in local authorities saddling their undertakings with the heavy incubus of rate relief, and he thought that not more than 1 per cent. on its capitalisation should be paid by the undertaking to the local authority. Wages had got to the breaking-point, and he thought there ought to be a uniform adjustment on this question, whilst their workmen ought not to be treated as if they were automatic machines. Regarding fares, they were hide-bound by Parliamentary precedent, and he was inclined to say, with Lord Milner, "Abolish precedents and damn the consequences." Everything had gone up in price except rain, fresh air, and tramway fares. Ald. Spencer advocated the establishment of power stations near the sources of coal and water supplies, the current to be distributed to the local authorities, and condemned the present method of generation as most wasteful. He also urged that the tramways committee should have such statutory powers that its decisions could not be upset by the mere caprice of the Council as a whole. They should have a more commercial administration, and a greater continuity of policy.

Mr. ARTHUR ELLIS (engineer and manager, Cardiff Corporation Tramways) said that many municipalities, including his own, were inclined to regard the Board of Trade Departmental Committee on Electricity Supply with great suspicion. Local authorities ought to have more representation upon it. He was the chairman of the Linking-up Committee for South Wales and Monmouthshire District, and they, like Lancashire and Cheshire, were going to try and show that the Board of Trade Committee was not likely to be required in settling this question. As to increased fares, he believed that the working classes, who did not know how to spend their surplus wealth, would pay them willingly. He condemned the present method of settling disputes through the Committee on Production, as it seemed that the employees had only to threaten the Committee to get what they wanted. They had every desire to be fair to the employees, but they did not like their hands being forced. At Cardiff they carried their own insurance, with the result that after paying one-half of the premium which a company would require they had saved £20,000 in 14 years, and had a good reserve.

Ald. R. T. FLETCHER (chairman, Wigan Tramways Committee), referring to the rise in interest, asked why they should pay interest at all on borrowed money. He suggested that municipalities could issue notes, to be repaid at a certain period, but bearing no interest, and there need be no repudiation of the sinking fund.

Baillie M. W. MONTGOMERY (chairman, Glasgow Corporation Tramways) said that their experience had been that as they had reduced the fares or increased the stages the traffic had gone up by leaps and bounds. Their halfpenny fares were very profitable, but their conditions might not apply to other localities. If all fare restrictions were removed, private companies would have monopolies that would be prejudicial to the public interest.

Mr. R. J. BISHOP (vice-chairman, Walthamstow District Council Tramways Committee) said his Council sat from 7 p.m. to 5 a.m. next morning before it decided to abolish halfpenny fares, but the step had proved a thorough success, and had been the means of turning a deficit into a profit. It set an example which had been followed throughout the London area.

Mr. W. MURRAY (general manager, Walthamstow) said that their experience of car meters to check the consumption of electrical current had been very successful, and had been the means of saving thousands of pounds.

Coun. DAN IRVING (vice-chairman, Burnley Corporation Tramways) said that anyone who had listened to the discussion would be justified in assuming that they were an association of privately-owned tramway companies, the sole object of their existence being the making of profits for shareholders. The principle of municipal ownership was public utility, without thought of profit. Public utility was altogether superior to profit, or ought to be so, and he thought the time would come when tramways would be free to all who required to use them, just as roads and bridges, over which a toll had once to be paid, were now free to the public.

Mr. W. G. T. GOODMAN, at the request of the President, gave an interesting statement on tramway matters in South Australia. There, he said, they had not adopted workmen's fares, but they had special fares for children, and they found that it brought traffic from other sources. On the question of power consumption, it would be impracticable to adopt car meters as, owing to labour conditions, they often had to change their car crews seven times a day. They had a properly constituted authority to settle matters in dispute between employers and employed, and the system worked very well, as it relieved the management of a great deal of responsibility. If, however, there was an authority to fix wages, there ought also to be one to fix fares in accordance with the increased expenses.

Coun. FRYER (Birmingham) said there was danger in the suggestion that a tramways committee should be regarded as separate and distinct from other municipal undertakings. It was an integral part of the municipal organisation, and he disliked the term "trading departments" when they performed a great public service. If a tramway undertaking, maintained on a sound and stable financial basis, with its management properly remunerated, and its employees working under decent conditions, made profits, then it was assuredly worth while to deflect some of those profits to helping on the prosperity of the town.

THE PRESIDENT defended workmen's fare traffic, which he considered to be very profitable, and said that at Burnley they found no difficulty in differentiating between those who were entitled to reduced fares and those who were not. Parcels traffic was highly profitable—75 per cent. of the receipts were profits—if it was properly managed.

Mr. HOLFORD, in replying to the discussion, said the question of finance was one over which the tramway committees had little control. The local authorities were seeking increased representation on the Board of Trade Committee on Electricity Supply. He did not think they were out to make profits, but they wished to avoid losses, and if profits were made on tramways he did not care how they were applied, so long as the systems were maintained in a sound financial condition. He thought it would be a long time before tramways became free, and, personally, he would not like to have

to manage such a system. He thought free food and free water ought to precede free travelling.

The Rule of the Footpath.

Mr. J. DALRYMPLE (general manager, Glasgow Corporation Tramways), who should have opened a discussion on "The Rule of the Footpath," was unable to be present owing to the Royal visit to the Clyde, and his notes on the subject were read by Bailie MONTGOMERY. The point raised was as to whether or not it was time that the rule of the road regarding pedestrians to "keep to the right" should be altered so as to be the same as for vehicular traffic, "keep to the left." From a tramway point of view, it was an important question, as uniformity would tend to prevent confusion, and so avoid accidents. Of 87 tramway authorities circularised, however, 39 had not given the matter consideration, 15 had come to no decision, and a like number had expressed approval. In one case the change had been made, and only three had put forward objections.

Coun. T. CANBY (vice-chairman, Huddersfield Tramways) said his Council had discussed the matter, but felt that it was more of a national than a local one. If adopted, however, it would be of great benefit.

Mr. H. E. BLAIN (London General Omnibus Co.) said this was a matter of much greater importance to traction people than they might imagine. In the Metropolitan area they had 46,000 street accidents in a year, of which 800 were fatal. When he joined his company the accident record and the amount paid in claims were phenomenal, but at the end of four years they had reduced their claims costs by £50,000 per year. In analysing the claims, it was found that if the rule of the footpath had been reversed three-fourths of the fatal accidents could have been avoided. In the London district 38 authorities were in favour of the change, and only eight against. Mr. Blain also referred to the success of the "safety first" campaign.

Sir J. W. COURTIS (chairman, Cardiff Corporation Tramways) suggested that the Home Office should be approached by a deputation on the matter, and this was supported by Mr. A. H. SCOTT, J.P., L.C.C., and Ald. SPENCER, Halifax. Other speakers, however, pointed out that the present rules of the road were largely ignored both by pedestrians and by drivers of vehicles.

It was decided that the Home Office and the various local authorities should be communicated with on the subject.

Differentiation in Fares.

Mr. W. MURRAY (general manager, Walthamstow) then presented his paper on "Differentiation in Fares," which was reported last week.

Coun. J. MOON (deputy-chairman, Plymouth Corporation Tramways Committee), who opened the discussion, said he thought the present concessions were largely the result of weak-kneed management in the past. If concessions had to be made to workmen, blind people, &c., by tramway committees, then other committees should do the same. Tramways were business undertakings, and not philanthropic undertakings.

Ald. BROADLEY (Halifax) contended that workmen's cars paid, and said that if they could have the same loads throughout the day they could afford to run at workmen's fares.

Mr. W. J. MCCOMBE (tramway manager, Hull) said they carried the workman there two miles and seven-eighths for a halfpenny, and the traffic was a profitable one, but this was a question which every municipality must decide for itself, having regard to its own conditions.

Mr. WM. CLOUGH (general manager, Bury Corporation Tramways) pointed out that Mr. Murray, in instancing the success of a halfpenny fare over the High Level Bridge at Newcastle, did not mention that this was a case where it was as cheap to ride as to walk, as, though the distance was only a quarter of a mile, every foot passenger had to pay a halfpenny toll.

Mr. A. ELLIS (Cardiff) said that owing to the whole of their industries centring at the docks, workmen's cars, at four and four and a half miles for a penny, were a distinct loss, as the cars had to run back empty, whilst in the evening, at the busiest time, they had to put aside 33 cars for the purpose of taking the men home again, with the result that often people who would have paid 2½d. for the journey had to walk.

Mr. R. J. BISHOP (vice-chairman, Walthamstow) said their cars were running practically empty from 10 a.m. to 5 p.m., and he did not think that Mr. Murray should have saddled the whole cost upon the workmen's cars. The probability was that if the workmen's cars were taken alone it would be found that they paid.

Mr. P. FISHER (general manager, Dundee) spoke of the great success of cheap fares there, where the maximum was one penny, but Mr. W. J. SCOTT'S (vice-chairman, L.C.C.) said he did not think the halfpenny fare would come back in London.

Mr. MURRAY, in reply, said he was satisfied that workmen's fares were not of much use, and that since they had abolished halfpenny fares and increased workmen's fares by 50 per cent. their traffic receipts had risen fully 4d. per mile.

Mr. ARTHUR ELLIS (Cardiff) read a paper on "The Development of Tramways," but the discussion was adjourned until the following day.

The Development of Tramways.

In opening the discussion on Friday morning, Coun. C. RAINE, J.P. (vice-chairman, Hull Tramways Committee), said that although Mr. Ellis had entered upon the somewhat dangerous sphere of prophecy, he was perfectly justified, for they all recognised that great changes would be made in the future in every phase of life, and probably in none more than tramway traction. The possibilities of development of passenger and goods traffic seemed to be overwhelming. The great difficulty was in joining up the urban and the suburban districts for the benefit of both. A point to which attention might be given was the provision of transit facilities for the people who lived in congested areas off the main thoroughfares of our cities, and who were entitled to have such facilities equally with those who lived on the principal roads. He thought that railless trolley cars might be used here with advantage. The present system, by which they had to go to Parliament when they wished to extend their systems, should be relaxed.

Mr. A. R. FEARNLEY (general manager, Sheffield) suggested that Mr. Ellis held the motor 'bus, as a factor in development of traffic, much too lightly. For the past four and a half years Sheffield had been largely developing rural traffic by motor 'buses, with most satisfactory results, for they had built up a traffic carrying 6,000,000 passengers per annum, with receipts amounting to £40,000. He suggested that there was a great deal to be done in developing the riding habit, seeing that out of a number of towns of which he had details there were only eight in which there was an average of over 200 rides per head of population per annum, whilst there were 58 between 100 and 200, and 37 below 100. Through-running and linking-up of systems were great features in the development of the riding habit.

Mr. N. J. YOUNG (general manager, Newport Tramways) said the time was ripe for the consideration of housing, town-planning, and tramway development as part of one combined scheme, and he thought there ought to be some measure of national assistance in the matter. Why should not Great Britain be divided into representative districts, worked under Government control, and grants be made to assist tramways extension where necessary?

Ald. W. C. FENTON (vice-chairman, Sheffield) objected to the idea, as tramways were a local, not a national, question, and Government control might mean interference with local authorities as to where extensions should take place. He believed in the American idea, that the provision of tramways made for population, and he advocated a bold policy in this matter.

Mr. A. BAKER (general manager, Birmingham) said the present method of Parliamentary control over the schemes of local authorities regarding tramways was simply monstrous. If a Council wished to extend its system in its own area it should have the power to do so, and though some form of control might be necessary where the interests of two or more authorities were concerned, some less costly procedure than the present one ought to be possible.

Ald. SPENCER (Halifax) referred to the question of goods traffic by trams as being one of vital importance, both from a departmental and from a national point of view. He instanced the case of a company with which he was connected, and which had made arrangements with the Leeds Corporation Tramways Committee for the carriage of the raw material in the industry from its source to the manufactory. Of 100 horse-carts and wagons, 80 had been taken off the roads, and the Leeds Corporation would be carrying goods to the extent of 50,000 tons per annum by the end of the year. It had paid his company, and he believed it had paid the Leeds Corporation. The development of this idea would prove of great national value. As to railways, he believed their great extension in the future would be towards electrification.

Mr. A. H. SCOTT (London) suggested that something very tangible might be done towards the reduction of food prices if municipalities were able to provide facilities for bringing agricultural produce direct from the urban districts to their own public markets.

Mr. ELLIS, in reply to the points raised, pointed out that at Leeds the Corporation Tramways Committee had been able to do much in the way of developing goods traffic for war work through the present system, by which it was only necessary to convince the responsible Minister that the extension was a desirable one in the national interest, for not only permission to be given to go on, but valuable wayleaves and privileges to be obtained. It would be a pity if something of this sort did not continue after the war. In considering the extension of tramways into outlying areas, it was very necessary that something should be done to protect the public against the enhanced value of the land along the route. When there was any suspicion of a tramway being extended the land was bought up, so that future development was retarded by exorbitant prices.

Business Meeting.

The annual business meeting followed, at which the report and balance-sheet were adopted. The President made reference to the loss which the Association had sustained by the deaths of Ald. J. Brodie, J.P. (chairman of the Blackpool Tramways and Electricity Committee), and of Ald. J. Miles, J.P. (chairman of the Bolton Corporation Tramways Committee, and a former vice-president).

Ald. S. FLINT, J.P. (chairman, Leicester Tramways Committee), the Vice-President, was unanimously elected President, and Mr. T. B. GOODYER (manager, Croydon Tramways) was elected Vice-President.

Mr. A. BAKER (Birmingham) and Mr. J. M. McELROY (Manchester) were re-elected members of the Executive Council. For three vacancies for councillors or aldermen there were nominated Ald. Spencer (Halifax), a retiring member, Ald. R. Wood (Stalybridge), Coun. R. Mayne, J.P. (Newcastle), Coun. J. Timpson (Portsmouth), and Ald. W. G. Wylie (South Shields). The three first-named were elected.

Mr. J. F. Simpson (Preston) was re-appointed auditor, and Messrs. E. R. Pickmere (town clerk, Liverpool) and Mr. S. F. James (town clerk, Ilkeston) hon. solicitors.

On the proposition of Mr. Baker, the Association placed on record its appreciation of the valuable services rendered as hon. secretary and treasurer by Mr. C. J. Spencer, of Bradford, who had resigned his office, after five and a half years' successful work, in order to take up duties under the Admiralty. It was decided that Mr. Spencer be elected hon. treasurer.

Mr. A. R. Fearnley (Sheffield) was elected hon. secretary, and was heartily thanked for his services.

The new President, Ald. Flint, moved, and Ald. Wylie (South Shields) seconded, a vote to Mr. Mozley for his services in the chair, and thanks to the Mayor and Corporation of Blackpool for the welcome and facilities given for the conference were heartily accorded on the proposition of Ald. F. A. Dunsford, J.P. (Southampton), seconded by Coun. Fryer (Birmingham). Mr. Charles Furness, Blackpool's borough electrical engineer and tramway manager, fittingly replied. Later the delegates were entertained to luncheon by the Blackpool Tramways Committee. Coun. R. Holt, J.P., the Deputy-Mayor, and chairman of the Committee, presided.

From every point of view the conference was distinctly successful, and the view was expressed that in future, as before the war, it ought to extend over three days in view of the many important tramway questions which call for discussion and decision.

WAR ITEMS.

Glass Order.—In the "London Gazette" for September 21st will be found a copy of the Glass and Glassware Order of the Ministry of Munitions, prohibiting the manufacture, supply, or delivery of any chemical or electric lamp glass, &c., except under specified conditions. Full explanatory notes are given.

The Cockerill Works.—"Les Nouvelles," of Maastricht, states that the Germans are completely destroying the Cockerill ironworks at Seraing-sur-Meuse. The iron girders have been removed, and all the blast furnaces are being blown up.—*Times*.

War-time Wages in Germany.—The "Labour Gazette" in an article on "The Course of Industrial Wages in Germany during the War," gives the following figures relating to wages in the metal, engineering, electrical, chemical, and pottery groups of industries:—

Trade group.	Average earnings per day.					
	Men.			Women.		
	March, 1914.	Sept., 1916.	Inc. %	March, 1914.	Sept., 1916.	Inc. %
Metal.. ..	s. d.	s. d.		s. d.	s. d.	
Engineering ..	5 5	7 11	44.5	2 0	4 0	99.5
Electrical ..	5 3	7 11	48.0	2 3	3 10	70.2
Chemical ..	4 5	7 4	64.6	2 8	4 9	74.5
Stoneworking and pottery	5 1	6 9	34.2	2 4	3 6	50.4
	4 5	5 4	21.3	1 8	2 2	31.1

Owing to the limited number of industrial concerns covered by the inquiry, as well as to disturbing influences resulting from war conditions, the German Department of Labour Statistics are of opinion that any conclusions drawn from the foregoing figures as to the movement of the level of wages in German industry during the war must necessarily be subject to certain reservations. No reference is made in the source to the question as to how far increased earnings may be due to the working of overtime.

Protected Trades Certificates.—At Bermondsey, attention was again drawn to the indiscriminate granting of certificates under the Protected Trades Schedule, when a warehouseman, employed by a firm of Lancashire cotton waste manufacturers, stated he had received a certificate, although no application was made for it either by his manager in London or by himself. It was sent to him from Lancashire. The Military Representative said he had to draw attention to the granting of four certificates under the Trade Protection Schedule. Three men were described as unskilled labourers, two 20 years old, both single men, and the other 28 years old, whilst the fourth was an unskilled millhand, 18 years old, all having obtained certificates. Coun. W. Shearring said the granting of these certificates in this indiscriminate way was most unfair to traders and large em-

ployers of labour, and also to the Tribunal, who were called upon to send married men with large families into the Army. The Military Representative said if a firm was on the Government list they automatically received protection cards for all their employes over 19 years of age classified B1 (garrison duty abroad), or in the lower medical categories, no matter what the men did. The Tribunal decided to ask the Badges and Protected Trades Department to receive a deputation on the question within the next fortnight. If no reply was received or a satisfactory solution arrived at in the meantime, the Tribunal decided that they would suspend the hearing of all further applications for exemption.

Municipal Tramwaymen in the War.—A return submitted to the members of the Municipal Tramways Association, at their meeting last week, showed that of 84 municipal authorities replying to the queries, the number of tramway employes at normal times was 55,208, and that 29,268, representing a percentage of 53, had joined the Forces. The amount paid to dependents of employes serving with the Forces totalled £1,437,603, or an average allowance per man of 11s. 4½d. per week. The amount collected on the cars for various national and other objects was £81,509, and tramway employes had contributed £38,170 to various relief funds. On 76 systems women conductors were employed, the number totalling 11,757, and on 18 systems there were women drivers numbering 611. Twenty-six undertakings employed auxiliary drivers, male, these totalling 564.

A French Advisory Council.—According to the "Board of Trade Journal," there has just been published in a French journal the text of a Presidential Decree of September 9th, creating a Conseil Supérieur des Travaux Publics ("Superior Council of Public Works") to examine and advise on the chief technical, economic, and financial questions coming within the province of the Ministry of Public Works (Under-Secretariat of State for Transports). The Council is to consist of (1) the members of the existing Conseil Général des Ponts et Chaussées; (2) members of Parliament and of certain important public and quasi-public administrative bodies; and (3) 21 members appointed by the Minister of Public Works from professional associations concerned in the execution and the development of public works. The Council is to be divided into four sections, of which the first will deal with matters relating to roads, traffic regulation, motor vehicles, and the distribution of electric energy; the second will deal with questions affecting navigation, the management and utilisation of water and water-power (floods, hydraulic works, &c.); the third, with matters relating to ports (works, the regulation of harbours and lighthouses, the provision of buoys and beacons, and coast erosions); and the fourth with matters affecting railways.

After the War.—Dr. Addison, Minister of Reconstruction, addressing a meeting at Huddersfield, said that whatever steps were taken to deal with the problems of reconstruction, we must rely in the main on people helping themselves. The Germans had been busy at the work of reconstruction for some time, and they had been endeavouring in different parts of the world to secure the supply of raw materials that our people would need. They were still making extensive efforts to acquire control of great mineral deposits. They had even tried to buy them in England during the war! Dr. Addison said that the unemployment problem ought not to be so formidable as it looked, but we must prepare to cope with the difficulties that might arise. Over a million men who were fighting would have their places kept open; another large class would be immediately required on shipbuilding and the railways at home and abroad. There would be big demands in many trades, but the provision of raw materials was essential. Shortage of ships had aggravated the shortage of some materials. The more the traders did for themselves to remedy this the better he would be pleased, and he proposed to consult the traders themselves as to how best to do it. It was of great national importance that the manufacturers should overcome their differences and co-operate. The Government had had as one of their chief difficulties the securing of such co-operation. In the past we had not made enough use of brains. Highly trained scientific men who had overcome the difficulties of supplying our armies, had in the past been paid salaries which were a disgrace. Increased productivity was the only way to overcome war's devastation. To secure such increased productivity we needed:—Co-operation between Capital and Labour; better conditions of life; better training; and better industrial methods. One of the chief reasons why Germany had invaded our markets was by organisation in buying and in selling; we must do the same. As a result of his examination of the results in factories where efficiency prevailed, he was able to mention one case where although wages had increased by 20 per cent., production costs had fallen by 20 per cent.

Mr. G. H. Roberts, Minister of Labour, speaking in London on Sunday, referred to plans for the return of soldiers to civil life. He recognised that public opinion would not tolerate procrastination in this matter. The men were recruited for the duration of the war, and they were formulating plans for carrying out that undertaking; but, of course, it would take some time. They might have to enjoin patience, but everything practicable would be done to expedite demobili-

sation. The men for whom situations were waiting would be returned earliest. Every man would have a month's holiday with full pay and full allowances. The men would have the right of unemployment benefit at the rate of at least 10s. per week. They were going to increase the number of Labour Exchanges and extend their functions. In regard to munition workers, the plans were not so complete, but they would be dealt with on very similar lines.

To be Wound Up.—The following company is to be wound up under the Trading with the Enemy Amendment Act, 1916 :—

The Chicago Raw Hide Co., Ltd., Hythe Road, Willesden, London, N.W., machine belting manufacturers. Controller. A. P. Ford, 41, Frederick's Place, Old Jewry, London, E.C.

Exemption Applications.—At the Marylebone Tribunal, Mr. V. J. Malton, aged 29, married, C.2, electrical contractor, of St. John's Wood, applied for further extension. He had been given four weeks' extension to enable him to find work of national importance, but, being offered as a substitute, had refused to take a job because he was offered 9½d. an hour instead of 1s. 1d., the Trade Union rate. The Military Representative said that Malton would be an exceedingly useful man in the Army. The Tribunal thought the man would have been wise to accept 9½d. The Army wanted men who could do the work that he could do. The application was refused.

Bexhill-on-Sea Tribunal, after a review, has granted six months' conditional exemption to W. H. Wakefield (38, B.3), clerk at the Corporation electric light works.

The Hull Tribunal has granted exemption until January 1st to a brake adjuster appealed for by the Corporation tramway department. The man is the only adjuster left for 100 cars.

At Lewes, on a review, conditional exemption held by a shift engineer (26, Class A) at the electric light works was cancelled, and three months substituted. The man stated that he joined the Army two years ago, but was sent back to civil work.

At Buxton, an electrical engineer who appealed stated that he was in poor health, and would break down if he had to join up. He was exempted until March 13th. Similar time was given to two other electricians, and a third had his appeal respite for a month to enable him to secure a Trade Protection Certificate.

Before the West Kent Appeal Court, renewed exemption was sought by F. Butcher (34), electrician, of Bexley Heath. The appeal was dismissed, and time to enable him to wind up his business affairs was refused.

At Deptford, four months' exemption was allowed to E. Brown (39), who is in sole charge of the electrical machinery at a local cattle food works.

At Brighton, a firm of electrical engineers, appealing for an electrician (39, B.2), stated that he was the only man left out of a staff of 18. He was employed on hospital and Government work, and the absolutely necessary installations for business people. Three months were conceded.

At Folkestone, a review was made of the case of A. H. Jenkins (31), chief clerk to the Electricity Supply Co., Ltd. Col. Daniel said that a suitable substitute in the person of a clerk from a bank had been found, but the company would not accept him. The substitution authorities considered that the substitute could have been given a month's trial. On behalf of the company, it was stated that the man sent as a substitute was not fitted for this particular work, and was evidently inefficient. Exemption was continued until a suitable substitute is found. The same decision was arrived at in the case of Mr. Dixon (21), switchboard attendant. In this instance, the substitute offered was 48 years of age, and had left the Twickenham sub-station on the ground of ill-health, and was not fit for any position needing experience and initiative. Other substitutes refused were a man recommended for direct-current work only, and a telephone fitter and jobbing electrician.

Dartford Rural Tribunal has granted six months' exemption to F. H. Luff (30), electrician, of Stone.

At Tring, the Grand Junction Canal Co. applied for exemption for J. Mead (24, Class A), charge hand of the electrical plant at Tring Ford. Exemption until October 7th was allowed.

At Bath, Military appeals were made against E. J. Cooke (35, C.1), electric tram driver, and H. Shrubsole (32, Class A), fitter and spare driver, employed by the Electric Tramways Co. The manager said that Shrubsole, although an inspector, had been doing fitting, &c., owing to the number of men released for the Army. In the case of Cooke, conditional exemption was continued, and in respect of Shrubsole the appeal was allowed, and the certificate of exemption cancelled.

At Southwark, Messrs. Hutton & Hodgson, electrical engineers, applied for the further exemption of F. W. Hutton, son of one of the principals, 26 years old, fit for garrison duty at home (C.1). He was described as an engineer, but Mr. Hutton, sen., claimed that his son was in a certified occupation, as he was a tool setter, having served his apprenticeship to tool making and setting. He was solely employed now on this work. He was granted conditional exemption as being in a certified occupation, on condition that his indentures of apprenticeship were produced for inspection.

BUSINESS NOTES.

The Trade of Guatemala.—The U.S. Consul in Guatemala reports that in manufactures of iron, copper, tin, and lead, and their compounds, the United States supplied during 1916 over 93 per cent. of the import trade, the increase in electrical goods more than equalling Germany's loss; but, he adds, after the war American manufacturers may have to meet vigorous competition in these lines, especially as Germans control the largest electrical installation in Guatemala, and their concession is practically a monopoly. The further development of electric lighting and power in small units on the larger coffee, cane, and other plantations, offers an opportunity that can be safely sought. "Ninety-five per cent. of Guatemala's industrial and agricultural machinery was imported from the United States in 1916. There is a decided preference for American industrial machinery, but as the country is purely agricultural there is little demand for other than repair machinery and small power plants for sawing lumber and cleaning coffee. As the most progressive 'finca's' or plantations are owned or managed by Germans, machinery of German make was preferred before the war. This handicap has been largely overcome, and, with careful handling, the trade can be held by the United States. All the railway material imported in 1916 was of American manufacture, as the railroads of Guatemala are owned by American capital. Other lines are projected, and the market for their supplies will be competitive."

Electrical Affairs in Jamaica.—According to an American Consular report, American manufacturers furnish most of the electrical supplies and equipment used in Jamaica. The imports are grouped separately under two headings, as follows :—(1) Apparatus necessary for generating, storing, conducting, converting into power or light, and measuring electricity; and (2) telegraph and telephonic wire and apparatus. The imports of both groups fall under the list of articles admitted duty free. During 1914 the imports of the first group amounted to £10,250, and in 1915 to £6,804, and the second group to £1,393 and £1,318 respectively. The reason why American equipment represents a large percentage of the imports is that in many instances the original installations consisted of American equipment. In Port Antonio district, embracing the parishes of Portland and St. Mary, there is one electric light plant and one telephone exchange, both located in Port Antonio. Both plants are relatively small, but well equipped. The Port Antonio Electric Light Co. has a capacity of 190 kW., and furnishes electricity for lighting purposes only at the rate of 1s. per kW. There is no demand for electricity for power purposes. The Port Antonio Telephone Co. has 52 instruments installed in the town. Practically all the supplies required by the local trade are handled by the operating company. In general, the equipment is much the same as that in use in the United States, although somewhat antiquated. This applies particularly to lamps, switches, telephone instruments, &c. Electrical accessories such as irons, fans, vibrators, and cooking utensils have no sale, owing to the fact that the local electric light plant operates at night only.

Trade Inquiries.—RUSSIA.—An engineer at Ekaterinodar, who proposes to open, after the war, an office and dépôt for the sale of machinery, &c., desires to receive catalogues, placards, illustrations, photographs for lectures and for lantern slide advertisements from United Kingdom electrical and engineering firms and works manufacturing electrical goods, &c. Name and address can be obtained from the *Department of Commercial Intelligence, 73, Basinghall Street, E.C. 2 (Reference No. 333).

DENMARK.—A Copenhagen firm which intends to inaugurate a commission business wants to get into touch with United Kingdom manufacturers of electric cable, various kinds of wires and wire rope, brass, copper, chinaware, &c. British goods only are to be dealt in to replace German goods, which are still prominent. Activities will be extended to cover Scandinavia, and eventually Russia. Name and address from the Department*, as above (Reference No. 334).

Auction Sales.—MR. T. H. GRIFFITHS will sell by auction on October 3rd, at Longton, Stoke-on-Trent, the premises, machinery, and effects recently in the occupation of Messrs. Adams Bros., electrical engineers, Longton. For particulars see our advertising pages to-day.

THE ASSETS AUCTION CO. will sell by auction on October 3rd, at 129, Newington Causeway, London, the stock of an electrical goods factor. For particulars see our advertising pages to-day.

France.—Under the style of Société Franco-Américaine Scholak, Varda et Cie, there has been formed in Paris, at 6, Avenue Perrichont, a company with a capital of 52,000 fr., for the manufacture of electrical apparatus.

The Société N. Husehard et Cie., of 10, Rue Nouvelle, Paris, electric suppliers, has been dissolved.

There has just been established at Nanterre (Seine), 18, Route de Cherbourg, a company with a capital of 1,500,000 fr., whose objects are the manufacture of all kinds of electric accumulators and their accessory apparatus.

Bankruptcy Proceedings.—OXLEY, H. H. (otherwise Oliver Huxley), consulting engineer, Ealing.—Trustee released September 11th.

Liquidation.—COLSTON ELECTRICAL WORKS, LTD., Bristol.—Liquidator (C. H. King) released September 14th.

Trade Announcements.—MESSRS. L. W. WILD & E. P. BARFIELD have disposed of their rights governing the Wild-Barfield process of steel hardening to Automatic and Electric Furnaces, of 6, Old Queen Street, Westminster, S.W. 1, who are manufacturing and installing complete equipments (furnaces, quenching apparatus, instruments, &c.) for carrying out precision hardening. Mr. Barfield is managing director. An illustrated booklet has been issued describing the equipment.

MESSRS. CREED & CO., LTD., announce that by the mutual agreement of the parties concerned, the arrangements for the acquisition by them of the wireless interests of the Indo-European Telegraph Co. and of the printing telegraph business belonging to Mr. Donald Murray, have been cancelled. The board of Creed and Co., Ltd., now consists of Mr. F. G. Creed (chairman), Mr. W. Arthur Coulson, and Mr. Nicol Paton Brown.

Electrical Trade in the Transvaal.—The Johannesburg Chamber of Commerce, in its review of trade conditions in 1916 in Johannesburg and the Province of the Transvaal, stated that the general feeling in the electrical trade was that, 1916 being the third year of the war, business had been exceptionally well maintained. Indent orders for the heavier electrical goods suffered, but the volume of business was satisfactory, and the increased costs due to manufacturing difficulties, extra freight rates, and insurance had not had an appreciable detrimental effect upon the demand for the smaller lines of electrical machinery, cable and wires, and electrical supplies. The total imports of electrical material into the Union of South Africa, of which about 40 per cent. was shipped to the Transvaal, were £472,287 in 1915 and £715,898 in 1916, divided as follows:—Electric cables and wires, £111,789 and £237,341; electrical fittings, including posts, £182,192 and £298,064; and electrical machinery, £178,306 and £180,493.

These figures include imports from neutral countries. The year was sharply divided into two well-defined periods as regards competition. During the first six months, when there were also considerable stocks available, the competition was quite keen; in the latter portion of the year, with the mining groups once more buying heavily and local stocks becoming gradually depleted, trade was brisk and prices attractive. During 1916, owing to the several causes previously suggested, there was an increase in the price of megohm wires, 30 per cent.; armoured cables, 50 per cent.; and motors, 25 to 30 per cent. There was hardly any difference in the prices quoted for metal filament lamps during 1916, but every indication of a sharp rise in 1917.

Hackney Carbon Contract.—The Hackney Electricity Committee has agreed to relieve the General Electric Co., Ltd., from the obligation of completing the balance of arc lamp carbons due under a contract of 1914, on the condition that the company guarantees to supply the Council with 600 240-volt half-watt type lamps at the list price in force on the date on which delivery may be effected after the removal of the Public Lighting Restrictions, subject to a preferential discount of 28 per cent., and to give such order priority. The company has accepted the condition. The contract for the carbons of different dimensions was at 60s. and 70s. per 1,000 pairs in 1914, but owing to increased cost of material, wages, &c., the ruling prices per 1,000 pairs are now £12 4s. 6d. and £10 respectively, which would mean a very serious loss to the company under the original terms.

Book Notices.—"Tramways and Light Railways Association Journal," September. Contains a copy of the Munitions of War Act, 1917.

Catalogues and Lists.—BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—List No. 2,255 A (eight pages), containing an illustrated description, with tabulated dimensions, of their type DQ continuous-current motors.

MR. GEORGE ELLISON, Wellhead Lane Works, Perry Barr, Birmingham.—Two catalogue lists detailing apparatus recently developed to meet a definite demand; No. 27 (10 pages), gives full description, with illustrations, diagrams, weights and dimensions, and prices in shillings, of disconnectors for A.C. and C.C. circuits up to 750 volts; No. 28 (eight pages) deals similarly with trailing cable sockets and plugs for oil-break gate-end boxes for the same circuits and voltages.

LIGHTING AND POWER NOTES.

Australia.—As terms could not be agreed upon between the Kerang (Vic.) Electric Supply Co. and the local Shire Council for the purchase of the company's electric lighting plant for £5,580, the Council has decided to accept the offer of the Falkner Electric Co. for the supply of a plant at £3,685.—*Tenders.*

Bray (Co. Wicklow).—PRICE INCREASE.—The Council has decided to increase the charge for electrical energy by 10 per cent. to meet the advance in cost of fuel oil.

Bury (Lancs.).—PRICE INCREASE.—The Electricity Committee has decided to advance the charges for electricity for lighting, power, heating, and tramways by the addition of 5 per cent. to each account. The advance comes into operation on October 1st, and the charges will then be 20 per cent. over the pre-war standard for lighting, heating, and tramways and 30 per cent. for power.

Cavan.—The Board of Guardians have communicated with Mr. J. P. Tierney, electrical engineer, Dublin, with regard to the proposed introduction of electric lighting in the workhouse buildings, and the question whether suction gas or oil plant should be used.

Continental.—NORWAY.—The city of Stavanger has decided to take a 10 years' lease of the 12,000 h.p. that is being developed by a private Norwegian company at Florli, on one of the neighbouring fjords, commencing in January, 1918, when the scheme is expected to be in working order. The price is \$12'06 per h.p.-year. Similar leases were effected in 1911, at \$7'50 per h.p., but it is necessary that the municipality should have as much electricity as possible at its disposal, owing to a possible shortage of fuel during the coming winter, as the city's present supply of hydro-electric power is insufficient and the plans for further utilising the available falls which the city owns cannot be carried through for some time. The company's power will be transmitted over very difficult country to the lake where the city's power station is situated, the line being carried on wooden poles straight up over the steep mountain side to a height of about 2,500 ft. above the fjord; one span alone will be a mile long, crossing the Hogsfjord, and saving a distance of 18 miles. The scheme will finally be built for 50,000 volts, but for the present about 30,000 volts will be utilised.—*U.S. Commerce Reports.*

NETHERLANDS.—The increased cost of coal has made it necessary to raise the prices of gas and electricity supplied by the Amsterdam municipal works. Electricity has been supplied, according to the quantity used, at 12 to 15 Dutch cents for light and 8 to 10 for power per kW.-hour. These charges it is now proposed to increase by 5 Dutch cents for light and 1½ cents for power.

Faversham.—PRICE INCREASE.—The T.C. has decided to increase the charges for electricity by ¼d. per unit.

India.—An application has been made to the Madras Government by Messrs. Best & Co., of Madras, for authority to establish an electric lighting and power installation in Madurai, 344 miles from Madras.

Launceston.—PRICE INCREASE.—The T.C. has decided not to oppose the application of the Launceston Electric Supply Co. to the B. of T. for power to charge a maximum of 8d. per unit for the supply of electricity.

Monasterevan (Co. Kildare).—STREET LIGHTING.—The Athy No. 1 District Council has accepted the tender of Mr. R. Griffin for the lighting of this town by electricity, 200-c.p. lamps to be used. A supply of current will be available also for business people and private residents. Hitherto Monasterevan has been lighted by oil lamps.

Morley.—BULK SUPPLY.—Owing to the heavy loss on the Corporation electricity works, several members of the Corporation are of opinion that the time has arrived when the question of purchasing energy in bulk should be considered, instead of generating it as at present.

Newport (I. of W.).—STREET LIGHTING.—The T.C. has accepted the offer of the Electric Light Co. for public lighting until further notice, at a charge of £30 per quarter.

Nuneaton.—PRICE INCREASE.—The T.C. has decided to increase the pre-war charges for electricity by 3¼ per cent. for the quarter commencing September 30th, and to apply for sanction to a loan for money expended on plant, mains, and services.

Oban.—PRICE INCREASE.—The rate for electric lighting has been raised from 7d. to 8d. per unit; for power to ordinary consumers, from 4d. to 4½d. per unit, and to large consumers, from 1½d. to 2½d. per unit; and for heating, from £1 per kW. plus 1d. per unit to £1 per kW. plus 1½d. per unit.

Rochdale.—STREET LIGHTING.—The Electricity Committee is suggesting that the problem of street lighting during the winter shall be partly met by the provision of arc lamps, supplied with current from the tramway overhead wires, on the main tramway routes. In the event of an alarm the lights would be extinguished when the current was switched off from the cars.

Salford.—DOCK EQUIPMENT.—The Manchester Ship Canal Co. proposes to carry out improvements at the Salford Docks, including the putting down of electrical plant for various purposes.

South Africa.—CAPE TOWN EXTENSIONS.—The City Council proposes to erect additional stores, workshops and offices for the E.L. department, at a cost of £16,940, and to install additional plant sufficient for the estimated requirements of the next 25 years, including the electrification of the suburban railway from Cape Town to Simons Town, and the energy required for tramway purposes. The plant that the power station will accommodate, with the alterations and additions now contemplated, it is estimated will deal with a demand of 24,000 kW., being five times the maximum present load. The purchase of the following new plant is recommended:—Additional 3,000-KW. turbo-alternator, £20,000; 1,000-KW. motor-generator for town and dock supply, £5,500; 400-KW. converter for supply of docks, £2,500; one boiler (35,000 lb. of steam per hour), £14,000; one boiler (17,500 lb. of steam per hour), £9,500; steam piping, £2,000; two turbo boiler feed-pumps, £900; wet air filters, £500; extra-high-tension and low-tension switchgear and protective devices, £30,000; additional bank of transformers of 11,000 volts, £2,000; and one of 2,200 volts,

£250; contingencies, £8,460; making a total of £95,610. It is also proposed to spend £68,000 on distribution cables.

JOHANNESBURG: COMPULSORY UNIONISM.—Recently the Amalgamated Society of Engineers notified the T.C. that unless the non-unionists employed at the municipal power station joined the Union or were dismissed, there would be a strike; there were about 200 mechanics employed at the station, of whom all but 14 were members of the Union. The general manager, on the instructions of the Tramway and Lighting Committee, issued a notice calling on all non-union men in the gas and electricity departments to join their respective Unions by July 31st last, or their services would be dispensed with. At a meeting of the T.C., the action of the Committee was discussed, and after a long debate a motion was carried disapproving of the Committee's action, and ordering the immediate withdrawal of the notice. It is reported that the non-union employees have now joined the A.S.E.

DURBAN: YEAR'S WORKING.—At a recent meeting of the Municipal Council, the Mayor (Councillor J. H. Nicolson) said that the electrical department had had another successful year, the revenue totalling £125,000, being £11,000 in excess of the estimates, while it was not likely that the expenditure would be more than the estimated figure, and, after contributing largely to the borough fund and making adequate provision for renewals, sinking fund, &c., a handsome surplus would accrue as a result of the year's working. The units sold would be 22,000,000, as compared with 20,000,000 for the preceding year and 15,000,000 units for the year immediately preceding the war; the figures demonstrated the wisdom of the T.C. in deciding early this year to adopt the borough electrical engineer's recommendation to take steps to increase the power station plant by installing a 3,000-kw. turbine and generator, at an estimated cost of about £20,000, including all accessories. The tender of the British Westinghouse Co. was accepted for this plant, but, unfortunately, the company found they were unable to execute the contract owing to the rapid advance in the cost of materials and labour, and the order was finally placed with the B.T.H. Co. at £14,500, about £150 more than the Westinghouse original price. It was anticipated that the machinery would be installed in such good time that the usual development of the undertaking would not be interfered with.

During the year some difficulty had been experienced in obtaining the necessary supplies on account of the irregularity of shipments, but fortunately last November the present shortage of materials was foreseen by the borough electrical engineer, and heavy stocks of all kinds were bought in, with the result that they were still able to meet all demands both from existing and new customers. For a long time past the only other large municipal electrical undertakings in the country—viz., Johannesburg and Cape Town—had not only had to refuse to make any new connections, but had to restrain customers already connected in their consumption of electricity: one satisfactory aspect of the situation, however, was that the department had been thrown more upon local resources than ever before, and expedients had been adopted bringing into use local productions, which would be of permanent benefit even after the war.

During the year the Council decided to obtain opinions from its consulting electrical engineers in England (Messrs. Merz and McLellan) on a number of points. In the course of their replies, the engineers stated that, in order to arrive annually at the minimum amount which should be set aside out of revenue on account of obsolescence, the following percentages should be taken:—Power station plant, 5 per cent.; power station buildings, 2½ per cent.; underground mains, 1½ per cent.; overhead mains, 2 per cent.; services, nil; sub-station and transformer equipments, 3 per cent.; sub-station buildings, 1½ per cent.; public lighting, electrical instruments and tools, and electric vehicles, nil.

THE RAND.—The chief engineer of the Rand Water Board, in his annual report, states that the policy of shutting down the electrical plant at Swartkoppies and Zuurbekom pumping stations during thunderstorms, as a precautionary measure against damage to the plant and machinery by lightning, has again been followed during the year under review. The plant was shut down on 71 occasions, aggregating a total of 257 hours, and damage to a total amount of £145 was done to the plant. During the previous year the plant was shut down on 100 occasions for a total duration of 230 hours, and damage amounting to £146 was done.

Southend-on-Sea: L.G.B. INQUIRY.—The L.G.B. has informed the T.C. that a local inquiry will be held relative to the application for sanction to a loan of £45,520 for additional generating plant.

Tonbridge: OVERHEAD MAINS.—The U.D.C. has applied to the B. of T. for consent to supply electricity by means of overhead lines outside the present area of supply. The Ministry of Munitions has advanced a loan of £18,130 for electricity extensions.

Walsall: WAR BONUS.—The Committee of Production has decided that the war bonus to male employees of the Corporation gas and electric supply departments shall be increased to 12s. per week for those aged 18 and over, and that in the case of youths and boys under 18 there shall be a further advance of 1s. 6d. a week.

Wharfedale: ELECTRICITY SUPPLY.—At a meeting of the Council, last week, the clerk reported that the Electrical Distribution of Yorkshire, Ltd., was again urging the Council to agree to the company's application for powers for lighting the district. A little while ago the Council was approached, and decided to adopt

a neutral attitude. The clerk had suggested to the Finance Committee that he might meet the company's officers to see whether any new facts could be advanced, and the Council approved of the suggestion.

Willesden: BULK SUPPLY.—The U.D.C. has received a letter from the North Metropolitan Electric Power Supply Co., stating the terms upon which it would be prepared to afford a supply of electricity in bulk for a minimum period of 15 years. The Electricity Committee is not satisfied with the offer, and the company is to be asked to supply energy in bulk for a period of three years from March 31st next at the prices now being paid under the agreement dated March 31st, 1910.

TRAMWAY AND RAILWAY NOTES.

Australia: TRAMWAY STATISTICS.—The progress of electric traction in the Commonwealth during the year 1915-16 is shown in recent figures of transportation issued by the Statistical Branch of the Commonwealth. The advance has been greatest in Victoria, where the mileage route open for traffic increased from 70½ in 1914-15 to 85. Queensland increased its mileage by about two, Western Australia by three, and Tasmania by two miles. The total capital cost of all the systems increased by £926,928, from £12,784,130 to £13,721,058. The energy generated totalled 120,206,835 kw.-hours, compared with 117,127,000 kw.-hours the previous year. The car-miles covered increased from 42,576,000 to 43,335,672; the gross revenue advanced from £2,939,703 to £3,047,736, while the working expenses increased from £2,178,142 to £2,240,611. The number of cars, motors, and trailers increased from 2,120 to 2,165. There are now 13,214 men employed in the service, against 12,223 for the year 1914-15. The total route mileage is 406.

TRAMCAR LIGHTING.—The Melbourne Tramways Board, after investigation of various car-lighting systems over a period of 12 months, has decided to light the cable tramcars by electricity, and tenders have been invited for the equipment of cars, &c., with a storage-battery system, the batteries being charged during the day by dynamos installed at the various car-sheds.

The Prahran and Malvern Tramway Trust reports that the total revenue from passenger fares for the 16 weeks ended June 27th last, amounted to £51,890, car-mileage 869,332, passengers carried 8,009,963, and revenue per car-mile 14'411d.; average operating costs per car-mile 10'619d. The report adds that the equipment of the cars with excess-speed alarms has had the effect of regulating the speed at which cars travel, and of reducing the cost of maintenance of armatures of the electrical equipment.—*Melbourne Age*.

Bradford: WAGES.—The women employees of the Corporation, to the number of 1,400, have applied, through the Council of Municipal Women Employees, for an early revision of the scale of bonus, and ask that the present and any future scale shall apply equally to men and women, contending that the cost of living is as high to women as to men, but that the women's bonus is only 6s. as against the men's 12s. They have secured the support of the local Trades and Labour Council.

Brighouse: WAGES AWARD.—The B. of T. arbitrator's award in a recent application for increased pay by the Corporation employees is not satisfactory to the latter. The award was that the standard rates should stand as they were. Within a fortnight the workers, through their Union, have put in a demand for an increase of 15s. per week. The Corporation, in view of the circumstances, has decided to forward the correspondence to the Chief Industrial Commissioner.

Continental: ITALY.—The Italian Government has made an inspection of the water courses in proximity to the Italian railway lines, and decided that sufficient water power exists for the electrification of numerous lines, thus economising fuel.

Doncaster: WAR BONUS.—The award of the Committee on Production, arbitrating between the Corporation and its employees in all departments in respect of the demand by the latter for an addition of 1s. per day to their wages, grants 4s. per week extra to all men and women over 18 years of age, and 2s. per week to those under that age. Any females whose work brings them under the Munitions Acts are not affected, as they are dealt with under those measures. It is understood that their pay is to be increased to a minimum of 27s. per week.

Edinburgh: NEW TRAMWAY.—The Tramway Committee has had under consideration the proposed electric tramway to Queensferry, and the burgh engineer has been instructed to prepare plans of the proposed routes, and to submit a report to a later meeting of the Committee.

Halifax: FARES.—Tramway fares are again under consideration, a special Sub-Committee having been appointed last week to inquire into and report upon the advisability or otherwise of increasing the fares. The Committee proposed higher fares some time ago, but the T.C. did not agree.

Morecambe.—ELECTRIC TRACTION.—After controversial debates in meetings during several years past, on the subject of the change of the old horse tramway system to some form of mechanical traction (electricity being the most favoured), the T.C. last week, decided in Committee to promote a Bill in Parliament for powers to adopt mechanical traction on the Front and in other parts of the town. In the meantime, as no wholesale transfer from horse to electric power can be made until after the war, the Council further decided to meet present needs by purchasing two electric buses as soon as sanction could be obtained. The vehicles will probably be on the Edison accumulator principle.

Newcastle-on-Tyne.—ELECTRIC VEHICLE.—At a meeting of the Town Improvement Committee of the Corporation, on the 19th inst., it was decided to purchase an electrical wagon for the removal of house refuse, at a cost of £1,123. A statement submitted by the acting city engineer showed that on 41 weeks' working of the present wagon there was a saving of £195 as compared with the cost of horse haulage.

Salford.—YEAR'S WORKING.—The annual report of the Corporation tramways for the year ended March 31st shows gross income 284,443; working expenses, £187,515; allowance to men on service, £16,711; gross profit, £80,217. After deducting payments to local authorities, interest and sinking fund, &c., totalling £79,250, there remains a net profit of £967, which has been carried to the renewals fund. During the year 58,801,870 passengers were carried, an increase of 2,343,604 on 1916; miles run, 5,673,639.

South Lancashire.—FARES.—The South Lancashire Tramways Co., whose system covers about a score of important colliery districts in Southern Lancashire, raised their fares by about 25 per cent., on the average, on Monday. Many hundreds of miners and other colliery workers are affected by the increase.

Venezuela.—La Guaira Harbour Corporation, which owns and operates the Macuto La Guaira-Marquetia Electric Railway, is considering a scheme for developing power from a stream near Galipan. The company's engineer considers that 300 H.P. can be obtained, which will be sufficient to operate the cars and the shops of the electric line and the harbour works.

West Ham.—COMPETITION.—The tramway manager (Mr. Lewis Slattery), in a report, says:—"It is inconceivable why no restriction is placed on competition with tramways; such would not be tolerated with other municipal trading departments. In my opinion, all municipalities should have statutory powers to license and define routes of all competitive services, if such are deemed requisite, and to regulate fares and fix charges for the maintenance of the roads traversed by such services."

TELEGRAPH AND TELEPHONE NOTES.

Canada.—Employés of the G.N.W. Telegraph Co. are striking for equal terms with the Canadian Pacific Co., and 70,000 operators are affected, in offices from the Atlantic to the Pacific.—*Daily Telegraph*.

Postal Servants.—Employés of the Post Office are to present a demand for the raising of their war bonus to 15s. a week for every full-time servant, male or female, and also for its conversion into wages. Up to the present the Post Office Associations have secured war bonuses ranging from 3s. 6d. to 8s.

Wireless Telegraph School.—A school for training wireless operators was opened in Leeds on Monday, in connection with the general campaign for the production of operators for the merchant fleet. It is hoped that Leeds will supply about 200 of them. The school is in an upper storey of premises adjoining the Education Committee's premises. The class numbered 30 at the opening, but further applications are being received daily, and a larger lecture-room is being equipped, containing a complete installation. Mr. R. E. Barnett, head of the Leeds Technical Schools, estimates that the Leeds quota in the present emergency demand will have been supplied to the service in nine months.

CONTRACTS OPEN AND CLOSED.

OPEN.

Kirkcaldy.—October 2nd. Corporation. Converting plant and switchgear. See "Official Notices" September 14th.

CLOSED.

Aylesbury.—U.D.C. Extensions to electricity works: Messrs. Webster & Cannon.

Tonbridge.—U.D.C. :—

Western Electric Co.—Cables.
Bennis & Co.—Stokers, &c.
Willans & Robinson.—Diesel engine and dynamo.
Veritys, Ltd.—Switchboard extensions.

NOTES.

Industrial Development and Research in South Africa.

The honorary committee of scientific and technical men appointed recently by the Government, to advise upon matters concerning the industrial development of the natural resources of the country, of which Mr. Bernard Price is chairman, is taking active measures to ascertain the present extent of knowledge regarding these resources, and to extend and accelerate the work of surveying them. Reports on more than 50 separate subjects have been requested from scientists and others throughout the country, many of whom are Government officials. Advertisements have also been inserted in the public Press, requesting information bearing on the subjects of these reports from all persons who have special knowledge thereon. The reports and data thus obtained will provide a basis on which to initiate further investigation, but without waiting for such information, the committee is already satisfied that an acceleration of certain survey work is urgently needed, and steps are being taken to hasten the completion of the survey of the mineral resources of the country and of water power. In order that the information and data collected by the committee may be widely disseminated for the benefit of the country, and with the object of stimulating industrial development, the committee has recommended to Government that a Journal of Industries should be established. Reports and statistics on various subjects, after publication in this journal, would be abstracted and reprinted in bulletin form, and these bulletins would be obtainable at a nominal price by everyone interested in the subject concerned. The committee is also dealing specially with specific questions referred to it as urgent matters by the Minister of Mines and Industries.—*S.A. Mining Journal*.

Electric Vehicles: A New Zealand Forecast.—The City electrical engineer of Christchurch is reported to have stated that the advent of the storage-battery for vehicular propulsion has opened a new era in that town, where there are already a number of electrically-propelled trucks and vehicles in use. He is of opinion that within five years after the close of the war, the town will have a fleet of five hundred electrically-propelled vehicles.—*Board of Trade Journal*.

Women's Work in Engineering.—There was opened on Wednesday afternoon at the Mappin Art Gallery, Sheffield, by the Lord Mayor of Sheffield, an exhibition of official photographs and samples of women's work in engineering and other industries of munitions of war. The exhibition, which is arranged by the Ministry of Munitions, remains open until October 9th. The collection, which it will be remembered was first exhibited in London and later in several provincial centres, has been considerably enlarged since it was shown at Newcastle. We are sure that our engineering readers in the Sheffield district would find a half-hour or more devoted to a study of these photographs and samples to be time very profitably and educatively spent.

Wages of Central-station Workers.—After considering a report of the proceedings at a Conference held on September 5th at the Ministry of Labour, presided over by Sir George Asquith, between representatives of the Associated Municipal Electrical Engineers (Greater London) and the Electrical Trades Union and the National Union of General Workers, the Hackney Borough Council Electricity Committee reports that there appears to be serious unrest prevailing throughout the electricity undertakings of Greater London at the present time, which is alleged to be mainly due to the delay on the part of various authorities in paying war wages awarded to the shipbuilding and engineering trades by the Committee on Production. "Workmen and junior officers appear to have joined up in the Electrical Trades Union to a very large extent, and this Union, with the National Union of General Workers, is bringing great pressure to bear upon the Ministry of Labour with a view to securing (1) a 48-hour week; (2) increased normal pay equal to what is claimed to be paid in the Post Office, dockyards and other Government works; (3) the Committee on Production's awards in the engineering trades as war wages."

The Committee states that the whole question was carefully considered at a meeting of the Associated Municipal Electrical Engineers (Greater London) held recently, when it was decided that steps should be taken to secure an agreement between the authorities and the Unions as to (a) hours of work, (b) minimum rates of pay, (c) war wages, and that there should as far as possible be uniformity throughout the London area. It was also recommended that each municipal authority in Greater London owning an electricity undertaking should appoint two (municipal) representatives and its chief electrical engineer to form a body which will be authorised (a) to treat with (1) the Electrical Trades Union in respect of uniform payment and conditions for electricians at power stations on the basis of the Union trade-card and in respect of the settlement of the war wages to be added to the wages which may be agreed; (2) the National Union of General Workers (and possibly the Bricklayers' Union and the Workers' Union) for consideration of the wages of the semi-skilled and unskilled men employed at power stations controlled by Councils in the Greater Metropolitan area, having special regard to the possible principle of uniform payments; and (b) to have power to refer points, failing agreement, to conciliation or arbitration.

The Hackney Electricity Committee recommends its Council to appoint two councillors, together with the borough electrical engineer, to act as delegates of and on behalf of the Borough Council upon the proposed body to be formed to treat with employes' representatives.

A Lady Electrician.—According to the *Staffordshire Sentinel*, Miss H. M. Pickston, a lady clerk employed in the chief electrical engineer's office at Stoke, was recently enrolled as the first lady member of the Stoke-on-Trent Engineers' and Engineering Students' Association. Miss Pickston qualified for admission under a recent rule, which requires success in an engineering examination in the case of women applying for membership, by obtaining a pass in the City and Guilds of London Institute examination in electrical engineering.

Calcium Carbide: Ministry of Munitions Order.—The Minister of Munitions has issued an Order taking possession as from September 24th of all calcium carbide in the United Kingdom except individual half-cwt. stocks. Nobody is permitted to sell or supply, except for the purpose of carrying out a contract in writing existing at the above date, or enter into any transaction or negotiation in relation to the sale or purchase of calcium carbide situated outside the United Kingdom, except under special Permit. Monthly returns have to be given of all calcium carbide held by them on the last day of the preceding month, of all purchased or sold by them for future delivery, and all calcium carbide delivered to them during the preceding month. No return is required where the stocks do not exceed half-cwt. Returns have to be sent and applications made, to The Controller of Non-Ferrous Materials Supply, AM2/H, Hotel Victoria, Northumberland Avenue, London, W.C.2.

Electric Vehicles in Siam.—Mr. J. L. Hansen, of the Siam Electricity Co. of Bangkok, Siam, on a visit to the United States, informed the National Electric Light Association that his company had a fleet of five electric vehicles, two of which had been in use since 1901. These 13-year-old veterans are used for lamp delivery, while the larger trucks are used by wiremen, and for various other purposes. They are successfully operated by un-

Russian Grant for Coal-Saving Electric Plant.—At a recent meeting of the Russian Provisional Government, a proposal of the Ministry of Ways and Communication was approved, granting 32,000,000 roubles for the construction of plant for using the water power of the River Volchoff. The installation of an electrical plant on the Volchoff will make it possible to economise 10,000,000 poods of coal a year, by which quantity the national trade balance will be improved.

American Copper Prices.—The *Daily Telegraph* correspondent in New York states that the agreement reached between the producers and the Government fixes the price of copper for the next four months at 23½ cents per lb., this price to be available to the United States and the Allied Governments and the public alike. "It is stipulated further that the producers will not reduce the wages of the miners, that they pledge themselves to maintain the maximum production, and prevent copper falling into the hands of speculators. Copper at 23½ cents is 3 cents below the existing market, more than 10 cents per lb. under the prevailing prices when the Government first undertook to fix the price, and about 10 cents above the pre-war average price. Generally speaking, the price is considered to be a fairly workable one, especially for large producers. Above all, the terms of the announcement indicate that the Government does not intend to reduce prices indiscriminately, but will endeavour to secure satisfactory agreements with the producers of raw materials, rather than enforce arbitrary price reductions by legal or administrative action."

Industry and Education.—A meeting will be held at the Institution of Civil Engineers on October 25th, at 3.30 p.m., for the purpose of considering the establishment of a central organisation for improvement in, and better co-ordination of, engineering training and the appointment of a representative Committee of engineering and educational interests to initiate action. Sir Maurice Fitzmaurice, C.M.G., president of the Institution of Civil Engineers, will preside, and representative engineers and educationalists have signified their intention to be present. Those interested are requested to obtain invitations from Mr. A. P. M. Fleming, British Westinghouse Co., Trafford Park, Manchester, or Mr. A. E. Berriman, chief engineer, Daimler Co., Coventry, who are acting as honorary organisers for the Committee responsible for arranging this meeting.

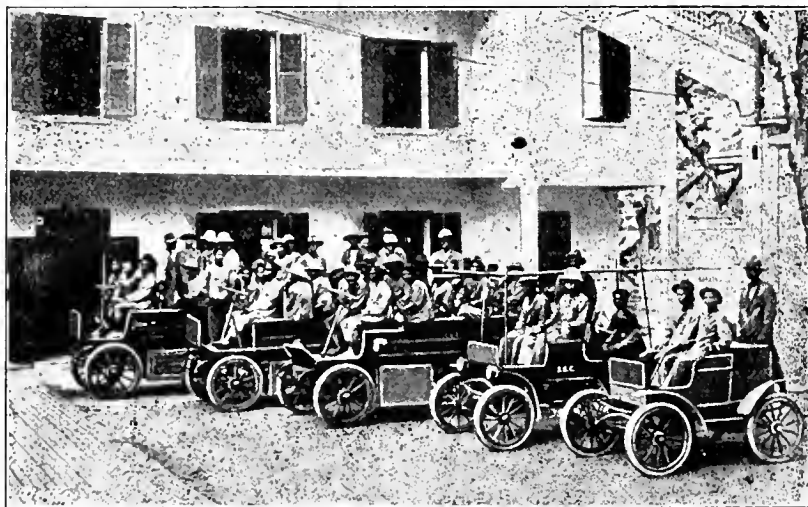
Engineering is one of England's most important staple industries, and it is of the greatest national consequence that all who are engaged therein from bottom to top should be representative of their highest respective types; this can only be secured when the proper purpose and value of education are not only recognised, but achieved, in the widest sense of the term.

Although engineering training has made great strides in the last 20 years, largely owing to the growth of provincial Universities and technical schools, and to the good influence of some of the more important engineering Institutions, it is a fact that the link between industry and education is not forged as closely as it should be in the interests of the State, and a strong nucleus of opinion has grown in favour of forming a central organisation for the purpose of promoting co-ordination as the best means to secure the improvement that is desired.

Household Coal.—All registered coal merchants in the metropolitan area have a stock of requisition forms, under the Household Coal Distribution Order, for every kind of house or premises. Application should be made by consumers to their usual merchant for these forms and further explanatory information. Any information which cannot be obtained in this way, can be afforded by the local coal overseer for the district in which the consumer resides. Each local authority in the metropolitan area has appointed a coal overseer, whose address can be obtained from the coal merchants. This address is usually at the Council Offices. It is not necessary that applications for forms and routine information should be addressed to the Metropolitan Coal Distribution Branch of the Coal Mines Department.

A Remarkable Defence.—Our correspondent at Cape Town writes:—"Charged with the theft of a motor from his employers, a respectably-dressed European youth made rather a remarkable defence. He explained to the magistrate that the motor used to catch fire when switched on, and a friend of his who was an electrician told him that it was a direct-current motor, and that 'we had turned on the alternating current'; he took the motor home for repairs, and it was now in perfect working order. Accused was reprimanded and discharged. The point is, however, that the building from which the motor was taken has no alternating-current supply, and no evidence appears to have been called as to this."

Sub-Station Attendants.—The twelfth course at the Northampton Polytechnic Institute for giving a preliminary training to disabled sailors and soldiers as sub-station attendants has just been completed, and a number of the men are awaiting vacancies. Engineers of supply undertakings having vacancies are invited to communicate immediately with Dr. R. M. Walmsley, Principal of the Northampton Polytechnic Institute, Clerkenwell, London, E.C. 1.



THE SIAM ELECTRICITY COMPANY'S ELECTRIC VEHICLES.

skilled natives, and are found to be as economical a means of transportation in Siam as they are in this country. This electricity supply company is especially interesting, since it is not dependent on coal as fuel, but uses rice husks in its place, which is obtainable in almost unlimited quantities at a small cost. To provide against a shortage of rice husks the company keeps an oil tank for reserve fuel, but it is rarely needed.

Electro-Harmonic Society.—The first smoking concert for the 1917-18 session of this Society is to be held on October 12th, at 8 p.m. The concerts are to take place in the Venetian Chamber of the Holborn Restaurant, on Fridays, as follows:—

October 12th. Smoking concert.
November 16th. Ladies' night.
December 11th. Smoking concert.
January 11th, 1918. Smoking concert.
February 15th. Ladies' night.
March 15th. Smoking concert.

Volunteer Notes.—COUNTY OF LONDON VOLUNTEER ENGINEERS (FIELD COMPANIES).—Headquarters, Balderton Street, Oxford Street, W. 1.

Orders for the week, by Lieut.-Colonel Clay, V.D., commanding:—

Officer for the Week.—Lieut. W. J. A. Watkins.

Monday, October 1st.—Drill and Elementary Bridge Construction for No. 3 Company, Right Half Company, 6.30. Signalling Class, 6.30. Recruits' Drill, 6.30.

Tuesday, October 2nd.—Physical drill and bayonet fighting, 7.30.

Wednesday, October 3rd.—Drill and Elementary Bridge Construction for No. 1 Company, 6.30.

Thursday, October 4th.—Drill and Elementary Bridge Construction for No. 2 Company, 6. Signalling Class, 6.30. Ambulance Class, 6.30.

Friday, October 5th.—Drill and Elementary Bridge Construction for No. 3 Company, Left Half Company, 6.30. Recruits' Drill, 6.30.

Saturday, October 6th.—Commandant's Parade for Route March and Drill. Parade at Headquarters, 2.15 p.m. Uniform. Recruits' drill, 2.30, with Corps Parade for Route March.

Musketry.—The Range at Belvedere Road will be open on Tuesdays, Wednesdays, and Thursdays, every evening between 5.30 and 7 p.m. All N.C.O.'s and men who have signed the "A" and "B" agreements are required to attend during this month to re-classify in order to enable the Corps to obtain the Capitulation Grant. Preference will be given to those N.C.O.'s and men in firing. This does not apply to those who hold the proficiency badge.

By order: MACLEOD YEARSLEY, Capt. and Adjutant.

Russian Prices for Electrical Energy: Increase Authorised.—The Board of the Russian Electricity Department has prepared a project for varying the conditions for the delivery of electric current by central stations for public use, owing to the increased cost of raw materials, &c. Central stations, both private and municipal, are authorised to increase their prices according to a scale and conditions published along with this announcement. A certain proportion of increased profits consequent on this widening of price limits is to go to the Government.

Hydro-Electric Power in New Zealand.—The development of hydro-electric power was discussed by Mr. E. Parry, chief electrical engineer to the Public Works Department, at a Conference of the Council of Agriculture at Wellington. He held that the cost of any system of electric power distribution would be recovered within four or five years. In other words, the coal saved would be sufficient in that time to pay for the establishment of the plant. He supported his statements by showing what was being done on the Lake Coleridge system as applied to rural requirements for light and power, and said that this was only an example on a limited scale of what should, and he believed would, apply to the whole of the Dominion. He did not mean that less coal would require to be mined. On the contrary, the demand would be increased, and the collieries would be much more readily developed. Low-grade, refuse coal could be gasified at low expense, and so used through the agency of electricity. From peat, ammonia and oils could be extracted in connection with a system of electrical distribution. With a general system of electricity supply it would be a simple matter to develop and utilise the smaller and more uncertain water courses. With respect to electricity in agriculture, Mr. Parry showed that production could be greatly increased. Its application already had proved a paying proposition for the Government in the Taitapu district. In fact, the country was a better customer for electricity than the town, applying it to so many and various purposes, apart from lighting. Electricity as a motive power for all farm purposes was undoubtedly suitable. He hoped trials would be made at Lincoln College of electric ploughing. Milk could be sterilised by electricity, although at the moment it was in the nature of an experiment. A trial was being made of checking frost in orchards by electricity, with good prospects.—*Auch. Weekly News.*

An Electrical Canteen.—*La Nature* for September 8th prints some particulars of a type of canteen which is the most original of its kind in France. This electrical canteen has been equipped on most modern lines at the works of M. Citroën, a manufacturer engaged on Government contracts. Everything that can be done by means of electricity is so carried out in this model mess-room. The food is cooked in electric ovens, kept hot on a series of electrically-heated hot tables, and served by waitresses on electrically-driven trolleys.

Electric fans and ozonisers are installed in the dining rooms, thus adding to the comfort of the workpeople. It is claimed that it is possible to serve 2,700 meals in less than half an hour, and by having three sittings some 8,000 breakfasts or dinners can be provided. The kitchen staff numbers only 18 persons. The cost per meal—even with the high prices at present ruling in France—works out at 1.50 franc (say 1s.). Details are not given of the actual electric equipment.

Germany and Raw Materials for After-War Trade.—In its column "Through German Eyes," the *Times*, on August 28th, referred to Germany's discussion of the problem of raw materials in connection with reconstruction schemes, as follows:—"The German industrial and commercial interests are never tired of discussing plans for resuming operations with the utmost possible speed when the war is ended and the blockade is raised. Such discussions are especially lively when German 'peace offensives' are in progress. The Association of German Chambers of Commerce has now published a long resolution on the much-disputed question of the importation and distribution of raw materials. It appears that German traders are all very anxious to escape as soon as possible from Government control, but it is universally recognised, on the other hand, that, owing to the depreciation in the value of the mark, uncontrolled trading with foreign countries will be impossible. There are also disputes between traders who have concluded bargains for the supply of raw materials from foreign countries and traders who want all available supplies to be divided by the State. The compromise recommended by the Chambers of Commerce may be summarised as follows:—The removal of restrictions on trade is of the greatest importance for Germany's international trade. Restrictions upon the importation of raw materials should be confined to measures which are necessary for economising the resources of German shipping and German railways, and for raising the value of the mark. Where restrictions are necessary, they should be applied to any other goods rather than to important raw materials. The State should not attempt to control individual bargains by refusing means of payment, but should do everything possible to facilitate payments by means of foreign loans and credits and foreign money. During the period after the conclusion of peace, during which scarcity of raw materials continues, it is necessary, 'for social reasons,' to distribute raw materials as equally as possible, according to the capacity of particular concerns and the extent of their activities immediately before the war. The various industries should establish their own distribution centres, but these centres should not be given any monopoly of freight space and foreign money; they should 'leave the importation of raw materials as much as possible to free trading'; care must be taken to guard the respective

interests of industry and trade. It is insisted that the compulsory fusions of businesses which have been effected under the Auxiliary Service Law should be abandoned immediately after the end of the war. The Chambers of Commerce are holding out against legislation which would compel employers to take back former employes on their return from the war. They express general approval of the Government proposals for demobilisation, and say that, in particular, it is much better to retain men with the Colours for a maximum period of four months, or until they have obtained definite employment, than to attempt any ambitious scheme of support for the unemployed."

Lighting Restrictions.—At Colne, on Monday, Mr. Alfred George Cooper, the borough electrical engineer, was fined 6s. for a breach of the Restriction of Lighting Order.

Appointments Vacant.—Testing assistant (45s.), for the Islington B.C. Electricity Department; book-keeper and invoice clerk (€110), for the Walthamstow U.D.C. Electricity Department; charge engineer for the North Metropolitan Electric Power Supply Co.'s Power Station, Willesden; general clerk for the Aberdare U.D.C. Electricity and Tramway Department; senior clerk (€160) for the Borough of Salford Electricity Department; switchboard assistant for the Stepney B.C. Electricity Department. See our advertisement pages to-day.

Fleetwood Council proposes to appoint an assistant electrical engineer at €150 per annum, rising to €175 in six months.

Organisation of Power Station Engineers.—We are informed that on Friday last, at a meeting of electric power engineers in the Birmingham district, it was decided that the Midland Electric Power Supply Engineers' Association be formed. It is proposed that the Association shall embrace the whole of the Midlands, and, later, join with similar organisations in other parts of the country. A further meeting will be held at Queen's Chambers, Snow Hill, Birmingham, on Friday, October 5th. Full particulars can be obtained from the hon. sec., Mr. P. J. Burgess, 21, Geraldine Road, South Yardley, Birmingham.

The C.A.V. New Electric Starter.—On Tuesday last a demonstration was given at the works of Messrs. C. A. Vandervell and Co., Ltd., Acon, of their new geared type of electric starter for motor-cars. The starter embodies an ingenious combination of two main principles with which the motor world is familiar—namely, the axial pull upon an armature which is not symmetrically situated with regard to the field magnets, and the use of a pinion working on a screw thread cut on the armature spindle; when the current is switched on, the armature moves axially and draws the pinion into contact with a gear on the fly-wheel, and as the armature revolves the pinion drops into mesh, and moves along the thread until fully meshed, when it is positively driven by the armature, and accelerates the fly-wheel. Directly the engine starts, the fly-wheel overtakes the pinion, and causes it to run back and disengage the gears. The starter is controlled by a plunger switch with two positions; the first starts the motor slowly and engages the gears, and when the plunger is pressed home the full power of the motor is applied. In the first position a momentary "dwell" is caused by a ball, backed by a spring, entering a recess in the spindle of the plunger. The whole operation is automatic and noiseless; the full power of the motor cannot be applied until the gears are fully meshed; no damage can possibly result from backfires, and the disengagement of the pinion when the engine starts is automatic and certain—once the engine is running it is impossible for the gears to remain in mesh. We are informed that the current consumption is extremely low; the starter is very light, strong, and simple, and no adjustment is required. It is made in three sizes, for cars and engines, ranging up to 150 H.P., and judging by the samples which we saw, it is extremely well designed and constructed.

On the same occasion we were privileged to make a tour of Messrs. Vandervell's works, which have been greatly extended, and are occupied with a variety of very important work; the completeness and efficiency of the organisation of the establishment were conspicuous features, and reflected the greatest credit on the staff of the company.

A descriptive pamphlet relating to the new machine appropriately bears the title, "Electric Starters—C.A.V."; as pioneers of the electric lighting of motor-cars in 1900 and of the variable-speed dynamo in 1904, the firm undoubtedly are "electric starters," and we may add that they are making the running and are certain winners.

Patents and Alien Enemies.—A list of some 24 German patents, mainly owned by the firm of Robert Bosch, is given in the *Illustrated Official Journal (Patents)* for September 26th, in respect of which application has been made to the Board of Trade by the British Lighting and Ignition Co., Ltd.

Electric Voting Machine.—The Argentine Government has been inviting tenders for the designing, manufacture, and installation of an electrical voting machine for the Chamber of Deputies of Argentina.

A Swansea Strike.—The *Times* says that a strike of steel workers at Briton Ferry, near Swansea, which arose over the dismissal of a foreman electrician, over 1,000 men being affected, has been settled, the men, after a conference with representatives of the Ministry of Munitions, deciding to resume the matters in dispute to be referred to arbitration.

The Belfast Strike.—When the case of the 32 employes of the Belfast Electricity Department was again before the Belfast Munitions Tribunal on September 18th, it was stated that since the order adjourning the cases was made, the men, in accordance with their undertaking, had returned to work, and there had been no cause of complaint against them since. The President adjourned the case for another six months, to see if they would keep their undertaking. He said he hoped that the men would remember that for the offence they had committed they were liable to heavy penalties, and the question of whether or not those penalties would be imposed would depend largely on how they conducted themselves in the meantime.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station and Tramway Officials.—The Rochdale Tramways Committee has unanimously recommended that the salary of MR. G. WEBSTER, the general manager, shall be increased from £450 to £500. A return submitted showed that the existing remuneration was below the average paid in towns similar to Rochdale, and warm appreciation of Mr. Webster's services was expressed by members of the Committee.

MR. J. WILKINSON, tramway electrical engineer, Hull, has returned to business after a serious illness of several weeks' duration, and will be glad if his business friends will note his new address:—Tramway Power Station Buildings, Osborne Street, Hull.

MR. J. A. RAYNER, manager, Galway Electric Light Co., has been presented with a gold watch by the employes, and with a smoking cabinet by the Galway Rowing Club, on his leaving for Hereford. His successor in the Galway managership is Mr. Collins, of Dublin.

MR. HAROLD WM. SANDERS, A.M.I.Mech.E., chief draughtsman, Manchester Corporation Electricity Department, has been appointed assistant constructional engineer to the City of Birmingham Electric Supply Department, Dale End, Birmingham.

MR. C. J. TURNER, chief engineer and manager of the Hoylake and West Kirby U.D.C. electricity department, was recently granted a commission as lieutenant, R.N.V.R., and on the occasion of his leaving to take up his duties as electrical officer in the R.N.A.S. he was presented with a case of pipes and a cigarette case by the staff.

General.—MR. JOSEPH FLANAGAN has been appointed electrical engineer to the Tees-Side Bridge and Engineering Works, Ltd., Middlesbrough.

GOLDEN WEDDING.—The many friends of ALD. BRUCE, chairman of the Sunderland Electricity and Lighting Committee, will be pleased to learn that on Monday next, October 1st, he will celebrate his golden wedding, and will join us in congratulating him on that happy occasion. Ald. Bruce was elected a member of the Sunderland Council in 1879, and was elected an Alderman in 1896. He was Mayor of the borough for two years (1897-8), and has been chairman of the Electricity and Lighting Committee since its formation, about 23 years ago (which is probably the longest record for a chairman of an Electricity Committee, unless Ald. Pearson, of Bristol, can claim to beat it). He was a member of the I.M.E.A. Council from 1905 to 1914, when he retired under the new rule that requires a member to retire for at least one year; he is also a director of the Municipal Mutual Insurance Association. Two of his sons are serving in France, both being lance-corporals, and the younger has been awarded the Military Medal. Under his wise guidance the Sunderland undertaking has been developed into a large and prosperous concern, and we trust for many years to come it will have the benefit of his matured experience and sound judgment.

Roll of Honour.—SAPPER ALBERT PENNY, R.E., who has died of wounds, was employed at the Salford Corporation electricity department.

PRIVATE S. D. DALBY, A.S.C., M.T., who has died from appendicitis in South Africa, was employed by Mr. George Newby, electrical engineer, Bradford.

MR. W. J. LARKE, assistant chief engineer at the Rugby Works of the B.T.H. Co., and lately engaged at the Ministry of Munitions, has been appointed an officer of the Order of the British Empire.

PRIVATE CECIL R. GIBBONS, Lancashire Fusiliers, killed in action, aged 20, was employed at the British Westinghouse Works, Trafford Park.

CORPORAL ARTHUR HALLIWELL, R.F.A., who was recently awarded the Military Medal, is in hospital in France, wounded. He was employed by the Lancashire Electric Power Co.

DRUMMER W. KIRKMAN, Royal Welsh Fusiliers, who has died of wounds, aged 32, was employed at the Bolton Corporation electricity works.

PRIVATE THOMAS TURNER, Duke of Wellington's Regiment, who has been killed, was employed at the Phoenix Dynamo Works, Bradford.

On Thursday, last week, at the Ediswan Works, LANCE-CORPORAL W. A. PRIME, of the 11th Batt., Middlesex Regiment, who was formerly employed in the Ediswan glasshouse, stamping and furnishing shops, was presented with an illuminated address, a gold watch, and a sum of money by Mr. J. W. Elliott, on behalf of the staff. Lance-Corporal Prime is only 18 years of age, but

won the Military Medal on February 26th, 1917, and was wounded at Arras on April 10th, losing his right foot.

SECOND LIEUT. WM. H. PALMER, R.F.C., who met his death at Lincoln while flying, owing to the petrol-tank igniting, was an electrical engineer, trained at Finsbury College. He was the only son of Councillor W. H. G. Palmer, of Kingston-on-Thames.

SIGNALLER P. O. MEARS, London Regiment, aged 19, who has been killed in action, was a draughtsman with the Western Electric Co., Ltd., at North Woolwich.

CAPT. R. J. ROONEY, R.E., who was wounded by a bomb at the Front, and whose death has just been announced, was an electrical engineer practising in Scotland.

Obituary.—We regret to learn that Mr. C. M. Dorman, of Whitehall, Brooklands, Cheshire, chairman of Messrs. Dorman and Smith, Ltd., electrical engineers, Salford, has lost his only son, SAPPER HAROLD MARK DORMAN, R.E. Sapper Dorman, who was 19 years of age, and was stationed at Marlow-on-Thames, was accidentally drowned near Boulter's Lock, on September 9th.

The death has taken place, at the age of 64, of MR. WILLIAM ROBSON, of Messrs. Wm. Robson & Sons, electric lighting engineers, of Kirkdale, Liverpool.

The death has occurred of MR. ARCHIBALD WILSON, one of the partners of the firm of Messrs. King & Co., Leith Electric Works, Edinburgh, as the result of an accident on Saturday evening. Mr. Wilson was riding his motor bicycle, and collided with a commercial motor lorry. He joined the firm 26 years ago.

CITY NOTES.

German Companies.

The directors of the *Deutsche Elektrizitäts Werke Garbe, Lahmeyer & Co., of Aix-la-Chapelle*, recommend a dividend of 6 per cent. for 1916-17, this comparing with 5 per cent. in the previous year.

The Kabel Werk Rheymdt, A.G., of Rheymdt, proposes to pay a dividend of 20 per cent. for 1916-17 on share capital of £250,000, as contrasted with 30 per cent. in the preceding year. At the same time the share capital is to be increased to £350,000.

The Internationale Stickstoff A.G., of Wiesbaden, which has had a nominal share capital of £103,000 since reconstruction in 1913, and had a debit balance of £46,000 at the end of 1915, is again to be reorganised by the reduction of the capital to £27,000.

The Hamburgische Elektrizitäts Werke A.G., of Hamburg, reports a large increase in working expenses in 1916-17, and a decline in the net profits from £88,000 in 1915-16 to £52,000 last year. The dividend on the ordinary capital of £1,100,000 is proposed at 3 per cent., as contrasted with 6 per cent. in 1915-16, 11½ per cent. in 1914-15, and 8½ per cent. in 1913-14.

The Fabrik Isolierter Drähte (late C. J. Vogel), of Berlin, has decided to increase the share capital by £112,000 to £375,000, for the purpose of defraying the cost of additional machinery for the new works at Köpenick. The new shares are to be offered to present shareholders at the price of 148 per cent., they having already been taken over firm by a banking syndicate at 140 per cent.

The Akkumulatoren Fabrik A.G., of Berlin and Hagen, reports that the undertaking at Milan has been disposed of, and the value of the other interests in enemy countries has been entered in the accounts for 1916-17 at figures which exclude any risks. After allocating £4,000 to depreciation, as against £3,400 in 1915-16, the net profits are returned at £193,000, as compared with £138,000, permitting of the payment of 25 per cent., as contrasted with a dividend of 20 per cent. in the previous year.

The Isaria Zähler Werke A.G., of Munich, which belongs to the Brown-Boveri group, reports that in addition to the army orders received in 1916-17, the company endeavoured to increase the output of peace products as far as possible, these still forming the greater portion of the production. It was, however, impossible for sale prices of meters to keep pace with the growth in the cost of raw materials and of wages. After setting aside £11,000 for depreciation, as against £6,000 in 1915-16, the accounts show net profits of £24,000, as compared with £21,000. It is proposed to pay a dividend of 12 per cent., as contrasted with 10 per cent. in the preceding year.

Victoria Falls and Transvaal Power Co.

Mr. A. E. HADLEY presided at the annual meeting, held in London last Friday. He said that the net earnings were £70,000 higher than last year, enabling them to pay 5 per cent. on the ordinary shares, and to raise the dividend on the participating preference shares to the full amount to which they could become entitled, namely, 10 per cent. They had transferred from the balance standing to the credit of the profit and loss account as at December last £150,000 to a reserve fund, which was available to meet contingencies that might arise, to improve the property, to equalise dividends, or for any purpose conducive to the interests of the company. For the first time there was a reduction in the amount of the first debentures; the amortisation at the rate of 5 per cent. per annum fixed by the trust deed had now come into operation, and the amount of the first debentures drawn or purchased was £152,100. Dur-

ing the year a further £75,680 of second debentures had been redeemed by purchase. The position with regard to excess profits in the United Kingdom was clearer than last year, the pre-war percentage on capital having meanwhile been settled, and it had not been considered necessary to make any provision under that head in the 1916 accounts. Since the close of the accounts the financial legislation in South Africa had been greatly modified, throwing a heavier burden on the taxpayer. The modifications, while involving a reduction in the rate of the old income-tax, imposed a dividend tax, together with an excess profits duty at the rate of 25 per cent., calculated on the same general principles as adopted by this country. The taxation was retrospective, so as to apply partly to 1916, and a provision had been made to meet the charge in the accounts now submitted. In regard to engineering matters, the station generating plant for electric power and compressed air had run successfully and been well maintained during this period. The overhead transmission and distributing lines, and the consumers' sub-station plant, together with the compressed air pipe line, had been operated satisfactorily, and had been kept in a good state of repair. There had been no extension to the generating or distributing plant, other than a small pole line extension to a new consumer in the Brakpan area, the Sub-Nigel Co., the capacity of the generating plant being 270,680 h.p. The quantity of water for condensing purposes accumulated in the dams at the various generating stations remained normal, and showed no sign of shortage. The supply of engineering spare parts had presented difficulties, owing to the shortage of supply from this country, but this had been overcome in some cases by the increased output from the company's engineering workshops, while the provision of general engineering stores had, in spite of the difficulties of supply, been maintained. The prosperity of the company being so closely interwoven with that of the gold mining industry on the Rand, they had reason to follow with feelings of admiration the successful manner in which, in spite of the difficulties created by the war, the output of gold and the general activity of the mines had been maintained. The extra cost of materials, increased wages, taxation, and fluctuations in the supply of native labour impose heavy burdens both on their consumers and themselves, while neither of them was in a position to raise the price of its product. The foresight and energy displayed by those responsible for the conduct of the mines, assisted by the sympathetic attitude of the Imperial and Union Governments, had enabled these difficulties of obtaining the necessary materials to be overcome, and had prevented the supply of gold from the reef, so essential to the conduct of the war, from falling away. Naturally, these war conditions were reflected in the working costs, and were felt most severely by those mines working low-grade ore; but, nevertheless, by good management these mines had been kept working, and such mines as had been shut down during the period under review had either come to an end of their ore, or had closed through causes normally incidental to mining. The developments in the Far Eastern Rand, where several of their largest consumers were situated, continued to be satisfactory, and during the year the Union Government had leased two further areas in this part of the Rand, both of which were acquired by existing mining houses. The chairman expressed appreciation of the work of the company's staff and their associates.

In replying to shareholders' questions, the chairman said he could not at present make any statement about the prospect of an increased ordinary dividend. The profits for the present year had been going practically the same as last year.

To be Struck Off the Register.—The following companies will be struck off the register in three months unless cause is shown to the contrary:—

Absorbent Engine Cloth Co.
Eastern Electric Co.
Electrical Engineering & Motor Co. (Carlisle).
Marine & General Oil Engines.
Standard Bolt & Nut Co.
Transport Development & Power Syndicate.
Vanadium, Ltd.
X.L. Electric Co.

Stock Exchange Notice.—Application has been made to the Committee to allow the following to be quoted in the Official List:—

Electro-Bleach & By-Products, Ltd.—120,000 ordinary shares of 10s. each, fully-paid, Nos. 1 to 120,000.

Calcutta Electric Supply Corporation, Ltd.—The units sold to consumers during the four weeks ended July 27th were 2,307,315, compared with 2,020,562 in the corresponding four weeks of 1916.

NEW COMPANIES REGISTERED.

Abrasives, Ltd. (148,486).—Private company. Registered September 19th. Capital, £10,000 in £1 shares. To carry on the business of manufacturers and factors of, agents for, and dealers in, metals, emery, emery stone, corundum, abrasives, polishing wheels, and the like, mechanical, electrical, and general engineers, &c. Agreement between J. S. Mitchell and B. R. Rowland & Co., Ltd., of the first part, W. M. Rowland of the second part, and the company of the third part. The subscribers (each with one share) are:—J. S. Mitchell, Hyland, Hargate Drive, Hale, Altrincham, Cheshire, engineer; W. M. Rowland, 24, Lancaster Road, Birk-

dale, Southport, engineer. The first directors are:—J. S. Mitchell and W. M. Rowland. Solicitors: Matthew, Hall & Thomson, 26, Victoria Street, Manchester.

E. O. S. Engine, Ltd. (148,451).—Private company. Registered September 13th. Capital, £1,000 in 41 shares. Mechanical and electrical engineers, &c. The subscribers (each with one share) are:—G. Patteson, Pinners Hall, E.C.2, accountant; T. S. James, 16, Edith Road, Peckham, S.E.15, engineer. The first directors are to be appointed by the subscribers. Solicitors: Francis & Johnson, 19, Great Winchester Street, E.C.2.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Alfred Danks, Ltd.—Memorandum of satisfaction in full on September 3rd, 1917, of mortgage debenture dated May 6th, 1916, securing £6,000 has been filed.

Gorseion Electric Light Co., Ltd. (39,944).—Capital, £10,000 in 41 shares. Return dated August 8th, 1917. 9,350 shares taken up; £2 paid; £9,348 considered as paid. Mortgages and charges: £780.

D. Hulett & Co., Ltd. (29,163).—Capital, £35,000 in 45 shares. Return dated August 8th, 1917. 6,000 shares taken up; £9,500 paid on 1,900; £20,500 considered as paid on 4,100. Mortgages and charges: Nil.

General Electric Co., Ltd. (67,307).—Capital, £1,400,000 in 80,000 pref. and 60,000 ord. shares of £10 each. Return dated July 31st (filed September 6th), 1917. 70,000 pref. and 50,000 ord. shares taken up; £880,000 paid on 63,000 pref. and 25,000 ord.; £320,000 considered as paid on 7,000 pref. and 25,000 ord. Mortgages and charges: £200,000.

STOCKS AND SHARES.

TUESDAY EVENING.

THE City awaits with keen interest the Government's declaration with regard to more borrowing. In some quarters a new popular Loan is considered so imminent as to lead the prophets to look for its issue this week-end. In other directions, it is thought that the Loan may be postponed until after Christmas. The only effect that the discussion exercises upon current prices is in the Consol market, where the tone has softened somewhat. All other investment sections are very hard, while in some markets speculation is boisterously active.

Home Rails are enjoying one of their rare and lucid intervals, with prices firmer, and business more pronounced. The reason seems to be that other domestic investments of sober class are becoming difficult to find, while the Railway stocks of companies operating outside Great Britain are all out of favour for one reason and another. This tends to drive investment money into the Home Railway list, and the Undergrounds receive their due heed of attention. Amongst them, Central London assented stocks are noticed for their yield, and rises of 2 points have lifted the ordinary and the preferred ordinary to 60½. Metropolitan Consolidated advanced to 24½, but reacted to 23½; the company's deferred dividend stock is up 1 to 21. Underground Incomes remain at 82, from which price they will probably advance; the tide of London's traffic reminds one forcibly of the old lady who aroused the concern of the elder Mr. Weller at the famous tea-party.

The electric lighting market is firm, Bromptons holding their rise at 6½, and Metropolitans gaining 5s. at 65s. The demand for debenture stocks and preference shares is perhaps rather less insistent than it was, for which the coming of the new War Loan is doubtless responsible. People want to see what its terms will be before putting much money just at present into gilt-edged securities. But there is no pressure to sell, and the buyers of ordinary shares are as alert as ever for cheap stock. The sleepy special constable wonders where all the London searchlights draw their "juice," as he watches their beams while he is on duty; wonders too, it may be, if readers will forgive a short article as he sits down to it after the "All Clear" releases him for burning midnight oil of his own.

Marconis have developed renewed buoyancy, which arose first in the shares of the Marine Co., taking the price to 54s. before a slight reaction occurred. The parent shares rose to 66s. 3d., Americans to 19s. 3d., and Canadians to half a guinea. Business in Marconis is so spasmodic as to render an observer cautious of saying much about it, but the market view is certainly optimistic.

The telegraph group has no fresh feature this week, business being handicapped by the scarcity of supply of stock obtainable. Telegraph Constructions are 10s. better at 39, and India-Rubbers keep very firm at 13½, shares being wanted at the price. Oriental Telephones have recovered their decline of last week, but United River Plates are still a trifle dullish.

Mexicans tend to halt. The dramatic rise in the price of silver is a bull point. The condition of the country calls for caution in putting money into Mexicans. Amongst the Utilities, Mexico Tramways Fives relapsed 2 points to 4½, but the remainder of the group keeps steady. British Columbia Electric Railway 4½ per cent. debenture stock has gone back to 50. The deferred and preferred issues are lower. Anglo-Argentine Trams are unchanged, the fatal railway strikes not affecting any of the tramway issues. A fair amount of speculative buying keeps Pernambuco Tramways

ordinary shares prominent, the present price being 7s. 3d. The 7 per cent. preference at 13s. and the 5 per cent. first debentures at 68 are firm. These latter look cheaper than the preference, as things stand at present.

British Aluminium shares have come back rather sharply, falling $\frac{1}{2}$ to 32s. in consequence of a good deal of profit-taking. Other members of the miscellaneous group, however, are strong. Electric Constructions rose to 20s.; British Westinghouse Preference put on 5/16 at 3 1/16. British Insulated are strong at 14 $\frac{1}{2}$. Babcock Ordinary advanced to 3 $\frac{1}{4}$ buyers. Victoria Falls & Power shares are very quiet at 19s. 3d. for the ordinary and 23s. 9d. for the preference, the price being unaffected by the meeting at the end of last week. The chairman spoke in a vein of cautious optimism, and his remarks formed an appropriate corollary to the recent report. There has been a little business just lately in the 6 per cent. preference shares of the Madras Electric Supply Corporation, the price being about 17s. 6d. Vera Cruz ordinary are changing hands on the basis of 7s. 6d. Crompton preference at 11s. 3d. are a trifle harder; the ordinary remain in the neighbourhood of 10s. 3d.

The rubber market is animated, with prices strong. A large volume of business is in progress, interfered with to some extent, in the early part of the week, by the moonlight raiders. The price of the material fluctuates a little from day to day, keeping very close to the neighbourhood of 2s. 10d. per lb. More activity has come about in armament shares. Armstrongs and Vickers both being firmer. A good deal of trade, too, is passing in the shares of the companies connected with base metals, those of the tin group being especially prominent.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.					
	Dividend	Price	Rise or fall	Yield	
	1915. 1916.	Sept. 25, 1917.	this week.	p.o.	
Brompton Ordinary ..	10 9	6 $\frac{1}{2}$	—	£6 18 6	
Charing Cross Ordinary ..	6 5	8 $\frac{1}{2}$	—	6 9 0	
do. do. do. $\frac{1}{2}$ Pref. ..	4 $\frac{1}{2}$ 4 $\frac{1}{2}$	8 $\frac{1}{2}$	—	6 13 4	
Chelsea ..	4 3	2 $\frac{1}{2}$	—	5 9 1	
City of London ..	8 8	12 $\frac{1}{2}$	—	6 4 8	
do. do. 6 per cent. Pref. ..	6 8	10 $\frac{1}{2}$	—	5 18 5	
County of London ..	7 7	11 $\frac{1}{2}$	—	6 5 10	
do. do. 6 per cent. Pref. ..	6 6	10	—	6 0 0	
Kensington Ordinary ..	7 6	5 $\frac{1}{2}$	—	5 14 8	
London Electric ..	8 8	1	—	Nil	
do. do. 6 per cent. Pref. ..	6 4	8 $\frac{1}{2}$	—	5 6 8	
Metropolitan ..	8 8	8 $\frac{1}{2}$	+ $\frac{1}{2}$	4 12 4	
do. do. $\frac{1}{2}$ per cent. Pref. ..	4 $\frac{1}{2}$ 4 $\frac{1}{2}$	8 $\frac{1}{2}$	—	7 4 0	
St. James' and Pall Mall ..	8 8	7	—	5 14 8	
South London ..	5 5	2 $\frac{1}{2}$	—	7 5 6	
South Metropolitan Pref. ..	7 7	21/8	—	6 10 3	
Westminster Ordinary ..	7 7	6 $\frac{1}{2}$	—	5 6 8	

TELEGRAPHS AND TELEPHONS.					
	Dividend	Price	Rise or fall	Yield	
	1915. 1916.	Sept. 25, 1917.	this week.	p.o.	
Anglo-Am. Tel. Pref. ..	8 8	98 $\frac{1}{2}$	—	6 1 10	
do. do. Del. ..	83/8 1 $\frac{1}{2}$	23	—	6 10 5	
Chile Telephone ..	8 8	7 $\frac{1}{2}$	—	5 11 4	
Cuba Sub. Ord. ..	5 5	8 $\frac{1}{2}$	—	5 14 3	
Eastern Extension ..	8 8	14 $\frac{1}{2}$	—	5 8 4	
Eastern Tel. Ord. ..	8 8	148 $\frac{1}{2}$	—	5 7 9	
Globe Tel. and T. Ord. ..	7 7	18	—	5 7 8	
do. do. Pref. ..	8 6	10 $\frac{1}{2}$	—	5 14 3	
Great Northern Tel. ..	22 24	87	—	6 9 9	
Indo-European ..	18 18	54 $\frac{1}{2}$	—	5 19 3	
Marconi ..	10 15	3 $\frac{1}{2}$	+ $\frac{1}{2}$	4 10 6	
Oriental Telephone Ord. ..	10 10	8 $\frac{1}{2}$	+ $\frac{1}{2}$	3 1 6	
United R. Plate Tel. ..	8 8	6 $\frac{1}{2}$	—	5 16 4	
West India and Pan. ..	6d. 6d.	1 $\frac{1}{2}$	—	3 9 5	
Western Telegraph ..	8 8	14 $\frac{1}{2}$	—	5 10 4	

HOME RAILS.					
	Dividend	Price	Rise or fall	Yield	
	1915. 1916.	Sept. 25, 1917.	this week.	p.o.	
Central London, Ord. Assented	4 4	60 $\frac{1}{2}$	+2	6 12 3	
Metropolitan ..	1 1	23 $\frac{1}{2}$	+ $\frac{1}{2}$	4 4 6	
do. do. District ..	Nil Nil	10 $\frac{1}{2}$	—	Nil	
Underground Electric Ordinary	Nil Nil	1 $\frac{1}{2}$	—	Nil	
do. do. "A" ..	Nil Nil	6 $\frac{1}{2}$	—	Nil	
do. do. Income	8 4	82 $\frac{1}{2}$	—	4 17 0	

FOREIGN TRAMS, &c.					
	Dividend	Price	Rise or fall	Yield	
	1915. 1916.	Sept. 25, 1917.	this week.	p.o.	
Adelaide Sup. 8 per cent. Pref.	6 5 $\frac{1}{2}$	4 $\frac{1}{2}$	—	6 3 1	
Anglo-Arg. Trams, First Pref.	5 $\frac{1}{2}$ 5 $\frac{1}{2}$	3 $\frac{1}{2}$	—	8 19 8	
do. do. 2nd Pref. ..	5 $\frac{1}{2}$ —	2 $\frac{1}{2}$	—	—	
do. do. 6 Deb. ..	5 5	67 $\frac{1}{2}$	—	7 8 3	
Brazil Traction ..	4 4	46	—1	—	
Bombay Electric Pref. ..	8 8	98	—	8 4 8	
British Columbia Elec. Rly. Pfee.	5 5	42 $\frac{1}{2}$	—	11 15 4	
do. do. Preferred	Nil Nil	80	—1	Nil	
do. do. Deferred	Nil Nil	27 $\frac{1}{2}$	—1 $\frac{1}{2}$	Nil	
do. do. Deb. ..	4 $\frac{1}{2}$ 4 $\frac{1}{2}$	50	—	8 10 0	
Mexico Trams 5 per cent. Bonds	Nil Nil	44 $\frac{1}{2}$	—2	Nil	
do. do. 6 per cent. Bonds	Nil Nil	10	—	Nil	
Mexican Light Common ..	Nil Nil	22 $\frac{1}{2}$	—	Nil	
do. do. Pref. ..	Nil Nil	31	—	Nil	
do. do. 1st Bonds	Nil Nil	46 $\frac{1}{2}$	—	—	

MANUFACTURING COMPANIES.					
	Dividend	Price	Rise or fall	Yield	
	1915. 1916.	Sept. 25, 1917.	this week.	p.o.	
Babcock & Wilcox ..	15 15	3 $\frac{1}{2}$	—	4 12 4	
British Aluminium Ord. ..	7 10	11 $\frac{1}{2}$	— $\frac{1}{2}$	6 6 0	
British Insulated Ord. ..	17 $\frac{1}{2}$ 20	14 $\frac{1}{2}$	+ $\frac{1}{2}$	7 0 4	
British Westinghouse Pref.	7 $\frac{1}{2}$ 7 $\frac{1}{2}$	3 $\frac{1}{2}$	+ $\frac{1}{2}$	4 18 0	
Callenders ..	20 20	14 $\frac{1}{2}$	—	6 18 0	
do. do. 5 Pref. ..	5 5	4 $\frac{1}{2}$	—	6 1 8	
Castner-Kellner ..	22 22	3 $\frac{1}{2}$	—	6 8 0	
Edison Swan, fully paid	— —	1 $\frac{1}{2}$	—	Nil	
do. do. 4 per cent. Deb.	4 4	72 $\frac{1}{2}$	—	5 10 4	
Electric Construction ..	7 $\frac{1}{2}$ 7 $\frac{1}{2}$	1	+ $\frac{1}{2}$	7 16 0	
Gen. Elec. Pref. ..	6 6	10 $\frac{1}{2}$	—	5 17 1	
do. do. Ord. ..	10 10	17	+ $\frac{1}{2}$	5 17 8	
Healey ..	25 25	16	—	7 16 3	
do. do. $\frac{1}{2}$ Pref. ..	44 44	4	—	5 12 6	
India-Rubber ..	10 10	13 $\frac{1}{2}$	—	7 5 6	
Telegraph Con. ..	20 20	80	—	6 3 1	

* Dividends paid free of income-tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, September 26th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic ..	per lb. 1/6	..
a Ammoniac Sal ..	per ton £75	..
a Ammonia, Murate (large crystal)	.. £54	..
a Bisulphide of Carbon ..	.. £23	..
a Borax ..	.. £39	..
a Copper Sulphate ..	.. £61	..
a Potash, Chlorate ..	per lb. 2/6	..
a Perchlorate ..	.. 3/-	..
a Shellac ..	per cwt. £12 10	10/- dec.
a Sulphate of Magnesia ..	per ton £16	..
a Sulphur, Sublimed Flowers ..	.. £35	..
a Lump ..	.. £26	..
a Soda, Chlorate ..	per lb. 10 $\frac{1}{2}$ d.	..
a Crystals ..	per ton 120/-	..
a Sodium Bichromate, casks	per lb. ..	..
METALS, &c.		
c Brass (rolled metal 2" to 12" basis)	per lb. ..	..
c Tubes (solid drawn) ..	.. ..	..
c Wire, basis ..	.. ..	..
c Copper Tubes (solid drawn) ..	1/7 to 1/8 $\frac{1}{2}$	3d. dec.
g Bars (best selected) ..	per ton £155	£5 dec.
g Sheet ..	.. £155	£5 dec.
g Rod ..	.. £155	£7 dec.
d (Electrolytic) Bars ..	.. £130	£7 dec.
d Sheets ..	.. £157	£5 dec.
d Wire Rods ..	.. £138	£7 dec.
d H.C. Wire ..	per lb. 1/4 $\frac{1}{2}$	3d. dec.
f Ebonite Rod ..	.. 3/-	..
f Sheet ..	.. 2/6	..
n German Silver Wire ..	.. 2/8	..
h Gutta-percha, fine ..	.. 6/10	..
h India-rubber, Para fine ..	.. 8/2 $\frac{1}{2}$	..
i Iron Pig (Cleveland warrants) ..	per ton Nom.	..
l Wire, galv. No. 8, P.O. qual.	.. £42	..
g Lead, English Pig ..	.. ..	..
g Mercury ..	per bot. Nom.	..
e Mica (in original cases) small ..	per lb. 6d. to 8/-	..
e " " medium ..	8/6 to 6/-	..
e " " large ..	7/6 to 14/- & up.	..
d Silicon Bronze Wire ..	per lb. 1/9	3d. dec.
r Steel, Magnet, in bars ..	per ton ..	..
g Tin, Block (English) ..	.. ..	..
n Wire, Nos. 1 to 16 ..	per lb. 8/6	..

Quotations supplied by—

a G. Boor & Co.	g James & Shakespeare.
c Thos. Bolton & Sons, Ltd.	h Edward Till & Co.
d Frederick Smith & Co.	i Bolling & Lowe.
e F. Wiggins & Sons.	l Richard Johnson & Nephew, Ltd.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	n P. Ormiston & Sons.
	r W. F. Dennis & Co.

Handling Coal with an Electric Truck.—Since the first of this year the Canton (Ill.) Gas and Electric Co. has been hauling coal to its electric and gas plants in an electric truck. The results, according to E. H. Negley, secretary and manager of the company, indicate that the investment was a good one, and that a considerable saving in coal-hauling costs is being made.

The haul from the railroad track to the company's electric plant is about three blocks long, and to its gas plant about 1 $\frac{1}{2}$ miles (2 $\frac{1}{2}$ km.). Over this distance this truck makes a round trip to the electric plant in about seven minutes, and can convey the contents of a 50-ton (45 $\frac{1}{2}$ -t.) ear of screenings to the station in about three hours. The round-trip haul to the gas plant requires about 30 minutes.

The speed of the truck loaded is about 7 miles (11 $\frac{1}{3}$ km.) an hour, and in ordinary operation it will cover from 15 to 25 miles (24 km. to 40 km.) a day, depending on how many trips are made. The truck is a Walker Vehicle Co.'s design with 44 cells of 31-plate Philadelphia storage batteries. It is said to be the first electric truck to be equipped with a Lee Loader Co.'s dump body; the dumping feature of this body has demonstrated its value at Canton, since the driver alone through the use of it can unload 10,000 lb. (4,536 kg.) of coal into the hopper in two minutes. The driver, who operates this truck exclusively, is responsible for its entire care, both as to charging and maintenance.—*Electrical World*.

Railway Electrification in South Africa.—In view of the attention which has been devoted of late to the possibility of certain portions of the S.A. Union Railways being electrified, and the general and increasing utility of electrical power, a large gathering assembled at the Durban Technical College on July 27th to hear a lecture on "Railway Electrification," by Mr. J. W. Kirkland, of Johannesburg, arranged by the Engineering Section of the Natal Society for the Advancement of Science and Art. The author told a graphic story of the Chicago, Milwaukee, and St. Paul Railway, which is the most important and largest instance of the application of electricity to railway operation, and which he has recently visited and inspected. He gave a summary of the advantages to be gained by the electrification of main line traffic, and in allusion to the practicability of adopting the system, so far as certain lines in South Africa were concerned, stated that the carrying capacity of the Natal line could be greatly increased by the electrification.—*Natal Mercury*.

ELECTRODES FOR ELECTRIC FURNACES: THEIR MANUFACTURE, PROPERTIES, AND UTILISATION.

(Concluded from page 286.)

Metallic and Compound Electrodes.—The use of vertical—or sole—electrodes of metal, or with a base of metal or secondary conductor, offers greater difficulties than the use of carbon electrodes, but it is essential in certain manufactures which necessitate the exclusion of carbonising materials to as great an extent as possible. On the other hand, it is sometimes desirable to incorporate certain ingredients of the final product with the electrodes to be used in its manufacture. Metallic electrodes facilitate cooling of pieces between which the arc plays; and compound electrodes are used where a conducting or semi-conducting medium is needed for special purposes.

Metallic Electrodes.—Tubular metal electrodes are used in several types of furnaces for the manufacture of nitric acid. In the Schonherr furnace, for instance, one electrode consists of a vertical steel tube of length proportioned to the power of the apparatus. The other electrode is a water-cooled tube of copper. At the centre of the second electrode there is an iron core which may be replaced

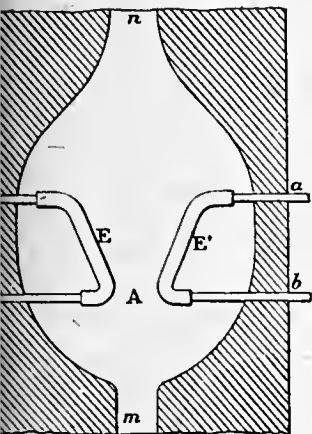
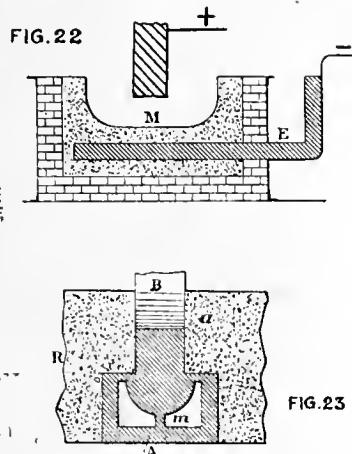


FIG. 21.



FIGS. 22 AND 23.

easily; its working life is about 2,000 hours, and replacement occupies only 15 minutes. The arc plays between the tube and the copper electrode.

The Moscicki furnace uses concentric electrodes, the external one being a copper cylinder 15 cm. in diameter, mounted in a clay base. The central electrode is a water-cooled tube 6 cm. in diameter, and

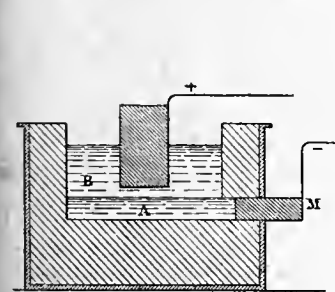


FIG. 24.

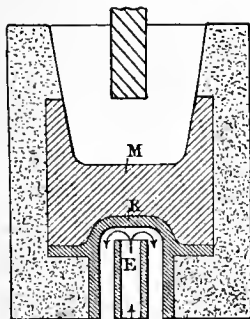


FIG. 25.

held at the top in a porcelain support. The arc plays between the two tubes, and is made to rotate by a magnetic device.

In the Birkeland-Eyde furnace the two electrodes are set in line. Each consists of a simple copper tube bent to U shape and water cooled. The electrodes wear very slowly, and are easily accessible and renewable.

Horn electrodes are used in the Guye & Pauling (fig. 21) for the synthetic manufacture of nitric acid. The electrodes E E' are of cast steel, and are made hollow to permit of water circulation. The arc is struck at A, where the electrodes are nearest together, but at once rises and spreads itself between the two horns. An air blast is maintained from m to n, and carries out with it the nitric products made by the action of the arc.

Massive metal electrodes are used in certain furnaces for the manufacture or fusion of metals. Such electrodes are preferably of the same nature as the metal to be melted, e.g., iron electrodes in iron or steel furnaces, and copper electrodes in furnaces handling copper, bronze, or brass. In the simple type of melting furnace, illustrated in fig. 22, a large iron or copper electrode is embedded in packing M of carbon pisé, which forms the working bed of the furnace.

In the Gin "channel and basin" furnace which utilises the

resistance of the molten steel itself, each electrode is formed of a block of soft steel A (fig. 23), terminating in the channel B of metal under treatment. The electrode is let into the refractory body R of the furnace itself, and has a circular cavity of the section shown at m, and through this circulates cold water. The cooling effected is sufficient to keep practically stationary the plane a of transition from the solid to the liquid steel of the same composition. A similar arrangement is employed in the Gired steel furnace, where a steel electrode M (fig. 21) is mounted laterally in the refractory body of the furnace. Fragments of the same grade of metal as it is desired to produce in the furnace are placed at A, and these, after solidification, protect the pole M, which is also water cooled. The space B forms the useful reducing and melting portion of the furnace.

Sole Electrodes.—Metallic bottom electrodes embedded in refractory, non-conducting material may be used in a number of ways differing more or less in detail. One of the first furnaces of this type was brought out by Siemens in 1880; two vertical electrodes were used, the upper one being of carbon and the lower one an iron rod fed forward by a screw mechanism in proportion to its consumption. In the Borchers furnace (1896) the steel bottom M (fig. 25) of the furnace chamber is mounted on a copper support R, which is cooled by water supplied through E.

The latest Gired furnaces employ electrodes which are either of graphite covered with metal or else entirely metallic. In the former arrangement (fig. 26), the object of the metal covering over the graphite is to protect the furnace charge against carbonisation. The poles R are embedded in the refractory brickwork of the furnace.

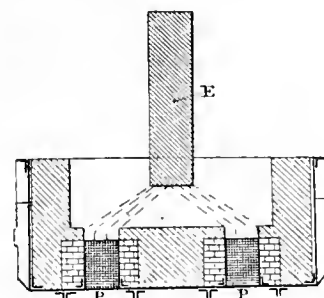


FIG. 26.

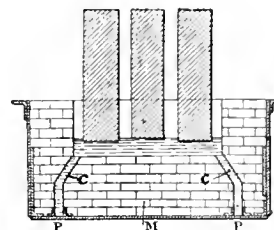


FIG. 27.

and the path of current flow from them to the upper electrode E is as shown by the dotted lines fig. 26—i.e., such as to traverse the entire thickness of metal in the furnace. The alternative arrangement (fig. 27) employs several steel poles P set in canals in the masonry of the furnace and water cooled at their lower extremity. As in the furnace illustrated by fig. 24, the canals c (fig. 27) are filled with pieces of metal which melt and then form a protection to the actual pole pieces. The latter are connected in parallel outside the furnace, and the masonry is naturally of such material and construction as not to be rendered conducting by the heat to which it is exposed.

Compound Electrodes.—A furnace bottom of pure carbon often presents serious inconveniences, particularly in the electrometallurgy of steel. In the latter case, the carbon combines with the charge to such an extent as to make impossible the production of low-carbon metal. This difficulty may be overcome by using a magnesia bottom, but it is then necessary to allow for the fact

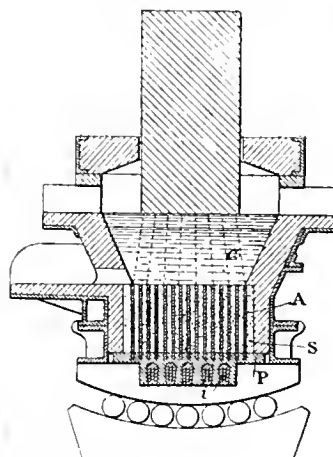


FIG. 28.

that magnesia is not an electrical conductor. A satisfactory compromise is to use a mixture of refractory non-conducting material (magnesia, dolomite, silica, &c.) with a carbonaceous, electrically-conducting binder of pitch, graphite and tar in various combinations.

No metallic conductor is used in this case, and the composition of the pisé may be varied so that the surface layers, in contact with the steel, contain insufficient carbon to carbonise appreciably the molten charge. This construction has been used successfully in the

Firming steel works. Numerous mixtures have been tested, and it is found that the ingredients do not cohere well with less than 2½ per cent. of tar, whilst with more than 10 per cent. the mixture becomes too liquid. The mixtures most used are cast-iron turnings, tar and calcined dolomite, and graphite, tar and calcined dolomite. From these ingredients it is easy to make refractory floors containing 10 to 20 per cent. of carbon, which become very good conductors at high temperature after a preliminary heating, and then remain sufficiently good conductors for regular working to be commenced without further preliminary heating. Similar results are obtained if the dolomite be replaced by magnesia or siliceous sand.

The first melt from such a bottom naturally contains some excess of carbon, due principally to tar driven off during the early stages of heating. Analyses of consecutive melts of steel turnings, containing 0·16 per cent. of carbon, 0·36 per cent. of manganese, and 0·349 per cent. of silicon, gave the following results:—

	First melt. Per cent.	Second melt. Per cent.	Third melt. Per cent.
Carbon ...	0·226	0·102	0·140
Manganese ...	0·161	trace	0·073
Silicon ...	0·060	0·027	0·069

The second and third melts are normal, the carbon content being inappreciably affected by the electrode. The latter requires very little repair in service.

Compound Melting Electrodes.—This name is used to describe a type of upper electrodes due to Gin and containing the metal (or a compound of the metal), which it is desired to alloy with the molten material in the furnace. For instance, in the manufacture of ferro-tungsten there is used a furnace with two vertical electrodes in series composed of cast tungsten or of tungsten carbide. The furnace charge consists of iron oxide and tungsten dioxide. When the furnace is in action, the electrodes of tungsten carbide melt and their carbon burns at the expense of the oxides in the charge, which is thus reduced. The alloy obtained contains not more than 0·15 to 0·25 per cent. of carbon. Similar compound electrodes may be used in the manufacture of ferro-molybdenum.

Reinforced Electrodes.—Metal "reinforcement" is sometimes used in carbon electrodes with the double aim of increasing their electrical conductivity and their mechanical strength. Héroult, for instance, bores a hole through the electrode (axially) and fills it with an alloy of aluminium and silicon. The Plania Works (Ratisbon) introduces bands of copper or iron into the electrode before or after baking, this process being especially recommended for long electrodes, which are thereby much strengthened. Use is made sometimes of composite electrodes consisting of a tube of carbon or iron filled with lime, iron oxide, or other scorifier, which is thus carried, during the operation of the furnace, to the hottest part of the charge.

Keller Steel-Magnesia Electrode.—A bottom electrode which is absolutely non-carbonising and at the same time very strong and durable and of high electrical conductivity is shown in fig. 28. Iron bars A from 1 to 1½ in. square are set vertically and close together in a metal base plate P. A secondary conductor, such as magnesia, is made hot and rammed very tightly between these bars, thus providing an "armoured" block of refractory material which is very durable and of exceptional mechanical strength, whilst it has the advantage of permanent through conductors to secure low electrical resistance and easy starting from cold. The upper layers at least of the secondary conductor have appreciable conductivity when the furnace is working, and owing to this and to the distribution of the bars A in close spacing over the whole base of the furnace, current flow through the charge is exceptionally uniformly distributed. In spite of the large proportion of magnesia which gives the base its durability, the electrical resistance is almost nil. The metallic portion of the electrode is cooled by water circulation at i. The refractory material between the steel bars hardens in service, so that the whole is remarkably durable. Operation is certain and simple, electrically and mechanically, and it is unobjectionable from the chemical point of view. There is no appreciable industrial loss.

The author of the articles from which the foregoing abstract has been made is M. JEAN ESCARD, Civil Engineer, Lauréat de l'Institut de France and of the Société d'Encouragement pour l'Industrie Nationale.

THE HIGH-TENSION MAGNETO.

At a meeting of the AERONAUTICAL SOCIETY OF GREAT BRITAIN, on April 14th, Mr. A. P. YOUNG, A.M.I.E.E., read a paper on "The High-tension Magneto, with Special Reference to the Ignition of Aeroplane Engines," which was printed in the *Aeronautical Journal* for April-June, 1917.

The paper is a lengthy one, dealing comprehensively with the various aspects of the subject, on which, as the author remarks, the amount of technical literature available at the present moment is very meagre. He points out that the degree of success achieved in the development of the combustion motor has at all stages been primarily dependent upon the efficiency of the ignition system used, and claims that the rapid strides which have, during recent years, been made in the construction of the petrol motor, *per se*, have mainly resulted from the very satisfactory high-tension ignition system that has been available. Without the high-tension magneto it is almost certain that the aeroplane would

never have reached its present high state of development, and the whole course of the present disastrous war would have been different, and much less in our favour.

Prior to the outbreak of war, the number of high-tension magnetos being produced in this country formed a negligible proportion of the total number being used for a variety of purposes. Through laxity on our part, this most vital "key" industry was allowed to develop in Germany, but the war has taught us a lesson in this respect; during the period of the war the magneto industry in this country has developed at a really wonderful rate, and all those participating are to be congratulated on the present healthy and hopeful state of the industry.

The British Ignition Apparatus Association is at the moment supported by 10 British magneto manufacturers who have, during the period of the war, supplied to the Government for war purposes, and chiefly for aeroplanes, no fewer than 200,000 magnetos. The British magneto as at present constructed is the equal of the pre-war Bosch magneto emanating from Stuttgart, and certain developments now taking place will result in the British manufacturers producing new types of magnetos that will prove to be vastly superior to anything turned out of Germany in the past.

The author urges that when the war is over, British magneto manufacturers should be encouraged and supported by Government and public alike, so that there may be established on a solid foundation a British industry producing magnetos and ignition apparatus unsurpassed in quality and design.

After tracing the history of electrical systems of ignition from Faraday's discovery of electromagnetic induction in 1831 to recent times, Mr. Young turns to the technical aspect of the subject, and states that any form of high-tension magneto consists of four

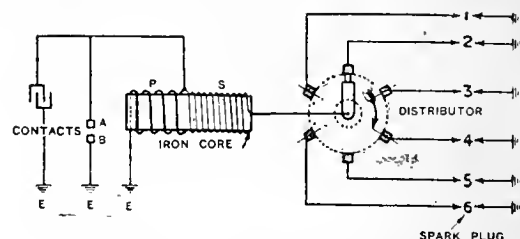


FIG. 1.—DIAGRAM OF CONNECTIONS OF MAGNETO WITH SIX-CYLINDER DISTRIBUTOR.

essential parts:—(1) A magnet system; (2) an iron core wound with primary and secondary; (3) a contact-breaker to interrupt the primary circuit at predetermined intervals; (4) a high-tension distributor.

The arrangement of connections generally adopted is illustrated in fig. 1. The earthed primary contact (B) is actuated by some form of cam, so that the primary circuit is continually being closed and opened.

The iron core which carries the armature windings may either revolve or be fixed. In the latter case, the rotor comprises certain iron masses so disposed that every 90° or 180° (depending upon whether the magneto is a two-spark or a four-spark), the flux flowing from the N pole of the magnet to the S pole, through the armature core, is suddenly reversed. When the armature rotates the flux reversal occurs—except when specially-shaped poles are fitted—every 180°, and the magneto gives two sparks per revolution. Magnetos provided with stationary armatures are said to be of the inductor type. The cycle of operations is as follows:—

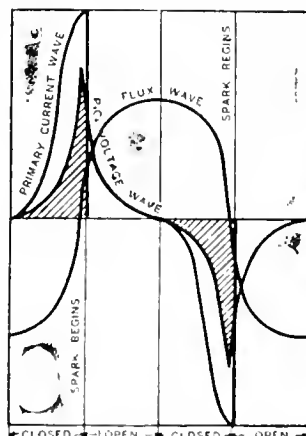


FIG. 2.—TYPICAL FLUX, VOLTAGE, AND PRIMARY CURRENT WAVES FOR H.T. MAGNETO.

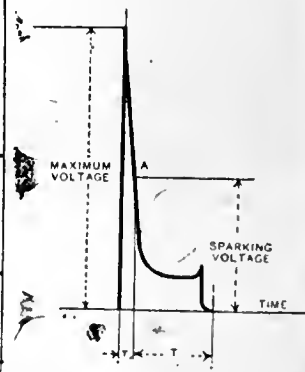


FIG. 3.

(a) The rapid reversals of flux in the armature core induce in both primary and secondary an alternating E.M.F., the maximum E.M.F. being reached for any given speed, when the actual flux in the armature core is substantially zero.

(b) The cam operating the contact breaker lever is so designed that the primary circuit is closed during the period when the induced voltage is growing from zero to its maximum value, and for some little while afterwards, but not until the voltage has become zero again.

(c) During the period of closure of the primary circuit the induced current will steadily increase in value. Then at a certain instant the contacts are suddenly separated by the cam. The condenser in parallel with them ensures that there is no sparking at this instant, consequently the rupture of the primary current is remarkably sudden.

(d) The sudden rupture of the primary current causes an instantaneous collapse of the magnetic field associated with it, and as this field is linked with the secondary turns, an enormous voltage is induced in the secondary winding at this instant. This voltage is sufficient to initiate a spark between the electrodes of the spark plug, and this spark is maintained, to some extent, by the voltage induced in the secondary by virtue of the continual flux change in the armature core produced by rotation during the period that the contacts remain open.

(e) After a certain short interval of time the cam allows the contacts to close again, and the cycle of operations (b), (c), (d) is repeated.

Theoretically, the whole of the energy stored up in the primary winding during the periods when the contacts are closed, and the primary current is creating a magnetic field, should re-appear in the secondary spark at "break" if there were no losses.

Actually, certain losses occur during the transfer, and only a portion of the energy stored magnetically appears in the H.T. spark. Generally speaking, about 80 per cent. of this energy is available for ignition in a well-designed magneto.

The maximum primary current for any given design is, within limits, proportional to the maximum armature core flux, this in turn being dependent on the magnetic characteristics and design of the magnets used. As the energy in the high-tension spark is proportional to the square of the primary current, the energy liberated at each discharge (that is, the intensity of the spark, but not necessarily the power of the spark to produce ignition) is proportional to the square of the maximum value of the flux produced in the armature core on open circuit by the system of magnets used. It is therefore evident that the magnet flux is one of the controlling factors in the design of any magneto, and very careful attention has been given to the magnetic quality of the magnets and the design of the whole magnetic system to ensure that the best results are obtained.

The rate at which the secondary voltage rises, and the value of the maximum reached, are dependent on the primary current broken; on the self-induction of the primary at "break"; on the ratio of secondary to primary turns; and on the characteristics of the magnetic circuit. It is necessary that the magnetic field created by the primary current shall instantly collapse at "break." A magnetic circuit which is totally laminated will ensure a more rapid dying-away of the magnetic field than will occur if there are in the magnetic circuit any solid masses in which eddy currents may be set up during the period of change, these eddy currents, by their reaction, tending to retard the rate at which the collapse of the magnetic lines occurs.

The character of the secondary voltage wave during the period of the high-tension discharge is of considerable importance, because the maximum value reached would seem to have some influence on the power of the spark to produce ignition. Furthermore, the shape of the wave controls, to some extent, the rate at which the energy liberated in the high-tension spark is dissipated, and the author holds the view that the rate of energy discharge is of more importance than the total amount of energy liberated, although the latter factor must be taken into consideration.

Experiments made on magnetos indicate that the voltage rise in the primary winding at the instant of "break" is very much greater than one would anticipate. It is reasonable to suppose from these experiments that a correspondingly abnormal rise of voltage occurs in the secondary at "break"—this voltage, of course, only being maintained for an infinitesimal period of time—and the curve shown in fig. 3 represents the way in which the author imagines the secondary voltage to vary during the period of the high-tension spark.

The voltage suddenly rises to a maximum and then suddenly falls again, the rise and fall occupying a time T_1 , during which period there is no actual discharge between the electrodes, but the gases in the vicinity are being ionised preparatory to a discharge which occurs at the point A, and is maintained during the subsequent period T_2 , at the end of which the voltage has dropped away to zero.

As soon as the spark is initiated at the point A the discharge is maintained to some extent by the voltage induced in the secondary winding in consequence of rotation, and this voltage is virtually superimposed upon the voltage induced as a result of the collapsing of the magnetic field stored in the primary prior to break.

Unfortunately, the present state of our knowledge concerning the process of ignition by means of a high-tension spark is by no means complete, but Mr. Young suspects that the maximum value of the secondary voltage reached is a controlling factor, and it is even within the bounds of possibility that the ionisation occurring as a result of the sudden application of an enormous voltage during the extremely small interval of time T_1 may in itself be sufficient to initiate the explosion. It has been demonstrated that ionisation in itself will produce an explosion, even though no spark occurs, and the apparent superiority of the polar inductor type of magneto over the rotating-armature type may be due to the fact that the secondary voltage wave is steeper and reaches a higher maximum during the interval T_1 , in consequence of the armature circuit being more thoroughly laminated, and therefore allowing of a more rapid flux change.

A common trouble experienced with the ordinary type of dis-

tributor in which a carbon brush is used is that the carbon dust generated is liable to be ground into the brush track of the distributor, thus producing a path of low resistance between the segments, this disease being known as "tracking." In certain cases, and particularly when two six-cylinder magnetos are used in conjunction on a 12-cylinder engine, tracking of this kind is very liable to cause misfiring, because the spark, rather than discharge between the electrodes of the spark plug in the cylinder under compression, will leap along the surface of the brush track in the direction of rotation to the next segment which is connected to a spark plug in a cylinder at practically zero pressure, the resistance of this alternative path being extremely low.

Experiments have shown that even with a distributor that is badly tracked, misfiring can be entirely eliminated if, instead of the ordinary carbon brush, a metal brush be used, this being so arranged that there is a very small air gap (about 0.01 in.) between the face of the rotating metal brush and the distributor segment. The superiority of this arrangement over the distributor and carbon brush combination would seem to be due to the fact that the introduction of a small air gap in the high-tension circuit, such as is interposed between the end of the secondary winding and the outside circuit, completely insulates the secondary during the small interval of time T_1 , and thus allows the voltage to rise to a very much higher maximum value than would be the case if there were any leakage paths of low resistance. This is a further confirmation of the view that the value of the maximum value of the secondary voltage at "break" is of vital importance. The spark-gap form of distributor has been tried with considerable success on aeroplane magnetos both in this country and in France, and is used generally on all the battery-ignition systems designed for automobile work in use in America. In the author's opinion it seems to be an advance in the right direction, provided that sufficient care is given to the design of the brush-holder and proper precautions are taken to ventilate the distributor, so that the products of ionisation resulting from the minute spark between metal brush and segments have easy means of escape.

The function of the magnets is to produce and maintain, in spite of the very severe conditions under which a magneto has to operate—including severe vibration and cyclic changes in temperature—a practically constant flux in the armature core. In comparing permanent magnets of different quality, it is usual to determine the remanence (B_r) and the coercive force (C_f). These factors apply to a closed ring of the steel, which is capable of being completely and uniformly magnetised. The remanence is the flux density in the steel, after the magnetising force H_{max} (usually 400) has been removed, and the coercive force is the demagnetising force that has to be subsequently applied to reduce this flux density to zero. The B.T.H. Co. accepts only those magnets which show on test a remanence and coercive force in conformity with the following:—

1. The product of remanence and coercive force in c.g.s. units must not be less than 580,000.

2. The actual coercive force must not be less than 55.

Experiment has shown that the active armature core flux in a magneto of given design is greatly dependent on the product of remanence and coercive force, or upon what the author terms the "magnet strength," using this expression to denote the factor $(B_r \times C_f)/10^4$. The spark energy output, being proportional to the square of the armature core flux, must in consequence be dependent on the magnet strength to a much greater degree.

The product remanence and coercive force is therefore a very important factor, and, generally speaking, it is sufficient when testing magneto magnets to measure this product only, because as a general rule a magnet which shows a product of not less than 580,000 will have a coercive force not less than 55. In other words, such a relatively low coercive force as 55 is usually associated with a remanence of the order of 10,500.

Looking at a magneto magnet from a purely mechanical standpoint, it is necessary that the pole faces, and also the edges, should be finally ground, after hardening, to a fairly fine degree of accuracy. It is of great importance that the ground pole faces be parallel to each other and exactly at right angles to the ground edges. The following limits are now being worked to by Sheffield manufacturers:—

Distance between the ground pole faces—Maximum + '2 mm.

—Minimum - '2 mm.

Width of magnet—Maximum + '15 mm.

—Minimum - '15 mm.

These limits may at first sight appear to be large, but it should be remembered that a hardened tungsten-steel magnet is a very difficult thing to grind, particularly when it comes to grinding the inside pole faces, because trouble is encountered, due to the springiness of the magnet itself.

The author draws attention to the very excellent way in which the various Sheffield steel manufacturers now engaged on the manufacture of permanent magnets have carried out their work. Bearing in mind that at the outbreak of war practically no permanent magnets were produced in this country, and that this subsidiary key industry was entirely in the hands of Germans, the results so far achieved are very gratifying, and reflect great credit on the British steel manufacturers, who, by virtue of their resourcefulness and skill, have grappled so successfully with this difficult problem. His own experience is that at the present time permanent magnets for magnetos are being produced in this country which are quite equal—and in many cases superior—to anything that has been produced in Germany in the past.

(To be continued.)

LEGAL.

GLASGOW CORPORATION ELECTRICAL EMPLOYEES: ARBITRATION CASE.

WE have received a copy of arbitration proceedings between the Electrical Trades Union (on behalf of three of their members) as claimants, and the Glasgow Corporation Tramways Department as respondents. The Arbitrator repelled the respondents' plea that the arbitration was incompetent, and found that the claimants were reasonably entitled to the advance claimed of 4s. per week upon their upstanding wage of 40s. The men, who were assistants known as "improvers," were promoted to take charge of stations when certain station charge hands were called to the Colours, and they had for a long period been doing the work of charge hands. The Arbitrator stated that the claimants' training and length of experience as charge hands entitled them to the 44s., which was the recognised wage of a qualified charge hand. In addition to their upstanding wage the claimants receive war bonus additions amounting to 9s., but with that the proceedings were not concerned, as the dispute was only in regard to the upstanding wage. The money element was not the important question in the case. The respondents contested the claimants' claim for an advance upon a ground of principle which was novel, interesting, and important. The respondents' contention was that the claimants did not fall within the Arbitration Provisions of Part I of the Munitions of War Acts at all, and so the arbitration was incompetent. The provisions of Part I apply to "Any Employer" and to "persons employed" on or in connection with munitions work. The claimants were admittedly "persons employed," but the respondents contended that the expression "Persons Employed" had a limited meaning, and included only workmen who were paid on a time rate or a piece-work rate, which was subject to interruption by any cessation of work, and that it did not include men of the class to which the claimants belonged, who received an upstanding wage, which was not interrupted by their absence on holiday or through illness. All station charge hands such as the claimants, received an upstanding wage for a normal week of six shifts. If, owing to shortage of staff or other emergency, they required to work more than six shifts, they received, *pro rata*, extra pay. They were allowed a fortnight's summer holiday in the year without interruption of the upstanding wage, which also continued to be paid during absence through illness. But this domestic arrangement did not affect the question of principle which was raised in the case. It might be an element to be taken into consideration in fixing the amount of the upstanding wage, and he had taken it into consideration in finding that 44s. was a reasonable wage, but this was not an element in deciding whether the claimants fell within Part I of the Act. He was unable to accept the respondents' limited interpretation that the Arbitration privilege belonged only to what might be termed operatives, as distinguished from what were known as staff hands. The Act was not limited to operative workmen, but applied also to classes who were accustomed to be remunerated by an upstanding wage, and whose remuneration was not interrupted by absence on holiday or through illness. The leading purpose of Part I of the Act was to prevent a strike or lock-out occurring during the war. The Arbitration provisions were the counterpart of the prohibition-of-strikes provisions. Either an employer or an employé might seek the aid of the Arbitration provisions to settle a difference. It had, perhaps, not been a common practice for foremen, or clerks, or typists, or charge hands to take part in a strike so freely as operative workmen were inclined to do, but there was nothing to prevent these classes taking combined action to cease work for the purpose of compelling the adoption of working conditions, and, if they should do so, they would undoubtedly fall within Sec. 2 (1) of the 1915 Act, and become liable to prosecution. The claimants' freedom of action was restricted just in the same way as was that of a workman paid on a time or piece-work basis. The strike prohibition took no account of whether a person employed was remunerated by an upstanding wage, or otherwise. The policy of the statute was that every "person employed" who was under the restriction of Sec. 2 (1) had the corresponding privileges conferred by Sec. 1 (1). The Arbitrator held that the claimants were entitled to the increase of 4s. which they sought from the date the difference was referred to arbitration.

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

- 12,924. "Luminous electric light switch." C. D. S. CRAMHO. September 10th.
 12,925. "Device for winding telephone, &c., wire on to storage drums or reels." F. FITTON. September 10th.
 12,938. "Insulation for windings of electrical machines, &c." R. L. CLEAVEL & SANDYCROFT, LTD. September 10th.
 12,957. "Ignition apparatus for internal-combustion engines." M. L. MAGNETO SYNDICATE & E. A. WATSON. September 10th.
 12,959. "Dynamo-electric machines." A. H. LAW & SIR C. A. PARSONS. September 10th.
 12,961. "Magnetic chucks." W. ARTER. September 10th.
 12,960. "Electric starting and ignition of aeroplane engines, &c." LEYLAND MOTORS, LTD., & J. G. P. THOMAS. September 10th.
 12,993. "Automatic time cut-off for electric, &c., power." W. C. HAIGH. September 11th.
 13,008. "Searchlights." A. C. FRANKLIN, G. M. ROBERTS & W. WALLER. September 11th.

- 13,019. "Apparatus for driving magnetos in connection with internal-combustion engines." SOC. LORRAINE DES ANCIENS ETABLISSEMENTS DE DETRICH ET CIE DE LUNEVILLE. September 11th. (France, September 30th, 1916.)
 13,028. "Electrodes for ionic tubes for use in wireless telegraphy, &c." O. DUROLE & OSRAM-ROBERTSON LAMP WORKS. September 11th.
 13,029. "Rheostats." W. R. SYKES'S INTERLOCKING SIGNAL CO. & R. W. TARRANT. September 11th.
 13,057. "Overhead trolleys or collectors for electric tramway or railway vehicles." E. SPENCER. September 12th.
 13,066. "ELECTRIC INCANDESCENT LAMPS." A. C. WOODMAN. September 12th.
 13,070. "Magneto-electric ignition apparatus for internal-combustion engines." C. E. HULSE & M. L. MAGNETO SYNDICATE. September 12th.
 13,071. "Magnetic compasses." E. C. WEILBACH. September 12th.
 13,073. "Wireless telegraphy and telephony." WESTERN ELECTRIC CO. September 12th.
 13,083. "Apparatus for driving magnetos for internal-combustion engines." SOC. LORRAINE DES ANCIENS ETABLISSEMENTS DE DETRICH ET CIE DE LUNEVILLE. September 12th. (France, January 29th.)
 13,084. "Apparatus for driving magnetos for internal-combustion engines." SOC. LORRAINE DES ANCIENS ETABLISSEMENTS DE DETRICH ET CIE DE LUNEVILLE. September 12th. (France, March 3rd.)
 13,094. "Audion or lamp relay for amplifying apparatus for use in wireless telegraphy and telephony." M. LATOUR. September 12th. (France, September 12th, 1916.)
 13,098. "Devices for controlling intensity of electric currents." W. ADAMS & J. WATKINSON. September 12th.
 13,108. "Apparatus for heating water by electricity." J. H. ROBINSON AND W. O. WORKMAN. September 13th.
 13,126. "Cable suspender." R. HAMMERTON. September 13th.
 13,136. "Brush gear for electric dynamos and motors." T. L. R. COOPER, A. A. LYON & J. C. TODMAN. September 13th.
 13,139. "Brush and terminal contact mechanism of dynamo-electric machines." A. H. DARKER & J. STONE & CO. September 13th.
 13,141. "Incandescent electric lamps." J. BILEFIELD. September 13th.
 13,148. "Sparking plugs for internal-combustion engines." G. REDING. September 13th.
 13,164. "Electric switches, &c." W. H. EDWARDS. September 14th.
 13,166. "Automatic electric switching apparatus." M. S. CONNER & C. C. PUCKETTE. September 14th.
 13,167. "Telephone receivers." M. S. CONNER. September 14th.
 13,172. "Electrodes for electric furnaces." H. A. BLACKWELL, W. B. HAMILTON & W. L. TURNER. September 14th.
 13,191. "Automatic telephone system." A. E. STEVENS. September 14th.
 13,192. "Automatic telephone sub-station mechanism." A. E. STEVENS. September 14th.
 13,193. "Automatic telephone central-station apparatus." A. E. STEVENS. September 14th.
 13,196. "Apparatus for detecting variation in a magnetic field." D. K. MORRIS, MORRIS & LISTER AND J. W. ROEBUCK. September 14th.
 13,221. "Electric ovens." K. MJELVA. September 14th.
 13,225. "Apparatus for reception and utilisation of electric-current impulses for wireless, &c., telegraphy and telephony." W. J. LYONS & SELECTIVE SIGNAL CO. September 14th.
 13,260. "Electric signalling systems for mines, &c." AUTOMATIC TELEPHONE MANUFACTURING CO. & C. REMINGTON. September 15th.

PUBLISHED SPECIFICATIONS. 31

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The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

- 7,064. ELECTRICALLY-CONTROLLED CLUTCHES. W. Langdon-Davies, A. Soames and Naamlooze Vennootschap de Nederlandsche Thermo Telefoon Maatschappij. May 17th, 1916. (108,871.)
 11,996. HAND LAMPS FOR SIGNALLING. G. Burney & H. P. Lake. August 24th, 1916. (108,891.)
 12,019. PRIMARY ELECTRIC CELLS. J. H. Nicholson (G. N. Antonoff). August 24th, 1916. (108,892.)
 12,070. MOUTHPIECE FOR TELEPHONE TRANSMITTERS. O. Thokle. August 25th, 1916. (101,296.)
 12,147. ELECTRIC FURNACES. British Thomson-Houston Co. (General Electric Co., U.S.A.). August 28th, 1916. (108,902.)
 12,395. MEANS FOR OPERATING APPARATUS AT A RECEIVING STATION FROM A SENDING STATION BY MEANS OF ELECTRIC PULSATIONS. September 7th, 1915. (101,411.)
 14,290. SPEARS FOR CURRENT-TESTING APPARATUS FOR ELECTRICAL APPLIANCES. C. E. Hunter & W. J. Davis. October 7th, 1916. (108,940.)
 14,960. ELECTRIC SELECTORS. S. Oulianine. October 20th, 1916. (108,949.)
 15,230. ELECTRIC CURRENT RECTIFIERS. H. Wade (H. S. Mills). October 26th, 1916. (108,954.)
 15,680. LOCKING DEVICE FOR USE WITH MAGNETO-ELECTRIC MACHINES. H. Knox, G. Weston & G. W. Barnes. November 2nd, 1916. (108,961.)
 15,901. "Magneto-electric machines." G. F. Cooke. November 7th, 1916. (108,967.)
 16,106. DASH-POT RETARDING AND TIME-LIMIT DEVICES, PARTICULARLY APPLICABLE FOR USE IN CONJUNCTION WITH ELECTRIC APPARATUS. Electric Control, Ltd., and O. Ellesen. November 10th, 1916. (108,974.)
 17,250. TREATMENT OF HYDRO-CARBONS FOR THE PRODUCTION OF OTHER HYDRO-CARBONS OF DIFFERENT SPECIFIC GRAVITY AND BOILING POINT. L. B. Cherry. February 21st, 1916. (104,330.)
 18,562. AUTOMATIC CUT-OUTS FOR ELECTRIC CIRCUITS. R. Johansson. December 28th, 1916. (108,998.)

1917.

640. OVERLOAD CIRCUIT BREAKERS. Igranic Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.). January 12th, 1917. (109,003.)
 1,125. LAMPS. C. K. Maltby. January 23rd, 1917. (108,810.)
 2,617. PROTECTIVE DEVICES FOR ALTERNATING-CURRENT ELECTRIC SYSTEMS. A. E. McColl. July 20th, 1916. (Divided application on 10,227/16.) (109,009.)
 2,872. REGENERATIVE BRAKING SYSTEMS. W. V. Turner. March 31st, 1916. (105,225.)
 3,046. DRAWN FILAMENTS FOR ELECTRIC INCANDESCENCE LAMPS. P. F. Guardiola. March 1st, 1917. (108,817.)
 3,881. APPLIANCES FOR THE SHAPING OF TELEGRAPH AND LIKE INSULATORS. Taylor, Tunnicliffe & Co. and P. Cooper. (March 16th, 1917. (108,821.)
 4,336. ELECTRIC MOTOR CONTROL SYSTEMS. British Westinghouse Electric and Manufacturing Co. (Westinghouse Electric & Manufacturing Co., U.S.A.). April 26th, 1917. (108,824.)
 5,168. SYSTEMS OF CONTROL FOR SINGLE-PHASE COMMUTATOR MOTORS. British Westinghouse Electric & Manufacturing Co. April 12th, 1916. (105,913.)
 5,295. INSULATION OF SUBMARINE TELEPHONE CABLES. Felten & Guillaume Carlswerk Akt. Ges. April 14th, 1916. (105,573.)
 5,315. SPARKING PLUGS FOR INTERNAL-COMBUSTION ENGINES. A. G. France. April 16th, 1917. (109,019.)
 6,036. ELECTRIC MULTIPLE SWITCHES. E. A. Laidlaw. April 28th, 1917. (109,023.)
 7,712. OVERWINDING PREVENTING SWITCH FOR ELECTRIC CRANES OR THE LIKE. S. H. Heywood & S. H. Heywood & Co. May 30th, 1917. (109,029.)
 10,178. DRY BATTERIES. A. Arnelin. July 13th, 1917. (108,846.)

THE ELECTRICAL REVIEW.

VOL. LXXXI.

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No. 2,080.

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Published every FRIDAY, Price 4d.

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Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 8d.; Canada, £1 3s. 10d. (\$5.80). To all other countries, £1 10s.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.

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LANCASTER: Gordon & Gotch, Cimitiere Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

MELBOURNE: The Mining & Engineering Review, 90, William Street; Gordon & Gotch, Queen Street.

MILAN: Fratelli Treves.

NEW YORK: D. Van Nostrand, 25, Park Place.

PARIS: Boyveau & Chevillet, 22, Rue de la Banque.

PERTH, W.A.: Gordon & Gotch, William Street.

ROME: Loescher & Co., Corso Umberto 1° 307.

SYDNEY: The Mining & Engineering Review, 273, George Street; Gordon and Gotch, Pitt Street.

TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.

WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

THE ASSOCIATION MOVEMENT.

A FORTNIGHT ago we briefly recorded the gist of an important speech made by Mr. L. A. Paish, on behalf of the Government, to the members of the Birmingham Brassmasters' Association.

It will be recalled that Mr. Paish then announced the Government's desire to support and assist in the formation of Trade Associations to the end that British manufacturers may be more efficiently organised and equipped to combat overseas competition after the war.

This Government advocacy of the association movement is welcome evidence of the new spirit which permeates the revitalised Commercial Intelligence Branch of the Board of Trade, whose efforts on behalf of British trade deserve all possible encouragement.

The justification of, and the necessity for, the existence of trade associations has been amply demonstrated on many occasions, but never so conclusively as in the present period of national stress.

The Government in particular has appreciated the advantage of being able to get into close contact with an entire trade through the medium of a well-regulated association representative of that trade, and the individual firms engaged in trade have learned that their policy and needs can be more effectively voiced by such a body than by their unorganised individual representations.

A prominent instance of such mutual recognition was provided by the Government's recent employment of the organisation of the Cable Makers' Association as the controlling authority for the distribution of the restricted supplies of copper amongst all British cable-makers—whether members of the Association or otherwise—for the purpose of facilitating the manufacture of insulated wires and cables required for repairs and maintenance.

It is well known that these functions were faithfully performed, and that the Government, the producer, and the consumer, all derived substantial benefits from the assistance thus afforded them by an Association which, according to its early critics, could not be expected to help anyone outside its own roll of members.

The C.M.A. is thus doing work of national importance, and, as is usual when an individual or an institution achieves distinction, we are encouraged to examine its origin and policy in the hope that the path of those who follow may be illumined by the light of the experience of those ahead.

Such a review becomes an urgent duty when we realise the increased attention now being devoted to the "association movement" and industrial organisation generally.

THE "ELECTRICAL REVIEW'S"
ELECTRICAL & ALLIED TRADES DIRECTORY
(THE RED BOOK),

1917 EDITION

NOW READY.

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Parenthetically, it may be hoped that the time is not far distant when each and every trade in the country will have its own trade association, competent and empowered to voice its opinions on the council of a Federation of such associations, to whom the Government could safely turn for guidance on all matters pertaining to industrial legislation.

It is probable that the comparatively backward state of the association movement in this country is to some extent due to the trait which, in an Englishman, is euphemistically described as "a sturdy spirit of independence." Although invaluable in pioneering and colonisation, this spirit becomes almost a handicap in a highly organised community in that it is liable to prevent the British manufacturer from co-operating with others engaged in his trade, even after such co-operation has been shown to be essential to his own welfare.

Reverting to the origin of the C.M.A., we find it was founded about 20 years ago, at a time when the public generally had no experience to guide them when buying electrical equipment, and when, accordingly, the *price* was the chief, and often the only, consideration.

Any cable-maker desirous of improving the quality of his goods was further hampered by the circumstance that in many cases his superior, and consequently more expensive goods, differed in *appearance* very slightly from those of his less scrupulous competitor, whose object was to make immediate profits rather than an enduring reputation.

The inevitable result was that the manufacturers were brought to the verge of ruin by their cut-throat competition, and the consumers slowly came to realise that the policy of accepting the lowest price was not always an unmixed blessing.

A few of the manufacturers therefore came together and formed the nucleus of the C.M.A. on the basis of their common agreement that it was vital in the interests of the entire electrical industry that their cables should conform to at least a minimum standard of quality, and the well-known "Association grades" were accordingly established.

Having set up these agreed standards of quality, the adoption of standard prices was an obvious and necessary sequel, and the public accordingly has for years been able to rely upon buying goods from any member of the C.M.A. at the same price, and of at least the same minimum and sufficient standard of quality.

As each member was at liberty to devote his profits to the betterment of his goods, there naturally arose a very keen competition in *quality*, which has been advantageous to the maker and user alike, whereas the former unrestrained competition in *price* was disastrous to both.

To-day, thanks to the initiative of the founders of the C.M.A., the goodwill of the expression "Association grade" is of an international character, and stands so high that the best recommendation those interested in the sale of non-C.M.A. cables can think of in appraising their goods is to claim that they are "equal to Association quality."

From the above, it will be seen that one of the principal ideals of each new trade association, as and when it is formed, should be the maintenance of the *quality* of their goods, or, as expressed by the late Prime Minister (Mr. Asquith), when speak-

ing on the Paris Economic Conference in the House of Commons on August 2nd, 1916, "the development of trade associations for common action at home and abroad to raise the average standard of production."

A New Electric Vehicle Maintenance Scheme.

IN the opinion of the Commonwealth Edison Co., of Chicago; the psychological moment has arrived to render particularly easy and attractive the pathway of the intending purchaser and user of electrical motor vehicles. Accordingly, the company in question has just issued details of a scheme which it has had under development for the past 18 months, whereby owners of such vehicles can secure complete maintenance of their machines, including garaging, charging of batteries, renewal of all wearing parts, periodical body painting, and the like, for a stipulated contract term at a flat rate based on an estimated daily service.

The scheme, which includes the erection of an electric vehicle garage with a capacity of about 100 machines, has been developed by Mr. Wm. P. Kennedy, a New York consulting engineer, who has had many years' experience of the electric vehicle problem, involving a complete examination of haulage methods and requirements, including the operating costs of many firms now using electromobiles. Following the example of the majority of electric light and power supply undertakings, the Commonwealth Co. does not intend to undertake the direct sale of the machines, although it is prepared to facilitate the arrangement of payments if clients so desire. Customers may select any one of the standard makes of industrial electric motor vehicles, thereafter providing only the drivers, paying the insurance charges, and making their own provision for depreciation. All other charges will be borne by the electric supply company under the terms of its contract. The latter provides for the maintenance of the vehicle in every respect, the basis charge being determined on the experience that most electric vehicles can be operated satisfactorily on a single battery charge per day. Where excess mileage is necessary, "boosting" charges will be furnished, the so-called "excess" over the standard service allowance being charged to the client at a figure which includes allowances for tire wear, renewal of worn parts, and other elements covered by the service, in addition to the cost of the extra energy put into the battery. The system throughout is based on the theory that the amount of energy taken out of the battery denotes the service the vehicle is yielding, and in that way measures its periodic requirement for maintenance.

Careful examination of performance records and maintenance outlays for large installations extending over considerable periods have enabled the company to fix upon a figure that assures it ample protection against loss, whilst at the same time affording the client a complete service guarantee at no advance over the ordinary costs for maintenance under the usual garage conditions. As a large buyer of tires, battery replacements, and other supplies, the company is naturally able to give service at a minimum of cost, figuring a safe operating margin on the basis of averages. The new maintenance system is not to be confused with the usual battery service systems which are in operation in various parts of the United States, for the reason that it comprises complete maintenance of the vehicles, including the supply of electrical energy, whereas the battery service system generally only comprises the supply of energy and battery maintenance.

AN APPROXIMATE METHOD OF CHECKING THE ACCURACY OF A DIRECT-READING INSULATION TESTING SET.

By G. W. STUBBINGS.

SUCH direct-reading instruments for the measurement of insulation resistance as the Megger and Ohmer are in very common use, owing to their convenience and portability. They enable insulation resistance to be tested at a much higher voltage than do such galvanometer and portable battery sets as the Kelvin, while they possess the important advantage over other testing sets requiring a pressure supply from the mains, of being available for use anywhere. There is, however, no direct method of checking the accuracy of direct-reading instruments except by the use of standard high resistances. The comparison of the insulation resistance of, say, a piece of defective cable, as measured by a Megger at 500 volts, with a corresponding measurement using a Paul set taking pressure from 240-volt lighting mains would give no reliable indication of the relative accuracy of the two instruments, owing to the difference of the voltages. Standard resistances even as high as one megohm are, on the other hand, costly, certainly too much so to justify purchasing them for this isolated use. The purpose of the present article is to suggest a method of checking the accuracy of direct-reading testing sets, by using a moderately high resistance in series with an E.M.F. opposed to that of the magneto generator. The apparent resistance of such a combination can be made as high as may be desired by adjusting the difference between the counter E.M.F. and the voltage of the generator.

The principle of the action of direct-reading insulation testing sets may be briefly recapitulated. They depend

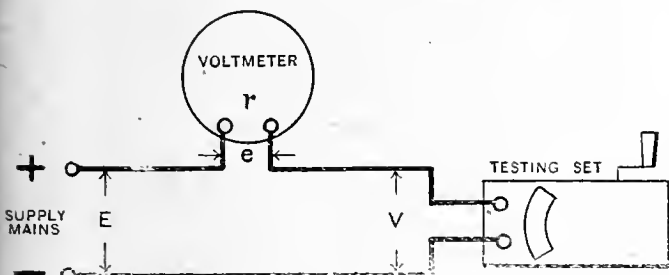


FIG. 1.—DIAGRAM OF CONNECTIONS.

upon the interaction of two magnetic or electrical fields, the one proportional to the voltage of the generator, and the other proportional to the leakage current through the fault. As this leakage current will be proportional to the voltage of the generator, the fault resistance meanwhile being constant, it follows that a variation in such voltage will affect both fields to an equal extent, and will have no effect on the readings of the instrument.

If such a direct-reading set be connected up to a high resistance in series with an E.M.F. opposed to that of the generator, the current through this resistance will depend upon the difference between the counter E.M.F. and the voltage of the generator, and the apparent resistance as indicated by the instrument will be higher than the actual value. If v be the voltage at the terminals of the instrument, E be the back E.M.F., and r the value of the resistance used, the current will be $(v - E)/r$, and the apparent resistance R , will be given by $R = v r / (v - E)$. If the voltage across the resistance be e , then $e = v - E$ and $R = r(E + e)/e$.

The method can be readily adapted by using the supply mains as the counter E.M.F., and an ordinary voltmeter whose resistance is known. The value of e can then be read off directly. The instrument will then be connected up as shown in the diagram, fig. 1, the connections being such that the voltmeter reads backwards before the generator handle is turned. When the generator volts are equal to the supply voltage the voltmeter reads zero, and the testing instrument reads "infinity." On raising the generator voltage, the reading of the testing instrument diminishes, whilst that of the voltmeter increases. By taking simultaneous readings

of the testing instrument and of the voltmeter, a very complete check can be obtained.

Assuming a supply voltage of 180, and a voltmeter reading 500 across the scale, such voltmeter will have a resistance of about 50,000 ohms. By regulating the speed of the generator armature to obtain readings of 5, 10, 15 and 20 on the voltmeter, values of R , the apparent resistance of the voltmeter, will be respectively 1.85, 2.45, 1.65 and 1.00 megohms. The method will only give approximate results for high values of R , as the corresponding values of e are observed on the low part of the voltmeter scale, but the accuracy will be sufficient to be very useful.

For checking values of R below 1 megohm a lower voltage should be used. This can be readily obtained by connecting a number of lamps in series across the outer lighting mains, and taking tappings at suitable points. The testing set can then be tested over its whole range without there being any need for an excessive generator voltage.

SPECIALISING AND SPECIALISTS.

By "TRAMP ROYAL."

It was during the war that I sat in the office at Berlin and learnt from my colleagues and the daily Press that England was crushed and the British Empire a thing of the past. At that time I could hardly class myself as either a specialist or an all-round man—for it was the Boer War to which I refer. What I am now is another story; but at that time I had great ideas upon specialisation, and I was developing in the hotbed of the genuine article. I saw men who earned their meagre salary checking strains and stresses in designs of building work, others who made steam calculations, and others who handled railway track problems day in and day out. I rubbed shoulders with foremen who were thoroughly trained as foremen, and workmen who were trained to do their bit skilfully, but to leave the thinking to others. We British—yes, and our American cousins—have felt the results of these intensive methods for many years. The German, in spite of his broad elementary and secondary education, falls easily a victim to the specialist mycelium; he soon loses both adaptability and initiative. The American, as an individual, is not a specialist, but rather a mass of energy in a groove. Although, generally speaking, he is a routinist, he is ever ready to tackle a new problem in a new way, because he has an inherent sense of adaptability.

In a little over a hundred years ago it was possible to grasp all the knowledge there was to be had of modern science; but, at the present time, no individual can know all the facts that have accumulated. Science and technology have now become so much broken into sections that if one is to be a useful worker one must specialise. Driven to this conclusion, we immediately set to work to shut ourselves in watertight compartments, and, making a mental picture of ourselves as specialists, we run the risk of losing grip of the general trend of science.

It is the exceptional man who becomes the real specialist—he is the "expert" *par excellence*; but to most of us is left the choice between a superficial covering of a large area and a developing of one's strong points. For efficiency, the latter choice must be made. How pleasant it is to feel that the division of labour makes it unnecessary for us to learn how to repair boots, starch collars, weave straw hats, and drive a motor-bus before we can put in an appearance at the office. Instead of devoting our energies upon learning a multitude of things, we can concentrate upon a few particular things—such as the prices of raw material, the functions of relays, and the labour problem.

The call becomes daily more urgent for good, all-round men who can specialise. By focussing for a time upon one small subject or line of work, one can get hold of all its details, and at the same time broaden the base of general knowledge. One's line of work at a certain time might make it an advantage to specialise upon cable joints and jointing, and a few years later, perhaps, supply meters or steam traps might offer themselves for concentrated study.

It must be our strong points that we build into our specialities; there is no room for average ability. As the old adage has it, "Strike while the iron is hot." Steep oneself in a thing until it is absorbed. Waste little time over weak spots. Develop the strong points, and continually bring them to bear upon every phase of work. We shall thereby produce, as it were, peaks of maximum experience, and these peaks will coincide with our natural abilities, opportunities for advancement, and external influences. During the process of absorption a few excursions around the edges of the territory of the man higher up will prove an advantage, as they will give a broader view to one's work.

The engineer who is not a specialist, but who makes a speciality of some small item, and gets thoroughly in touch with its bearing upon general experience, not only tends to become an expert, but really increases his efficiency in his more expansive every-day line of work. The man with this broad mental scope and ability to concentrate often beats the ordinary specialist on his own ground. There is a psychological reason for this: the mind being brought to bear continually upon a subject a stage is reached which one might call the point of saturation. In economic science there is such a thing as the Law of Diminishing Returns, which applied to specialisation means that if we work at one thing several hours we progress; more hours and we gradually fall off in production; go on increasing the hours, and we reach a stage at which our subject becomes unproductive or stagnant.

On all sides we find Nature specialising: Special organs for digestion, special developments for different geological ages, and it is only by specialising that many members of the animal kingdom are able to exist. They are not specialists, but they have developed a special function or organ. The Pholas specialises in rock or timber boring, its shell being of the nature of a round file. Its activities are limited: it cannot crawl and it cannot crack nuts. The burying beetle, on the other hand, cannot bore rock, but has its body specialised into a digging machine, and its labours are limited to those of grave-digger. A bird, which is higher in the scale, can fly, use its beak as a pick, pair of pliers, or tongs; it can walk, and sometimes swim. The hand of man can be trained to the art of using the saw or gimlet, equally with that of holding a plough, using a needle, or a pair of compasses. He can travel on land, in water, and in the air. Specialising for him must mean more than a rut—it must mean a cutting edge with a solid backing.

In conclusion, I would recommend cultivating a genuine interest and a warm enthusiasm for one's work. No matter what kind of work comes our way, make it individual—give it something characteristic. Remember that the man who can adapt himself readily, but has only ordinary ability, is often found holding a good position, while our brilliant class-mate is unable to land the responsible job because he is too clever to stick at the details and drudgery.

WAR PRICES FOR ELECTRICAL ENERGY.

As in every other department of industry, one effect of the war has been to increase the cost of production of electrical energy and to necessitate increases in the prices charged to consumers. Such advances have been chronicled in our "Lighting and Power Notes" from the commencement, but necessarily are distributed over a great number of issues, as hardly a week passes without an instance arising. From inquiries which have reached us, we infer that the subject is of considerable interest to many of our readers, and have therefore thought it well to bring the data together into a compact form in which they will be readily accessible; the list is not exhaustive, but will probably be found to contain sufficient information for most purposes, and we shall be glad of the assistance of supply engineers, to enable us to bring it up to date on future occasions, if necessary.

The figures given below are additive except where otherwise stated. L. = lighting. P. = power. H. = heating. C. = cooking. T. = tramways. R.V. = rateable value; where not otherwise specified, the increases are understood to apply to all supplies. In the case of complicated tariffs, only the main features are given. The names of months indicate approximately the quarter in which the increase took place (usually following the month named). Prices in pence are per unit.

ABERDEEN.—Oct., 1915, L. 10 p.c., P.H.C. 25 p.c.
 ABERDEEN.—March, 1916, L. 4d.; Oct., 1916, L. 1d.
 ABERYSTWYTH.—Dec., 1915, 10 p.c.; July, 1916, 10 p.c.
 ACKINGTON.—May, 1915, 20 p.c.; March, 1917, L. 0.2d., H. 0.1d., R.V. 0.1d., P. 10 p.c.

ACTON.—May, 1915, 10 p.c.; Nov., 1915, min. per qr. 13s. 4d.
 ALDERSHOT.—March, 1916, L. 10 p.c., P.H. rev. prices, 2d.—1½d.; Dec., 1916, rev. prices, L. 6d., P.H. 3d.—2½d.
 ALORINGTON.—June, 1915, 4d.
 ASHTON-UNDER-LANE.—March, 1916, L. 10 p.c., P.H. 25 p.c.; Dec., 1916, L. pre-war price plus 1d.
 ATHERTON.—Dec., 1915, P.H.C. 20—10 p.c.
 AYLESBURY.—March, 1916, L. 10 p.c., P. 4d.
 BACUP.—Dec., 1917, L. 10 p.c., P.H. 15 p.c.
 BANGOR.—June, 1915, L. inc. to 6d.
 BARKING.—April, 1915, 10—5 p.c.; Aug., 1916, rev. price, P.H. 1½d. plus 5 p.c., to 1d.
 BARNLEY.—June, 1916, L. 4d., P. 10 p.c.
 BARNSTAPLE.—June, 1916, inc. to 6d.
 BARKOW.—Sept., 1915, L.P.H. 10 p.c.
 BATH.—Sept., 1915, 10 p.c.; Dec., 1916, 10 p.c.; Sept., 1917, L. 4d., H. 5 p.c.
 BATLEY.—Sept., 1917, L. 7½ p.c., P. 2½ p.c.
 BECKENHAM.—June, 1915, 15 p.c.; June, 1916, L. inc. to 7d.
 BEDFORD.—March, 1916, 5 p.c.; Sept., 1916, 5 p.c.
 BELFAST.—July, 1915, L. 4d., P. 4d.; July, 1917, 4d.
 BEXHEAD.—Sept., 1915, 10 p.c.; July, 1916, 5 p.c.
 BIRKENHEAD.—Dec., 1915, 7½ p.c.; March, 1916, rev. prices, L. 4d., P.H. 1½d., to 1d., plus 10 p.c.; March, 1917, L. 5 p.c.
 BIRMINGHAM.—March, 1916, L. 15 p.c., P. 20 p.c.; Dec., 1916, L. 15 p.c., P. 10 p.c.; Sept., 1917, 15 p.c.
 BISPHAM.—Jan., 1917, rev. price, P. 2d.
 BLACKBURN.—Oct., 1915, 15 p.c.
 BLACKPOOL.—June, 1915, 10 p.c.; June, 1917, rev. prices, L. 4½d., or 7d. and 2d., P. 3½d. and 1d., H.C. 1d.—1½d.
 BOGNOR.—Nov., 1916, 1d.
 BOLTON.—May, 1915, L. 4d., P. 10 p.c.
 BOOTLE.—June, 1916, 12½ p.c.
 BRAY (WICKLOW).—Sept., 1917, 10 p.c.
 BRIDLINGTON.—April, 1916, rev. prices, L. 5½d.—4d., H. 2d.—1½d.
 BRIGHTON.—March, 1915, L. 4d., m.d. 6d. and 2d. raised to 6d. and 3d., public lighting, 4d., P. 0.1d.; Oct., 1915, L. 4d., P. 0.15d., T. 0.05d.; March, 1916, rev. prices, L. 6½d.—4d., P. 1½d.—1½d.; June, 1917, 10 p.c. (T. 0.1d.).
 BRISTOL.—April, 1917, L. 22½ p.c., P. 45 p.c., Contract 37 p.c.
 BROADSTAIRS.—Sept., 1915, 10 p.c.
 BROMLEY (KENT).—July, 1915, 10 p.c.
 BURNHAM (SOMERSET).—Dec., 1916, 1d.
 BURNLEY.—Aug., 1915, rev. prices, L. 3½d., H. 1½d., P. plus 5 p.c.; March, 1916, L.H.C. 4d., T. 0.05d., P. 5 p.c.
 BURTON-ON-TRENT.—March, 1916, 15 p.c.
 BURY (LANCS.).—June, 1915, L. 10 p.c., P.H. 15 p.c.; June, 1916, L. 5 p.c., P.H. 10 p.c.; Sept., 1917, 5 p.c., making total L.H.T. 20 p.c., P. 30 p.c.
 BUXTON.—Sept., 1917, 20 p.c.
 CANTERBURY.—May, 1916, 4d.
 CARDIFF.—March, 1917, 5 p.c.
 CARLISLE.—Sept., 1917, 10 p.c.
 CATERHAM.—July, 1916, rev. price, 7d.
 CHATHAM.—March, 1915, 20 p.c.; March, 1916, 13½ p.c.; Sept., 1917, rev. prices, L. 6d., P. 1½d., H. 4½ p.c., -spl. rates 10 p.c.
 CHELTENHAM.—June, 1917, 10 p.c.
 CHESTER.—Dec., 1915, 15 p.c.
 CHESTERFIELD.—Aug., 1915, 12½ p.c.
 CHICHESTER.—Dec., 1915, 1d.
 CHISLEHURST.—July, 1915, 10 p.c.
 CLONES.—Oct., 1915, 1d.
 COLCHESTER.—July, 1915, 4d.
 COLNE.—June, 1915, P. 4d.; March, 1917, increase.
 COLWYN BAY.—June, 1916, 4d.
 CONISTON.—May, 1917, 2d.
 CORK.—June, 1915, 10 p.c.
 COVENTRY.—July, 1916, P. 2 to 16 p.c., according to price of coal.
 CREWE.—June, 1916, 10 p.c.; June, 1917, 15 p.c.
 CROYDON.—March, 1915, L. 4d.; June, 1916, 10 p.c.; Dec., 1916, rev. price, P. 2½d. to 600 units, 1d. over; Sept., 1917, 15 p.c.
 DALKEITH.—July, 1915, rev. price, L. 5½d., P.H. 2d.; July, 1916, L. 4d., P. special charge.
 DARLINGTON.—June, 1915, L. 4d., P. 4d.
 DARTFORD.—Sept., 1915, L. 1d. and 4d., P. 4d.; March, 1916, 20 p.c.; July, 1917, L. 10 p.c., P. 15 p.c.
 DARWEN.—June, 1915, L. 10 p.c., P. 20 p.c.; June, 1916, P. 5 p.c.; June, 1917, 5 p.c.
 DAWLISH.—Aug., 1916, L. 10 p.c.
 DENNY.—Sept., 1916, L.P. 4d.
 DEWSBURY.—June, 1915, L. 10 p.c., R.V. 12 p.c., P.H. 15 p.c.; June, 1917, L. and R.V. 2½ p.c., P.H. 10 p.c.
 DOVER.—Sept., 1916, 4d.
 DUBLIN.—March, 1915, L. 4d., P. 4d.
 DUNDEE.—June, 1917, L. 4d., P. 4d.
 DURHAM.—June, 1915, 0.02d. for every 6d. above 7s. cost of coal per ton.
 EALING.—Aug., 1916, 33.3 p.c.
 EASTBOURNE.—March, 1916, L. 4d.; Sept., 1916, L. 4d.
 EAST HAM.—Dec., 1915, 10 p.c. (T. 5 p.c.); June, 1917, 10 p.c. (T. 5 p.c.).
 ECCLES.—Sept., 1915, L. 10 p.c., P.H.C. 20 p.c.; Dec., 1916, L. 15 p.c., P.H.C. 5 p.c.
 EDINBURGH.—July, 1915, L. 4d.; Aug., 1917, L. 4d., P. 5 p.c.
 ELLAND.—July, 1915, P. 12½ p.c.; Aug., 1916, L. 4d., P. 7½ p.c.
 EPSOM.—March, 1916, 25 p.c.; March, 1916, rev. prices, L. 7d., P. 3½d., public lighting 4½d.
 ERITH.—Sept., 1915, L. 4d., P. 10 p.c.
 EXETER.—June, 1916, L. 1d.
 FALKIRK.—April, 1915, 30 p.c.
 FARNHAM.—Dec., 1916, rev. prices, L. 8d., P.H.C. 4d. (restricted).
 FAVERSHAM.—Oct., 1915, 4d., Sept., 1917, 4d.
 FINCHLEY.—June, 1916, L. 20 p.c., P. 10 p.c. and scale.
 FLEETWOOD.—Sept., 1915, 10 p.c.
 GREAT YARMOUTH.—July, 1915, 4d.; Dec., 1915, 4d. with rebate.
 GILINGHAM.—April, 1915, L. 4d.; Dec., 1915, 10 p.c.; Oct., 1916, 15 p.c.; Aug., 1917, 15 p.c.
 GLASGOW.—June, 1917, rev. prices, L. 5d. and 1½d., or 4½d., P. 2d. and 1d., and scale, H. 1½d. or 1d., kw. charge inc. 15 p.c.
 GLOUCESTER.—July, 1916, 20 p.c.; June, 1917, 13.3 p.c.
 GRAVESEND.—March, 1916, 25 p.c.
 GRANTHAM.—June, 1916, 20 p.c.
 GRAYS.—June, 1915, 10 p.c.; June, 1916, 15 p.c.; July, 1917, 8.3 p.c.
 GRIMSBY.—Oct., 1915, 4d.
 GUILDFORD.—Sept., 1915, L. 10 p.c., P.H.C. 20 p.c.
 HALIFAX.—Sept., 1916, P. 17½ p.c.
 HAMPTON.—July, 1916, 20 p.c.
 HASLINGDEN.—June, 1917, rev. prices, L. 4½d., P.H. 15 p.c.
 HASTINGS.—Sept., 1915, L. 10 p.c.; Dec., 1915, 10 p.c.
 HEBDEN BRIDGE.—Dec., 1916, L. 20 p.c., P. 25 p.c.
 HECKMONDWIKE.—June, 1915, 10 p.c.; July, 1917, 33.3 p.c., making L. 6d., P. 2d. and 4d.
 HERLFORD.—May, 1915, 10 p.c.; May, 1916, 25 p.c.
 HESTON AND ISLEWORTH.—March, 1917, 25 p.c.
 HEXHAM.—June, 1915, L. 4d.; Sept., 1916, L. 4d., P. 4d.
 HAYWOOD.—May, 1915, 10 p.c.; Dec., 1915, L. 5 p.c., P. 10 p.c.
 HIGH WYCOMBE.—June, 1915, 10 p.c.
 HORSLEY.—March, 1916, 10 p.c.
 HORSHAM.—March, 1917, rev. prices, L. 6d., P.H. 2d.
 HOVE.—Sept., 1915, 20 p.c.; Sept., 1917, P. 10 p.c., or flat rate 2d.
 HUDDERSFIELD.—June, 1915, 12½ p.c.; Sept., 1916, 12½ p.c.
 HULL.—Dec., 1915, 4d., or 15 p.c.
 ILFORD.—March, 1916, 12½ p.c.

LESTON.—March, 1916, rev. prices, L. 4d., P. 2½d.-1½d., 11. 1½d.
LISWICH.—June, 1915, L. ½d., P.H.C. and K.V. 10 p.c.; March, 1916, L. ½d., P.H.C. 15 p.c.
KEIGHLEY.—Sept., 1915, ½d.
KENDAL.—June, 1915, L. 1d., P. ½d.
KESWICK.—June, 1916, L. 10 p.c.
KETTERING.—June, 1915, P. 10 p.c.
KINGSTON-ON-THAMES.—April, 1915, rev. prices, L. 5d. or 7½d. and 3½d., P.H.C. 1.65d.; April, 1916, R.P.L. 6½d.-4½d., P.H.C., 1½d.-1d.
KING'S LYNN.—July, 1915, L. ½d., P. 5 p.c.; Jan., 1916, P. 5 p.c.
LANCASTER.—April, 1916, ½d.; April, 1917, L.P. 22 p.c., T. 12½ p.c.
LEEK.—June, 1915, 10 p.c.
LEICESTER.—July, 1915, L. ½d., P. 20 p.c.; March, 1917, L. 1d., P. 15 p.c.
LEIGH (LANCS).—June, 1917, L. 15 p.c.
LEYTON.—March, 1916, L.P.H. 15 p.c., T. 5 p.c.
LINCOLN.—Dec., 1915, L.P. 20 p.c.
LIVERPOOL.—Dec., 1915, 12½ p.c.
LLANDUDNO WELLS.—July, 1916, 1d.
LLANDUDNO.—Aug., 1915, ½d.
LONDON COMPANIES.—
Brompton & Kensington.—Sept., 1917, total inc. 20 p.c., ckg. 1d.
Charing Cross, West End & City.—June, 1916, rev. prices, 5d., 4d. & 2d.
Chelsea Electric Supply Co.—Sept., 1917, 20 p.c.
City of London.—March, 1915, P. 10 p.c.; March, 1916, 10 p.c.; June, 1917, public lighting 15 p.c.
Kensington & Knightsbridge.—Dec., 1916, rev. price 5½d.
London Electric Supply Corporation.—Sept., 1917, total increase from 20 to 30 p.c..
Metropolitan Electric Supply Co.—Sept., 1917, total inc. 20 p.c.
Notting Hill Electric Supply Co.—March, 1915, ½d.; Sept., 1916, ½d.; total inc. 20 p.c.
South London Electric Supply Co.—Dec., 1915, 9 p.c.
South Metropolitan.—March, 1915, 10 p.c.
LONDON BOROUGH COUNCILS.—
Battersea.—Sept., 1915, 10 p.c.
Bermondsey.—June, 1917, L. 40 p.c., P. 50 p.c.
Bethnal Green.—Sept., 1917, 33.3 p.c.
Fulham.—March, 1915, 5 p.c.; Dec., 1915, rev. prices, L. 4d., P. 1½d.; March, 1917, 5 p.c.; May, 1917, s.w. system, plus 0.0075d. p.u. for each 6d. over 13s. cost of coal per ton.
Hackney.—Sept., 1915, 10 p.c.; Feb., 1916, 7½ p.c.; Sept., 1916, L. 2½ p.c., P. 12½ p.c.; June, 1917, 10 p.c.
Hammersmith.—Sept., 1917, L.P. 12½ p.c.
Hampstead.—Sept., 1916, 10 p.c.; Dec., 1916, 23.3 p.c.
Islington.—Dec., 1916, 25 p.c.
Puplar.—March, 1916, P. and public lighting, 10 p.c.; Sept., 1917, 10 p.c.
St. Marylebone.—Sept., 1915, 10 p.c.
St. Pancras.—June, 1915, 10 p.c.; Sept., 1917, reduced to 2½ p.c.
Shoreditch.—March, 1917, L.P.H., 25 p.c.
Southwark.—Jan., 1917, total increase equal L. 30 p.c., P. 50 p.c.; Sept., 1917, rev. prices, L. 6d.-3d., two-rate L.P. 8d. and 2d.
Woolwich.—March, 1915, 4d.
LONG EATON.—June, 1915, rev. prices, L. 4d., factory 3½d. and 2½d., P. 1½d. and 0.85d., H. 1d.
LOUGHBOROUGH.—Sept., 1915, 12½ p.c.; Dec., 1916, 12½ p.c.
LOWESTOFT.—March, 1916, L.H. 10 p.c.; May, 1917, L. ½d., P.H. 10 p.c.
MAIDENHEAD.—Sept., 1915, L. ½d., P. 10 p.c.; April, 1916, L. ½d., P. 10 p.c.; July, 1917, L. 1d., P. 10 p.c.
MAIDSTONE.—Dec., 1914, P. ½d.; April, 1915, L.H., ½d.; Dec., 1915, L. ½d.; March, 1916, H. reduced to 1d.; June, 1916, rev. prices equal 25 p.c. inc. on original prices; Aug., 1917, L. ½d., T. ½d., other 10 p.c.
MALTON.—March, 1916, 20 p.c.
MALVERN.—May, 1915, 1d.
MANCHESTER.—May, 1915, L. 10 p.c., P. 15 p.c., R.V. from 12 to 15 p.c.
MERTHYR TYDFIL.—June, 1915, rev. price, 4½d.
MEXBOROUGH.—July, 1916, rev. price, L. 4d.
MIDDLETON.—June, 1915, L. ½d., P. 12½ p.c.; March, 1916, L. ½d., P.H. 12½ p.c.
MIRFIELD.—May, 1915, P. and public lighting, 10 p.c.
MORCABB.—June, 1917, rev. price, P. 3d.
NEWCASTLE-UNDER-LYNE.—May, 1916, L. 5 p.c., P. 16½ p.c., P. 20 and 10 p.c.; Oct., 1916, rev. price, L. 7½d.
NEWPORT (MON.).—June, 1915, 20 p.c.; June, 1917, 10 p.c.
NEWPORT (I.O.W.).—June, 1916, L. 15 p.c., P. 10 p.c.
NEWQUAY.—Dec., 1915, rev. price, 7d.
NEWTON ABBOTT.—July, 1915, 16 p.c.
NORTHAMPTON.—Sept., 1915, L. 10 p.c., P. 7½ p.c.; Sept., 1916, L.H. 10 p.c., P. 12½ p.c.; June, 1917, 10 p.c.
NORTHWICH.—June, 1916, 10 p.c.; June, 1917, rev. prices, 7d. and 4½d., flat rate 6d.
NUNEATON.—June, 1917, 20 p.c. (P. 10 p.c.). Sept., 1917, total inc., 33.3 p.c.
ORMSKIRK.—Nov., 1915, L. 10 p.c.
OXFORD.—June, 1916, 20 p.c.
PENBROKE (DUBLIN).—March, 1915, L. 5 p.c.
PERTH.—Aug., 1916, L. 12½ p.c., P. 5 p.c.; Aug., 1917, 40 p.c.
PETERBOROUGH.—Sept., 1915, P. ½d.; Oct., 1915, 10 p.c.; Sept., 1917, total increase 20 p.c.
PORTSMOUTH.—Dec., 1917, total increase will equal L. 30 p.c., P.H. 45 p.c.
PLYMOUTH.—Sept., 1915, L. ½d.
PRESTON.—June, 1915, L. ½d.
QUEENBOROUGH.—Dec., 1915, 15 p.c.
RADCLIFFE.—Sept., 1915, L. 10 p.c., P.H. 15 p.c.; July, 1916, L. 5 p.c., P.H. 10 p.c.
RATHMINES.—June, 1916, L. ½d., P.H. ½d.
RAWENSTALL.—June, 1916, P. 5 p.c.
REIGATE.—March, 1916, L.P. 15 p.c., H. ½d. plus 15 p.c.; April, 1917, 18.3 p.c.
RICHMOND (SURREY).—April, 1915, 10 p.c.; Nov., 1916, rev. price, 4½d.
ROCHDALE.—June, 1915, L. 10 p.c., P.T. 15 p.c.; May, 1917, L. 10 p.c., P. 3d. instead of 15 p.c. Also coal clause.
ROTHERHAM.—July, 1915, L. ½d.
ROWLEY REGIS.—Aug., 1916, 20 p.c.
ST. ANNES-ON-SEA.—June, 1915, L. ½d., P.H. 10 p.c.; April, 1917, inc.
ST. HELENS.—June, 1915, L. 10 p.c.; July, 1916, 10 p.c.; Dec., 1916, 10 p.c.; April, 1917, 10 p.c.
SALFORD.—June, 1915, L.P. 7½ p.c.; March 1916, L. 2½ p.c., P. 7½ p.c.
SCARBOROUGH.—June, 1915, 10 p.c.
SHEFFIELD.—July, 1916, prices over 2d., 10 p.c.; under 2d., 20 p.c.
SHIPLEY.—June, 1915, rev. price, L. 4½d., P. 10 p.c.; March, 1916, P. 10 p.c.
SHREWSBURY.—March, 1916, 20 p.c.; June, 1917, 13.3 p.c.
SLEAFORD.—March, 1917, L. ½d., P. ½d.
SOUTHAMPTON.—June, 1916, 10 p.c.; Sept., 1916, 10 p.c.
SOUTHEND-ON-SEA.—June, 1917, L. ½d., P. ½d.
SOUTHPORT.—June, 1915, 10 p.c.; June, 1917, 5 p.c.
SOUTHWOLO.—March, 1916, 20 p.c.
SPENBOROUGH.—June, 1915, rev. prices, L. 4½d., P.H. 2½d. and 1½d.; April, 1917, R.P.L. 5½d., P. 2½d.
STAFFORD.—June, 1916, P. ½d.; Sept., 1916, rev. price, L. 7½d.
STALYBRIDGE.—Dec., 1915, P. (on prices less than 1d.) 0.1d.
STAMFORD.—July, 1915, 10 p.c.
STOCKPORT.—June, 1915, rev. prices, L. 5d., H. 1½d. (above 25 units, existing rates plus 10 p.c.), P. coal clause.
STOKE-ON-TRENT.—June, 1917, 25 p.c.; Sept., 1917, 8.3 p.c.
STONMARKET.—April, 1917, price raised from 8d. to 10d.
STROUD-ON-AVON.—April, 1916, 1d.; August, 1917, 4d.
STRETFORD.—Aug., 1915, L. 10 p.c., P. 15 p.c.; Oct., 1915, 15 p.c.
SUNDERLAND.—March, 1916, ½d.
SURBITON.—March, 1916, 1d.; March, 1917, 1d.
SUTTON.—July, 1916, L. ½d., P.H. ½d.

SWANSEA.—Sept., 1915, hours of m.d. inc. from 91 to 137 in winter qr., meter rent adopted.
SWINDON.—Sept., 1915, L. 12½ p.c. or ½d., P. 12½ p.c., public lighting and T. 10 p.c., H.C. ½d.; Sept., 1916, L. ½d.
TUNSTON.—Sept., 1915, 15 p.c.; June, 1916, 10 p.c.; March, 1917, 8.3 p.c.
TIDDINGTON.—June, 1916, 20 p.c.
THURSK.—April, 1916, 20 p.c.
TORYVALE.—Sept., 1916, L. ½d.; June, 1917, ½d.
TROWBRIDGE.—Aug., 1916, 10 p.c.
TUNBRIDGE WELLS.—Sept., 1917, L. 10 p.c., P.H., 25 p.c.
WAKEFIELD.—Sept., 1915, L.P. 12½ p.c.; April, 1916, P. 12 p.c.
WALLASEY.—July, 1915, rev. prices, L. 4d. and 3½d., P. 2½d., H.C. 1½d.
WALTHAMSTOW.—June, 1915, 15 p.c.; Nov., 1916, L. 5 p.c., P.H. 10 p.c.; Sept., 1917, L. 5 p.c., P.H. 8.3 p.c.
WALTON-ON-THAMES.—Sept., 1916, rev. price, 7d.
WARRINGTON.—July, 1915, L.T., 10 p.c., H.P. 15 p.c.; July, 1916, 5 p.c.; June, 1917, 10 p.c.
WATFORD.—June, 1915, L. 12½ p.c., P. 10 p.c.; Sept., 1916, rev. prices, L. 5½d.
WIDNESBURY.—Dec., 1914, 15 p.c.
WEST BROMWICH.—June, 1915, 20 p.c.; Dec., 1915, P. 15 p.c.
WEST HAM.—Sept., 1917, 10 p.c.; Sept., 1917, further 10 p.c.
WEST HARTLEPOOL.—Sept., 1917, 15 p.c.
WYMOUTH.—April, 1916, L. 15 p.c., P.H.C. 20 p.c.; Sept., 1916, rev. price, L. 6d.
WYMAN.—March, 1917, rev. prices, L. 5½d. to 3½d.; Sept., 1917, rev. prices, P. 2d.-1d., plus 25 p.c.
WIMBLEDON.—March, 1916, 10 p.c.; Sept., 1916, 15 p.c.; Sept., 1917, rev. prices, L. 6d., P.H.C. 2d.
WINCHESTER.—Sept., 1916, 15 p.c.; Dec., 1916, 10 p.c.
WINDERMERE.—June, 1916, 10 p.c.
WISBECH.—June, 1916, inc. to 6½d.
WOLVERHAMPTON.—June, 1916, 10 p.c.
WORCESTER.—Oct., 1915, L.P.H. 10 p.c.
WORKSOP.—Sept., 1915, L. ½d., P. ½d.; May, 1917, ½d.
WORTHING.—Oct., 1915, L. 10 p.c., or total 5½d.; Jan., 1917, 20 p.c.
WREXHAM.—Dec., 1916, 10 p.c.; Sept., 1917, L.H. 15 p.c., P. 6.7 p.c.
YORK.—March, 1917, L.P. 10 p.c.

AFTER-THE-WAR ELECTRICAL PROBLEMS IN RUSSIA.

AMONGST the technico-industrial problems that will come to the front in consequence of the war a very prominent place will be occupied in the post-war era, undoubtedly, by the question of the quickest and most reasonable development of the application of electricity in Russia. Unfortunately, no country previously to the war worked so unreasonably, dearly, wastefully, and unproductively as Russia; and of the various branches of Russian industry, as will be shown below, the Russian electrotechnical industry has been marked by these negative properties to a particularly large extent, says P. Gurievitch in the *Elektrichestvo*. Whilst in Germany, in the years 1900-10, district stations were reasonably introduced, and in the last five years a further great step forward has been made in so-called "grosskraftwerke"—that is, large stations for the supply of electric current to whole provinces, and even whole Governments—the Russian electrical industry has not emerged from the stage of uneconomical local electrical stations. The large power station using water power or brown and grey coal has not yet emerged from the sphere of platonic desire and project. In this irrational and uneconomic management of Russian local electric stations we find, however, a great danger for the whole future of industrial development in Russia.

The great progress made by the electric lamp in Europe and America, which he describes, leads M. Gurievitch to say that the supersession of the kerosene lamp by the electric lamp, owing to advantages of the latter over the former from the point of view of hygienic and sanitary conditions in the houses and workmen's dwellings, and also the greater safety in regard to fire, will become intensified in Russia in the near future, the more so as with the rational installation, production, and distribution of electrical power, electric lighting, at least in the towns, can easily compete with gas, and even with kerosene lighting. Gas and kerosene have their particular spheres of application where electricity, at least in the near future, cannot compete. A great future is in store, without doubt, in the large towns for gas for cooking, and for kerosene and petroleum as fuel for internal combustion engines. In the Russian Press the need is being urged of extending gas lighting, because in Russia a great need is being experienced for by-products of gas production required for the manufacture of explosives; but no doubt such can be obtained in sufficient quantity by the transformation of all the Russian coking furnaces for the recovery of the waste or by-products. With the chronic scarcity of coal in Russia, and the urgent necessity of it for the metallurgical industry, the burning of coal for lighting purposes appears to be, from the point of view of economy, altogether inadmissible, as electrical power can be successfully obtained by the use of cheap fuel—such as brown coal, peat, and the many water courses.

The writer then points out the increasing application of electricity to power purposes, which is leaving the lighting factor in the background; and to show how year by year this is taking place, he provides the following table, which includes the figures for Petrograd and Moscow:—

Year.	Berlin, 1911-12.	Chicago, 1911.	London, 1910-11.	Moscow, 1913.	Petrograd, 1913.
Population in millions...	2.6	2.2	6.5	1.5	2
Useful kw.-hours delivered per head of population ...	170	310	110	87	62.5
Delivered for lighting, per cent. ...	24	19	61	19	39
Motors, per cent. ...	45	12	27	40	33
Tramways, per cent. ...	31	69	12	41	28

This, he urges, shows that only in London and Petrograd has the delivery of electrical energy for lighting purposes surpassed that for other forms of application. In Chicago and Moscow only a fifth and in Berlin only a quarter of the total useful energy was delivered for lighting. Chicago, true, is in a somewhat special position, as a very large quantity of its power is used for the underground railway, whilst in Berlin 45 per cent. and in Moscow 40 per cent. is used exclusively in motors.

In Berlin 35,000 motors were connected in 1913-14, including 6,900 with 24,000 kw. for working metals; 4,755, with 29,000 kw. for lifts; 3,741, with 11,000 kw. for wood working; 3,723, with 8,861 kw. for printing presses; 3,329, with 1,253 kw. for fans; 1,920, with 5,814 kw. for sausage and meat shops; 1,638, with 1,066 kw. for sewing machines, &c. All these data are very interesting, as they illustrate the immense development possible for the introduction of electric motors in the large Russian towns, of which in 1913 there were connected in Moscow (1912), 6,976 electric motors; in Petrograd (1913), 6,851; in Warsaw (1913), 3,103; and in Lodz (1912), 2,404 electric motors.

About the same movement in the development is observed in Russia, where in 1913 the four towns with the largest electric stations used only 82,000,000 kw.-hours for lighting, but 207,000,000 kw.-hours for motors, &c., and 89,700,000 kw.-hours for tramways. With a total delivery in these towns—Petrograd, Moscow, Baku, and Lodz—of 378,000,000 kw.-hours, only 21.6 per cent. was supplied for lighting purposes. In all Russia, with the exception of the eight Governments of the Kingdom of Poland, the supply of electric current for lighting purposes, and also for technical purposes and motors, is shown in the following form, in millions of kw.-hours:—

	For lighting.			For motors and industrial purposes.		
	1905.	1913.	Increase, per cent.	1905.	1913.	Increase, per cent.
Central stations	52.1	175.5	238	47.9	444.8	829
Private "	169.8	209.4	23	212.4	1,045.7	393
	221.9	384.9	73%	260.3	1,490.5	473%

We see from this table that the expenditure of electrical energy in the eight years, 1905-13, for lighting purposes only, increased by 73 per cent., whilst the expenditure for motors and other industrial purposes rose 473 per cent. In other words, the application of electricity for motors and general industrial purposes increased during that time $6\frac{1}{2}$ times quicker than for lighting purposes. But if we take Poland into account, the expenditure of electric energy in 1913 for the whole Empire amounted to about 2,000 million kw.-hours, of which only 20½ per cent. was used for lighting and 79½ per cent. for motors, whilst in 1905 the deliveries for lighting made 46 per cent. and for motors 54 per cent. only.

The figures for Lodz are particularly striking. There, in 1913, there was supplied for lighting only 3,662,000 kw.-hours, against 33,409,000 kw.-hours for motors. Thus we see that even in Russia, in the towns with a large industrial development, the supply of electric current for motors, excepting tramways, exceeds that for lighting by almost nine times.

The Moscow lighting station delivers over twice as much current for motors as for lighting—namely, 51,677,000 kw.-hours, against 24,812,000 kw.-hours. Of the large Russian industrial centres, only Petrograd is distinguished by its backwardness in the supply of current for motors. There, in 1913, only 41,490,000 kw.-hours were delivered for industrial motors, against 18,745,000 kw.-hours for lighting purposes, and 34,872,000 kw.-hours for the tramways.

In a comparison of the prices of electricity it is observed that, whereas in Berlin the normal price is 16 pfennige per kw.-hour, or 7½ coopeks; in Switzerland 16 centimes, or 5.9 coopeks, in Russia, according to figures published in the "Elektrichestvo" in 1913, most of the stations accepted normal and small consumers for motors at 15 or 16 coopeks per kw.-hour—that is, 100 to 150 per cent. more than in Switzerland or Germany. In these dear tariffs, which may properly be called prohibitive, there is great danger for the whole future of the development of the electrical industry of Russia. Losses in working power in the form of men killed and made incapable of work will make at least 5,000,000 by the end of the war; that is to say, a sixth of the productive power in workers of 19 to 15 years of age, as given in the *Torgova Promyshlennaya Gazeta* in 1916. But even if, thanks to a reduction of holidays, Saints' days, and holiday Mondays, and preserving the present obligatory sobriety, the productivity of the remaining live-sixths of the workers is raised to the average level of before the war, such a level is so low in comparison with America, and even Western Europe, that if it is maintained in the future, Russian industry cannot expect, with a whole series of unfavourable conditions of a political, economic, and civilian character, to reach rapidly that stage of development that would enable it by means of a rapid rise in the productivity of the country to recover from the blows of the war, and pass over from the intense (from the economic point of view) unproductivity and exhaustion of war-time work to the productive economy of peace time.

Besides the foregoing, if Russian industry is to operate as previously to the war, then, notwithstanding any protective tariffs whatever, it will not be in a position even on its own market to compete with other countries, whether they be Germany, Japan, or the United States, which during the war have acquired immense capital and established in many branches of industry miracles in the form of factories, the equipment of which before the war is finished will have been paid for completely owing to the large war orders.

But how will Russian industry be in a position to pass over into productive and intensive work?

If we put aside the many causes of a general character that have

prevented and will hinder Russian independence, and limit ourselves only to a review of the strictly technical causes that are intimately connected with the question we are considering—namely, the future of the electrical industry in Russia—we may confidently state that one of the chief causes of the limited productivity and dearth in Russian industry is the too limited application of mechanical power.

American industry, as is known, is distinguished by the highest productivity in the whole world, and that is explained, to a large extent, by the fact that, being always short of hands, the Americans were obliged more than in other countries to adopt the principle of attaining the largest possible result with the smallest expenditure possible of labour. After a lengthy examination of the conditions influencing the industries of foreign countries, paying particular attention to fuel, M. Gurievitch lays great stress on the use made of cheap power, as in the case of Switzerland, and adds that Russia belongs to the list of countries that enjoy such advantages, and that therefore the rational development of the production of electrical power is one of the first problems to be dealt with immediately after the war.

If we turn to the present condition of the Russian electrical industry, we shall see that with very few exceptions—for example, the Moscow station—the Russian electrical stations are equipped irrationally in technical respects, and, above all, with old machines. As the still young electrical industry is in a stage of rapid development, it has of recent years made such colossal progress that the machines installed in the Russian stations 10 or 15 years ago, perhaps at the time the very last word in technical equipment, are at this moment quite unsuitable for electric current production.

According to statistics published in 1913 in the "Elektrichestvo," there were, for example, 47 stations with steam engines of a total power of 228,562 kw., besides 70 steam turbines, and, further, 137 steam engines of an old type, about 72 vertical and 65 horizontal, that had worked at the stations in large industrial centres and consumed unprofitably an immense quantity of coal, which is particularly dear in Russia, thanks to which the stations were obliged to retain their abnormally high tariffs for electricity, corresponding to the position of the electrical industry of 10 or 15 years before. Whilst in Berlin the normal tariff for electric light was only 40 pfennige—18.4 coopeks—per kw.-hour, in Petrograd it was 30 coopeks—that is to say, 63 per cent. dearer. This high Petrograd tariff was due to a whole number of other reasons—dearth of fuel, machinery, and especially cable systems, the creation of three separate companies, with their expensive boards, &c.

But it is certain that in the year 1913 in the Petrograd stations the 25 worn out steam engines, with 15 steam turbines, had a very unfavourable influence on working expenses. If the Russian electrical stations, with their great material expenditure, were modernised, as it is proposed they shall be in Petrograd in the near future, this question of the rational organisation of the production of the electric current in Russia would still remain unsolved as to modernise the existing electrical stations, means at bottom only to limit oneself to patches.

The present basis of the Russian electrical industry rests exclusively on the principle of small local electrical stations with high quality fuel obtained literally from the world's end, and it is essentially irrational and opposed to all the tenets of economy. Every new patch on this unhealthy organism, every new large central station of a local character is only another stumbling block which, in something like ten years, will have to be got over or removed at great expense, as, without a doubt, the Russian electrical industry with the uninterrupted development of things will be obliged in ten years' time, and perhaps before, to change over to the system of large interconnected regional stations which work with water power or cheap brown or grey coal, and are recognised as the only and profitable way for the production of electric current.

That one large electrical station is, in respect to original cost of equipment and current working expenses, more profitable than a series of small stations of equal power is obvious. Here the writer quotes numerous examples of installations in other countries, particularly in the United States, where, all the same, there are many small irrationally exploited electric stations. Thus in 1912 in that country there were 5,221 central stations, of which only 161 had a power of over 5,000 kw., or 3.1 per cent. The same is the case in Germany, where, out of 4,040 stations in 1913, only 103, or 2 per cent., had a power of over 5,000 kw. In Russia, out of 220 central stations only 21, or 9.5 per cent., had a power of over 5,000 kw. This is shown more clearly in the following table:—

	Year.	Total No. of central stations.	No. of stations of 5,000 kw.	Ditto in per cent.	Power of all stations in kw.	Total power of stations of over 5,000 kw.	Ditto in per cent.
United States	1912	5,221	161	3.1	5,135,000	3,610,000	70.3
Germany	1913	1,010	103	2	2,100,000	1,560,000	74.5
Russia	1913	220	12	5.5	—	199,000	—

The Russia item is particularised as follows:—The Moscow electrical station with 35,000 kw.; the Moscow tramways 23,100 kw.; the Petrograd 1886 Co., 45,000 kw.; the Petrograd Belgian Co., 18,160 kw.; the Petrograd Electrical Equipment Co., 18,000 kw.; the Petrograd tramways, 7,500 kw.; Baku, 29,000 kw.; Warsaw, 11,500 kw.; Lodz, 15,000 kw.; Kieff lighting, 7,550 kw.; Odessa lighting, 7,500 kw.; and Riga, 7,060 kw.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Old Lamp Tops.

I note in your issue of September 21st that a correspondent is inquiring as to the best method of recovering platinum from old electric lamp tops. I do not know if he intends dealing with large quantities or only a few thousands at a time. Assuming the latter, the best method to adopt is as follows:—

First of all, break out the cement or plaster and the glass from the caps, then "rough sort" the material obtained in order to reduce the bulk as far as possible. Crush what is left with a pestle and mortar until the plaster, &c., is reduced to a powder. Put the powder on a sheet of white glazed paper, spread on a bench, sit down in front of it, draw a small portion of the powder towards you, and commence blowing it away gently. The platinum and other wire will be left behind. Having done this, sort the wire as far as possible. A magnet should be used for separating the nickel wire, but all wire should be carefully examined for any pieces of platinum which may be attached to it. Put the remainder of the wire in a good porcelain dish, pour pure nitric acid on it, and boil until all the foreign matter is dissolved. Wash well and dry off. The process is a very tedious one, and requires good eyesight. A person can, by sticking at it, recover the platinum from 1,000 lamp ends in eight or ten hours. Needless to say, the boiling should be carried out in the open air, as dense red fumes are given off.

If your correspondent intends dealing with large quantities at a time, it will be necessary to put down special machinery for it.

Harry W. Brown.

Ballycarry, September 26th, 1917.

A Static Electricity Phenomenon.

The experience of Messrs. J. O. Grant & Taylor is similar to that which I have met with in connection with a steam car fitted with rubber-tired wheels. In this case a person standing on the ground and touching the metal work of the car would receive an unpleasant shock.

I also remember another case where a steam engine was driving some printing machinery by means of a 12-in. copper-sewn leather belt. When running, sparks 1 in. to 1½ in. long could be obtained from it by bringing the fingers near the belt.

Harry W. Brown.

Ballycarry, September 20th, 1917.

[The electrification of belting is a not uncommon phenomenon, due apparently to mechanical friction, or, perhaps, more accurately, to contact followed by separation. In paper mills very long sparks can be drawn from the rolls of hot dry paper as it leaves the calendars.—EDS. ELEC. REV.]

The E.T.U. and A.E.S.E.

Being a central station engineer of many years' standing, I should like to make the following remarks in connection with the letters from the secretary of the E.T.U. (L.D.). I am not a member of the E.T.U., or of the A.E.S.E., but after reading the aforementioned letters I should certainly never join the E.T.U. if those are correct samples of their progressive industry. To hit a Society that stands aside (from purely patriotic motives, and loses a number of its unpatriotic members in so doing) is a very low and unsportsmanlike attitude to adopt, especially to a Society that before the war was slowly bringing about some very essential radical improvements in the welfare of station engineers. To my mind it smacks very much of "beer and skittles," and appears to me just why central station engineers who have the least respect for themselves have so far refrained from joining Unions of such an unsavoury nature. Let the status go to blazes if it has to be got thus.

W. G. Ritchie.

Brighton, September 28th, 1917.

Scale on Evaporative Condenser Tubes.

I would advise "Central" to try and prevent the deposit of scale on the tubes by painting the tubes with aluminium paint. It would be interesting to try the effect of this on a small section of the condenser, and I would be very glad if "Central" would let me know the result.

London, W., September 25th, 1917.

C. Orme Bastian.

Fusing of an Electric Wire.

I was interested to read your correspondent's article, but I think that he arrives at the wrong conclusion. "The whole question 'is not' one of efficiency . . . the efficiency of the electrical engineer and his workman." The bulk of his illustrations bring out the fact that the general public think they are quite competent to do electrical work. The draper's assistant and budding electrical engineer, and every other incompetent, thinks he is qualified to interfere with an electrical installation, and that a contractor is quite unnecessary.

As regards the A.C. motors in controlled establishments, these were probably supplied by a wholesale house, or the motor manufacturers, and installed by the firm's own workmen. I know of many jobs which have not been interfered with, which have been "installed and forgotten."

I quite agree with Mr. L. E. Wilson's letter *re* periodical testing, and I think that in apportioning the blame to a large extent to the wholesale house he is getting near the root of the evil.

In a large percentage of installations the following circumstances happen: The installation, as handed over by the contractor, is a sound one. The maintenance is then given to a wireman, engineer, or odd man who looks after the motors and attends to the lights. Extra work is required from time to time, and the man, in addition to his daily work, carries out the extensions, which are very often done in a temporary manner, without any regard to overloading of circuits and other questions, so that in course of time the job becomes anything but a good one; then, if trouble arises, the contractor is blamed, for you cannot expect the man to condemn his own work.

By constituting any odd man about the place as his electrician, the consumer is entitled to trade terms (thanks mainly to the Tungsten Lamp Association), and supply houses, lamp factors, motor manufacturers, and cable makers tumble over one another to supply his wants at trade terms, and assist him in robbing the contractor of his legitimate work. Why should the T.L.A. give terms which make it impossible for a contractor to retain his customers? Why should a motor maker whose motor a contractor has sent direct to a job, be justified in calling immediately on the contractor's customer and offering trade terms? Why should supply houses sell a few dozen accessories or the lamps at trade terms immediately a contractor has finished the installation, and endeavour to cut out the contractor by even going to the length of finding third-rate firms who will fix the material they supply?

Why for a paper cable should cable makers quote exactly the same price to a penny to a consumer as they do to a contractor, seeing that the consumer is only a chance customer and the contractor a regular one, and this, moreover, when the contractor is working for the consumer?

How long is this policy of grab to continue? Is there no honour in the electrical trade? Is the policy of the German firms to be perpetuated by the supply houses, many of whose nationality would not bear the strictest examination? The business policy of the present associations and others in course of being formed bids fair to out-German the German. It is time the contractor made up his mind that, without combining, he will be squeezed out. Let every contractor help those who are determined not to submit to these injustices by joining the Contractors' Association, which has already done good work, and can do much more if backed by the whole of the contractors in the kingdom.

Contractor.

Instructions to Meter Readers.

May I suggest that Mr. Stubbings, in his otherwise thoughtful article concerning the "Do's and Don'ts" of meter readers, indicates insufficient appreciation of the commercial value which may attach to a consumer's conversation. It is, of course, extremely difficult to find the valuable combination of salesmanship and ordinary ability to read meters accurately, in the type of individual available to fill posts as meter readers; but I do firmly believe that, however polite may be a request that the consumer address his or her requirements of new work to the office, such request in very many cases would be directly responsible for opportunities of extended service being unhappily lost.

However lowly as an employé the meter reader may be regarded, I think that he or she should be definitely instructed in such a way as to enable appreciation of the valuable chances of further increasing the revenue of the supply undertaking concerned.

It would appear that, to carefully note in writing, and report to the office for attention of the sales department, the requirements of consumers, could be one of the suggested instructions with which your contributor concludes his article, without the disadvantage which, by some, might be thought to result from overlapping.

P. O. Wittey,

Staff Sergeant R.E.

B.E.F., France, September 29th, 1917.

War Bonus for W.O. Station Engineers.

Reading the small column in last week's REVIEW relating to a war bonus "under consideration for W.O. engineering staffs," I feel it my duty to state a similar case, but, being under the "Southern Command," I am one of those unlucky ones still working for a low pre-war wage, and not receiving any war bonus whatever, although I have been waiting for one since 1915, when a war bonus was granted. I have made several applications since that date for it; the answers have been: "It is coming through." The last answer, received a few weeks back, was, "Under consideration." Two years have passed, and they have only got to "under consideration": will it take another two years before they make up their minds?

We work the whole week through, Sunday included, and get no extra for it, but what we cannot understand is, that some of the staff have received the war bonus since 1915, and others not.

Is it not nearly time we had "fair play"? My fellow workman has received the war bonus since 1915. I have not: for what reason none of us can tell. Cannot someone wake things up?

Married Man.

UNION OF SOUTH AFRICA MUNICIPAL ELECTRICAL UNDERTAKINGS.

By E. POOLE, A.M.I.E.E., Assistant Borough Electrical Engineer, Durban.

(Abstract of paper read before the Engineering Section of the NATAL SOCIETY FOR THE ADVANCEMENT OF SCIENCE AND ART, at Durban, on August 28th, 1917.)

A FEW years ago the municipally-owned electrical undertakings of what is now the Union of South Africa could easily be counted on one's hands, and from a list I compiled in 1904 there were then only seven, viz.: Bloemfontein, Cape Town, Durban, East London, Johannesburg, Ladysmith, and Pietermaritzburg, while there were six towns which were controlled by private companies, viz.: Claremont, Kimberley, King William's Town, Newcastle, Pretoria, and Potchefstroom.

Durban, East London, and Pietermaritzburg were supplying electric tramways as well as lighting, while Cape Town tramways were supplied by a private company, as were also Port Elizabeth and Camps Bay.

To-day there are no fewer than 35 municipalities within the Union operating electrical undertakings, representing a total capital expenditure of about £5,500,000, including expenditure on tramways, with which Durban, East London, Johannesburg, Bloemfontein, Pretoria, and Pietermaritzburg are provided, as well as electric light.

There are seven other municipalities which purchase current in bulk from company undertakings, and generally carry out their own distribution work, a capital expenditure of about £170,000 having been incurred, including the expenditure in connection with the Boksburg and Germiston tramways. Four other municipalities have granted concessions to companies which control the whole of the electric light undertakings, the capital expenditure on which amounts to about £28,000. Other concessions are at Cape Town, Camps Bay, Port Elizabeth, and Kimberley, where there are privately owned electric tramways.

The grand total of units sold last year in all the various undertakings amounts to approximately 84,500,000.

Johannesburg, with over 25 million units, and Durban, with over 20 million units, sell between them slightly more than all the other towns put together, Johannesburg's increase over Durban being practically all taken up in extra tramway units.

Unlike England, electric lighting has practically the monopoly, there being no gas works other than in Johannesburg, Port Elizabeth, Cape Town, and Grahamstown; the former is the only town having both gas and electric municipal works, and the latter the only town with a gas company holding the monopoly.

Johannesburg has the largest output, having sold last year no less than 25,057,534 units, while Ceres has the smallest output, with an estimated sale of 9,000 units. To my mind it is the smaller towns we should encourage; in fact, there are only small towns left now, and their problems need just as much consideration in proportion as do the larger towns.

There are no Board of Trade Rules in South Africa, as in England, though these regulations are in the main observed, but the various Provinces of the Union have certain Acts which the electrical undertakings are subject to.

It is unfortunate that our electrical undertakings have no uniformity of plant, for we find all sorts of boiler pressures, engine and generator speeds, voltages and frequencies, &c. Also, in statistical returns we have no standard for such compilation. Some towns go very fully into these returns in their Mayor's Minutes, whilst others are very brief. In accounts we find all sorts of styles, so much so that it is almost an impossibility to make comparisons between one town and another. It is to be hoped that some day this will be rectified.

If uniformity had been aimed at more in regard to plant, the advantages would be manifold, for situated as we are here, some thousands of miles from the manufacturers, if a breakdown happens, we may find ourselves without the necessary spares, or if we are short of the ordinary run of material we have to wait a long time for it, and it is little use expecting our local suppliers to keep spares, or even hold stocks, of all the varieties of plant in use, seeing there are so many different voltages, sizes, &c., required. On the other hand, there can be very little interchange of plant between one municipality and another, even if one municipality were fortunate enough to have plenty of spares.

The chief source of power is steam, which is likely to be retained for some time to come. Of gas plants, the failure of the Johannesburg plant has no doubt caused a set-back in the adoption of such large plants elsewhere in South Africa, but we find some successful small plants operating. Diesel engines, using crude oil, are running with great success.

In water-power plants, Worcester and Aliwal North are partly dependent, and Cape Town has still a small supplementary water plant, but Ceres, Paris, and Paarl are the only towns entirely dependent on water. Unfortunately, water power in South Africa is generally out of court on account of its varying supply, for what are at one time raging torrents are merely small trickles at other times.

Coal is worked in all the Provinces of the Union, the largest producing area being the Middleburg district of the Transvaal, where it is of an average value of 12,673 B.T.H.U. The other Transvaal producing areas are Boksburg, Springs, and Heidelberg. In the Orange Free State we have the Vereeniging district, where the coal is of an average value of 10,626 B.T.H.U.

In Cape Colony the seams worked are in the Molteno, Cyphergat, and Serkstroom districts, but the coal is of poor quality. In Natal there are several districts where coal is worked, both north and south of the Biggarsberg, the average value south of the Berg being 13,079 B.T.H.U.

The finest South African coal, however, comes from the Hatting Spruit district, being as high as 14,306 B.T.H.U.

Outside the Union, in Rhodesia, we have the Wankie Colliery, where the coal has a value of 13,039 B.T.H.U.

Steam pressures are found to vary between 120 and 200 lb. per sq. in., while the price of coal varies from 8s. to as much as 23s. 6d. per short ton, and the pounds of coal used per unit varies from as low as 3.19 to as high as 16 lb. In the larger stations the water tube boiler of the Babcock & Wilcox type is chiefly to be found. The old style of boiler house, with its long range of boilers and one or more tall chimneys, is now becoming a thing of the past.

Turning to the smaller stations, boilers of the loco. type are principally to be seen, and may be looked upon as being best suited for small outputs. They are cheap in first cost, easy to install, very efficient, and can well be left in the hands of an Indian or native to operate.

The storage of coal and handling of coal and ashes has received due attention at the larger stations; the bin at Cape Town has a capacity for 3,620 tons. The class of coal used in some towns where there are mechanical stokers is that known as dross, which at one time was looked on as waste, the price per ton at the pit mouth being from about 1s. to 3s. per ton, as compared with the previously used round coal for hand firing at about 7s. 6d.

Of engines and generators we find quite a large variety, of many sizes; where a few years ago a number of small units were to be seen, these have been superseded by a few large units.

Speeds up to 3,000 R.P.M. are now common in turbines driving alternators; the first geared turbine in South Africa is at the Durban power station, where the speed is geared down from 3,000 to 428 R.P.M. The saving in large turbines is very marked, and we are able to obtain a result as low as 14.3 lb. of steam per unit as against 20 lb. in a reciprocating set. In the smaller steam stations the reciprocating engine of the high-speed vertical type still holds sway.

In the smaller stations atmospheric exhaust is often adopted owing to the lack of a water supply, as well as the necessity of keeping down the capital expenditure, though a saving of from 20 to 25 per cent. can be effected thereby with reciprocating engines. The question of water supply for condensing purposes is one of great importance. Few towns have a natural supply, the general practice being to use water from the town mains, in conjunction with cooling arrangements, though Johannesburg is fortunate in having five bore holes from which a good supply of water is obtained.

Of the coastal towns, only Cape Town and East London have taken advantage of the sea water by building their power stations near the wharves.

The Diesel oil engine, the type in use in this country, is looked upon as the best of its class. They are generally of the four-stroke type, in sizes up to 700 or 1,000 H.P., and vary in speed from 150 to 400 R.P.M.; above this power they are of the two-stroke single-acting type.

In generation we find examples of both direct and alternating current, the latter being three, two, and single-phase at various voltages and frequencies. In the larger towns we find—with only one exception—a mixture of D.C. as well as various phases of A.C. generation, but the smaller towns generally rely on the one source.

The exception in the larger towns is at Bloemfontein, where three-phase only is generated and distributed from sub-stations, while rotary converters in the power station convert the three-phase A.C. into D.C. for the tramway supply.

At Durban generation is D.C. for tramways and motor supply to private consumers, also single-phase as well as three-phase for lighting and power, the three-phase being used for Government bulk supply, large power consumers, the supply to the suburbs of Red Hill and Greenwood Park, and also for supplying rotary converters used to supplement the D.C. supply. It is also transformed down to two-phase, 2,750 volts, through sets of special transformers (Scott-connected), from which single-phase feeders are taken off and balanced between the two phases.

At Port Elizabeth generation is D.C. and three-phase, the latter operating motor converters to supplement the D.C. supply, and also supplying the outlying districts with A.C. single-phase D.T. distribution, as well as three-phase for large power consumers.

At Pietermaritzburg generation is three phase as well as D.C. and single-phase, the three-phase supply being supplemented by a motor-generator and rotary converter from the A.C. single-phase and D.C. supply respectively.

At Johannesburg generation is chiefly by two-phase turbo-alternators, with motor-converters for the D.C. supply for

lighting and tramways in the inner area, but there are also a few reciprocating generator sets for both the A.C. and D.C. supply. The two-phase also supplies the outer area with single-phase distribution for lighting, and D.C. supply through rotary converters in sub-stations for tramways.

At Cape Town generation is D.C. and A.C. two-phase 2,200 volts, with motor-converters from the latter source of supply converting to 440 volts D.C. for the old Cape Town area. The two-phase supply is also transformed up to 11,000 volts; three-phase, for the suburban distribution, and also for the supply to the railway works at Salt River.

In the smaller towns D.C. generation is practically universal. The exceptions are at Paarl, King William's Town, and Harrismith, the former town having made a wise and unique selection in A.C. three-phase at 3,300 volts, while the two latter towns have adopted A.C. single-phase.

The largest generators are in Johannesburg and Cape Town, being 3,000 kw. each. Durban is the only place where boosters are used to compensate for the voltage drop at distant points on the tramway track, while Cape Town uses them for keeping up the pressure on the L.T. lighting network.

Durban and Cape Town are the only large stations where a battery is installed, though in a few of the smaller stations batteries are provided with the object of being able to shut down the running plant during the hours of light load.

The universal practice is to earth at the power station the negative of a D.C. supply to tramways, and also to earth the neutral point in a three-wire supply. In A.C. single-phase working the side to which the outers of the outgoing concentric feeders are connected is always earthed, while in three-phase working with star-wound generators, the neutral point is sometimes earthed through a small resistance, which in the case of Durban is 8 ohms.

The latest type of switchgear as in use at the larger stations is the remote-control oil switch in cubicle form. At Pietermaritzburg there is a separate switchroom just off the engine-room, and at Johannesburg the switchgear is arranged on three floors. At Durban the switchgear is divided, that controlling the generators being mounted on a platform a few feet above the engine-room floor, while the outgoing feeder switchgear is in an adjacent room, where also are installed the boosters, converters, three to two-phase transformers, &c.

In Durban there is installed a special time-signal device which, by throwing a choking coil in the circuit at a time arranged (8 p.m.) lowers the voltage sufficiently for the consumers to observe, and thus their clocks can be adjusted, the time signal being given by the Post and Telegraph Department.

In the smaller stations supplying lighting only, one can hardly avoid the objectionable peak; in the larger stations, however, the introduction of motor load, cooking, tramways, electric vehicle charging, &c., has helped very much to flatten out the peak, and thus improve the load factor, which is highest in Durban at 44.8 per cent.

In connection with "daylight saving," if this is adopted Durban will be affected more than any other town in South Africa, owing to its geographical position, and the fact that approximately solar time is kept. The summer load factor under ordinary conditions works out at 32.39 per cent., but with the introduction of daylight saving it is raised slightly to 32.48 per cent.; 1,260 less units are sold during the 24 hours, representing a saving of two tons of coal for the day, with a loss of revenue of £18 a day.

DISTRIBUTION.

Generally speaking, the use of bare overhead mains is the common practice in South Africa. Some towns adopt it entirely; others have underground mains as well, but Harrismith and Aliwal North are the only towns where no overhead mains of any sort are used. There is no doubt that the use of overhead mains has in a very great measure helped the progress of electricity supply in South Africa on account of the great saving in first cost, as well as the accessibility to carry out repairs. The prejudice on the score of unsightliness and danger of falling wires is now practically non-existent.

The general practice in the case of feeders both for high and low-tension mains is to lay them underground, but in a few cases extra-high-tension as well as high-tension feeders are run overhead. With distributors, the practice in the larger towns is to lay them underground in the business areas, and overhead in the residential districts, and in the smaller towns they are mostly overhead bare copper (though at Worcester, aluminium wires are partly used), three-wire distribution being generally adopted, but Cape Town in some parts has five-wire distribution, and Paarl and Bloemfontein have four-wire.

In low-tension work the Siemens and the sectional type of steel pole are common practice, varying in height from 20 to 35 ft. in most cases, but on the coast there is an opening for a pole less affected by rust, and in the reinforced concrete pole we have an excellent substitute, which, while rather heavy to handle, has its advantages in life as well as in appearance.

The cross-arms in use are wood, channel iron, and tubular steel. Johannesburg has probably the largest low-tension network of overhead mains, amounting to no less than 191½ route miles. With overhead mains many arrangements are put forward to dissipate the effects of lightning, which is

very severe, especially in the towns of high altitude, and the use of earthed guard wires on the top of the poles has for a long time been looked upon as a safe precaution, in addition to the use of arresters on the lines at frequent points, though, of course, no device will avert a direct stroke. There are, however, one or two towns which have not taken these precautions, and opinion is still very divided on the subject. Apart from the fact of the earthed guard wire being a precaution against lightning, it is also advisable from a safety point of view, in preventing a pole from becoming dangerously charged owing to any of the mains coming in contact with same. The Government regulations provide that cradles or guard wires shall be erected under the mains at railway crossings and certain other places, but with good construction there is little to fear from falling wires, and frequently the precautions taken in this regard, as well as in the case of lightning, are more a source of trouble in themselves than a preventative.

With high-tension work, the bulk of the mains are laid underground, though in Johannesburg, Bloemfontein, Durban, and Cape Town a few of the routes are by overhead wires, Durban having extra-high-tension also for supplying the adjoining suburbs, and in the case of Bloemfontein the overhead H.T. mains are insulated wires. Durban is very fortunately placed in having practically the freedom of the whole of the roads for pole line construction, as the telephones are municipally owned as well as the tramways, the former being the one instance in South Africa, and with this one control many of the taller poles carry electric lighting wires on the top, telephone wires below, and under these the tramway span wires. In regard to the cost of overhead mains against underground mains, there is very little difference in the first cost of a circuit for high-tension work, using the best class of material throughout, but a great saving is effected when an additional circuit is required, as the cost of poles does not then come in for consideration. In low-tension work, however, there is a decided saving in favour of overhead mains, to say nothing of the saving in street-lighting and house-service costs.

Where underground mains are in use, the general practice is to use lead-covered, armoured and served mains laid direct in the ground at a depth of from 2 to 3 ft., but there are a few cases where they are drawn in through pipes or ducts, or laid in a trough filled in solid with bitumen. In Durban a charge of 1s. 9d. per yard of running trench is made by the roads department for reinstating after any excavations. Various dielectrics are in use, such as rubber, fibre, bitumen, and paper, and cables laid over 20 years ago with vulcanised rubber insulation seem as good to-day, as far as the rubber and wires are concerned, as when laid; but rubber cables are out of court on account of the price, and a very excellent type is the paper-insulated cable, which is universal the world over. Where at one time joints were made by screwed fittings in a cast-iron box filled up solid with special compound, the common practice now is to sweat it all up solid and insulate with tapes, after which a lead sleeve is wiped on, and in the hands of a careful plumber-jointer there is no more fear of a joint giving out than the cable itself. Too much attention cannot be given to the matter of joining all the armourings of the cable through and bonding them whenever opportunity offers to any rails or pipes. Faults on underground mains will, however, occur even with the best construction. By adopting a system of ring main and the free use of interconnecting switch pillars, great relief can be afforded, as the fault can then be localised between any two pillars, and at the same time supply can be maintained by the duplicate route that exists.

In extra-high-tension mains Cape Town has about 20 miles laid, with some routes at 11,000 volts, and Johannesburg has the longest routes of both high and low-tension, with 61½ miles of the former and 143½ miles of the latter.

(To be continued.)

Electrolytic Iron for Commercial Use.—The Société Le Fer, in France, has succeeded in producing electrolytic iron on so large a scale, in retorts absorbing as high as 20,000 amperes, that the Bouchayer and Viallet Works, at Grenoble, which hold a concession of the Society's patents, have already commenced the manufacture of pipes of large size from electrolytic iron. These are 4 m. long, 100 to 200 mm. in diameter, and 1.5 mm. in thickness (13 ft. long, 3.9 to 7.8 in. in diameter, .06 in. thick). These tubes are employed for various industrial purposes, such as conduits for water, steam, or compressed air. They have given entire satisfaction in practical use. Such a tube of electrolytic iron is said to possess the same strength as a tube of cast-iron 20 times as thick. The iron obtained by this process is said to be entirely different from ordinary iron, both in aspect and in properties. From the magnetic point of view it is possessed of a very high permeability and a low degree of hysteresis, making it particularly valuable for the manufacture of motors and transformers; from the mechanical point of view it possesses great strength and a considerable degree of extension. The tubes are expected to replace successfully the German tubes of which Mannesmann held a monopoly before the war.—*Scientific American*.

THE ELECTRICAL INDUSTRY AND THE WAR.

ON Tuesday last week Mr. J. S. HIGHFIELD, M.Inst.C.E., delivered an address, as President of the ASSOCIATION OF SUPERVISING ELECTRICIANS, dealing broadly with the conditions prevailing in the electrical and other trades in this country. He pointed out that the war was but a continuation of the trade war which was previously in active progress, and that, in addition, there had been excessive internal competition, particularly in some branches of the electrical industry; prices had been cut to a degree which compelled the reduction of quality of materials and labour, as well as low wages and inadequate profit. No trade could exist in a healthy state under these conditions; the best men would leave it, credit would be reduced, and capital would be withheld from it. Everybody had worshipped the fetish of cheapness without regard either to quality or to the general good of the community, or to the security of the nation, and, by this carelessness, the foreign suppliers were provided with an easy means of capturing many of our trades. The British customer who bought German wire and German switches before the war helped to build the German navy or weaken the British, because, even when the goods were supplied by the German at cost price or under, a certain amount of money passed to Germany, and at the same time some British were rendered less capable of contributing to the cost of our Navy. The foreigner supplied goods at these low prices only so long as the competition of the home manufacturer continued, the object being to carry on until the British manufacturer went out of business altogether. During this period some advantage accrued to the British purchaser, but as soon as the home manufacturer was driven out of business, the foreigner naturally increased the prices as much as possible, and then the British purchaser enjoyed his advantage no longer.

Unless British manufacturers held a very substantial part of the home market they could not take an active part in foreign trade. Therefore, one of the most important things to be done was to see that, in the future, the laws of this country should be such as to help them to manufacture for and to trade in a secure home market. The average purchaser would have learnt, before the war was over, that he should buy as far as possible articles of British make, and employ men of British birth, but this might not be sufficient, and then it would be for all of them to see that proper steps were taken to make sure that the desired end was accomplished, if necessary, by legislation.

They would agree with him that the capital invested in the electrical business had not earned sufficient profit, owing to the prices having been too low. To reduce prices before profits were obtained was a gamble. Their own particular branch of the industry had suffered from low prices, although he considered that the average standard of work was good; they must in future endeavour to make it a well-paid business, carrying out good work in sufficient volume to enable it to be done at low prices. Competition must be fair, and all the men in any trade should realise that they were working for a common end, and pull together.

There was no way so effective in improving design as the clear realisation of the defects of existing apparatus, and this could only be done by the men in actual daily touch with the difficulties; they could do a great service to the wiring business by collecting information about defects in the existing gear that they used, and by making suggestions as to the remedies they found necessary, and as to permanent improvements. A committee might be formed for this purpose.

Better wages were desirable, using the expression in the sense that the earner could get a better exchange, and with more work done by each man, and more men and women working, the desired result could be secured. This desirable result could be furthered by using standard designs, labour-saving machinery, and better skill in direction; but the one great essential was to secure a large and increasing market for labour, and the things it produced.

In addition to working for themselves, they would have, in the future, to work for all those who in the war had lost the power to keep themselves, and the women and children left by the gallant men who were no more. The sternest efforts were wanted to win the war, and winning the war meant not only conquering the enemy, but preserving a stable State wherein each man could, with his neighbour's assistance, lead a proper life, full of work, and with some comfort. The common credit of the nation had been used in this war with the most marvellous results; the same credit might be required to carry on successfully in peace. But credit must be paid for, or it vanished like a dream, and it was their business to consider how their trade could pay its share.

Electro-Galvanising.—MR. SHERARD COWPER-COLES has now erected at Sandbury-on-Thames one of his latest electro-galvanising plants, which embodies many important improvements and ensures an even homogeneous coating which is amalgamated with the surface of the iron. Mr. Cowper-Coles's process has been largely adopted by the Admiralty and various Government departments, also by several of our Allies.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The Generation of Continuous Current by Turbines.

The practice of generating continuous current by the use of turbo-alternators coupled to rotary converters is rapidly extending. One of the numerous installations of this description laid down by the GENERAL ELECTRIC CO., LTD., is depicted in the accompanying illustration. This plant is installed in an important engineering works, and comprises a 1,500-KW. "Witton" turbo-alternator running at a speed of 3,000 R.P.M. and generating six-phase alternating current, which is delivered to two 750-KW. "Witton" rotary converters running at 600 R.P.M. and generating continuous current at 460 volts.

The installation has proved completely satisfactory, and has again demonstrated the utility of this method of generating continuous current, which enables the turbine to be run at a speed

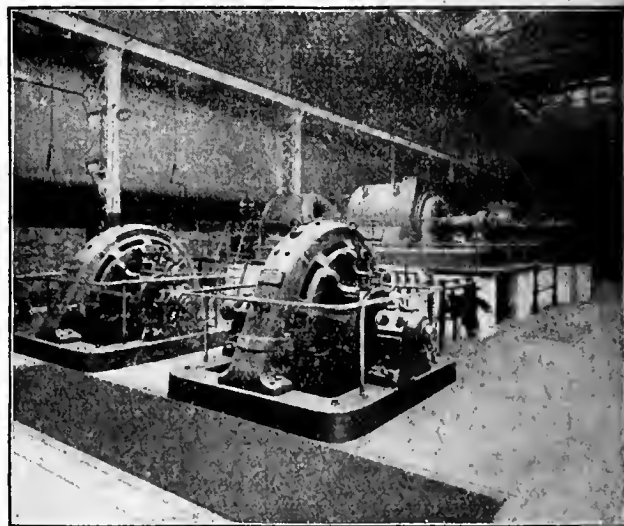


FIG. 1.—1,500-KW. "WITTON" TURBO-ALTERNATOR AND ROTARY CONVERTERS GENERATING CONTINUOUS CURRENT.

at which the highest efficiency is attained, while at the same time the continuous-current commutators on the converters can be designed with a peripheral speed consistent with satisfactory working.

In the background of the illustration a 750-KW. "Witton" continuous-current turbo-generator set is seen, which has now been running for over ten years. This type of machine is now superseded for the generation of continuous current by the combination described.

The complete installation was laid down by the General Electric Co., Ltd., of Witton, Birmingham, and Queen Victoria Street, E.C.4.

B.T.H. Direct-Current Motors.

A range of D.C. motors of 0.15 to 10 H.P. at pressures up to 600 volts is described in a new list of the BRITISH THOMSON-HOUSTON CO., LTD., Rugby; the machines are fitted with commutating poles,

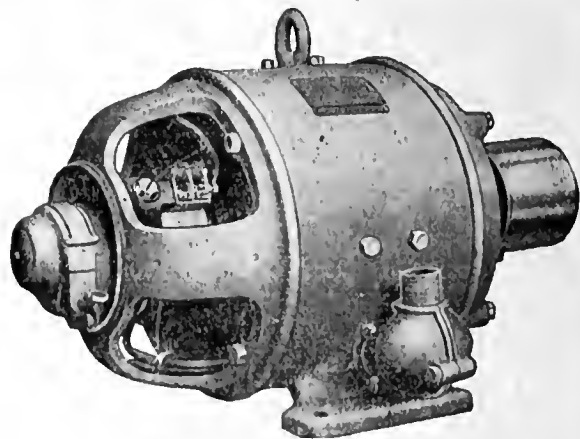


FIG. 2.—B.T.H. PROTECTED TYPE DQ MOTOR.

end-shield bearings, ventilating fans, and enclosed terminal boxes, and can be supplied as protected, enclosed ventilated, or drip-proof motors, while the larger sizes can be supplied as pipe-ventilated motors.

Fig. 2 shows the protected type, from which the others differ in

the design of the end-shield. The motors will stand overloads and are capable of shunt speed regulation up to 50 per cent. above normal. They can also be fitted with covers making them "totally enclosed," the rating then being modified. The armature windings are vacuum-impregnated, and are tested with 1,500 volts A.C. after the full-load heat run. The magnet frame is of cast-steel, the laminated poles being removable, with the field coils, without disturbing the armature, and the bearings are provided with oil-ring lubrication.

The Willard Accumulator Plate Separator.

We are able to give a few additional particulars of the new accumulator plate separator which has lately been adopted in the batteries made by the WILLARD STORAGE BATTERY CO., of Cleveland, O., U.S.A., and reference to which was made in a recent issue. Because of the fact that rubber forms an excellent insulating material, many experiments in the direction of using it as a plate separator have been made in the past. Punching holes in the rubber has not, however, proved entirely satisfactory, because if the holes were too small, the electrical resistance was high, while if the holes were large, small particles of the active material were likely to bridge the gap and short-circuit the plates. In the new Willard separator, the same idea is adopted, except that the holes are closed

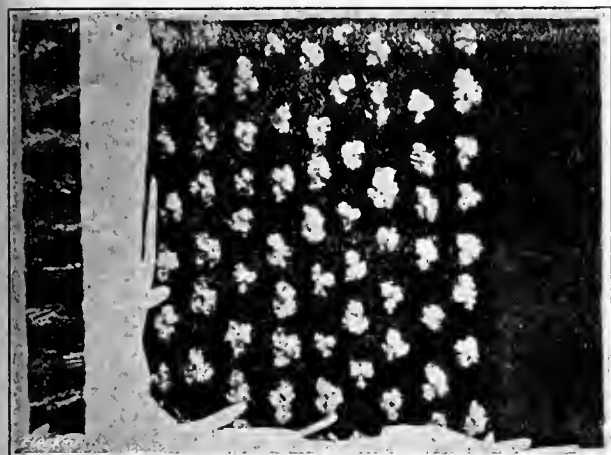


FIG. 3. PHOTOMICROGRAPHS OF THE WILLARD SEPARATOR.

by a very large number of threads which act as wicks. In fact, it is stated that each separator is pierced by no fewer than 196,000 threads, $\frac{1}{32}$ in. long, and of a diameter so small as to be almost invisible to the naked eye. It is stated that the battery solution is drawn through these threads by capillary attraction and offers a free passage to the electric current, while at the same time presenting a solid face to the active material. It is not claimed that the new separator—for the manufacture of which special machines have had to be designed—will render the battery indestructible, or that it will permit neglect by the owner or user; the makers do, however, claim that the new separator tends to increase the capacity of accumulators to stand abuse and to lengthen their useful life.

WAR ITEMS.

Germany's Coal Shortage.—The "Times" states that owing to the dearth of coal Berlin householders are ordered to reduce lighting to an absolute minimum. Also that owing to lack of coal five towns in Bohemia are without electric light, and three without water.

Trading with the Enemy.—The "London Gazette" for September 28th contains a further list of persons and bodies in the following countries with whom trading is prohibited:—Argentina, Chile, Colombia, Netherlands and Netherlands East Indies, Norway, Peru, Spain, Sweden; also a number of variations in previous lists.

The One-Man Business.—Sir Auckland Geddes, Minister of National Service, last week received a deputation from the National Association of Business Men. A considerate hearing was given to the statement advanced concerning the calling-up for military service of the proprietors of "one-man businesses," and a further conference takes place later.

Exemption Applications.—At Southwark, Coun. T. E. Hewitt, a member of the Tribunal, who carries on business as an electrical engineer in Southwark Bridge Road, applied for the exemption of three sheet-metal workers, aged respectively 28, 27, and 23 years, and for a fitter and mechanic, 33, all passed for general service. He said the cases had been adjourned in order that he might obtain certificates under the Protected Trades Schedule. After some delay, an officer from the Department visited his works, and expressed his satisfaction, but stated they would be prepared to grant the certificates provided that the men would join as munition volunteers under the substitution scheme. If they did that

the Government would have the first claim on his men, and therefore he did not know how he should stand, as he would have to prove that the work on which they were engaged, although not for the Government, was of national importance. Mechanics and fitters were so badly wanted by the Government that there would be very little chance for him to keep them. He therefore came before the Tribunal for protection. He was prepared to release the two younger sheet-metal workers, provided they would permit him to retain the other two men. The remaining sheet-metal worker had been with him since he was a boy, and he would be the only man left in the department, where before the war he had 17 men. The fitter was the only one he would have left. He must at least have these two men to carry on. The two sheet-metal workers were instructed to join up by November 1st, and the other sheet-metal worker and the fitter were granted three months' exemption each.

At Bermondsey, the Tribunal unanimously adopted a resolution that, in view of the large number of men in low medical categories now appealing for exemption, they considered it would eliminate considerable hardship and increase the efficiency of the fighting forces if Class A men (general service), who were unmarried, between 18 and 25 years of age, were taken for military service in large numbers from munition works, and they urged the Government to take action in this direction.

At Batley Tribunal last week, H. Jagger, electrician, aged 37, married, whose medical examination had been postponed, submitted a communication from a Sub-Committee of the Ministry of Munitions, in reply to his application for a protection card under the list of protected occupations, stating that arrangements had been made for the issue of a certificate to the applicant. The Tribunal granted temporary exemption to November 1st.

Exemption was claimed at Windsor by W. J. Hetherington (38, Class A), electrician with Messrs. Martin & Co., on the ground that he was engaged on work of national importance. The Military Representative said that there was a very great need in the Army for electricians, and a man with appellant's knowledge was valuable. The appeal was refused, with a month's grace.

A Crawley firm applied to the Horsham Rural Tribunal for exemption for an electrician (31, B1), the only practical man left, and who had been medically rejected for the Volunteers on account of deafness. Three months were granted, with a fresh medical examination in the interval.

At Tunbridge Wells, A. T. Spurrell (C1), and A. E. Hills (B1), were appealed for by Mr. E. Powell, electrical engineer. The men are wiremen, and Mr. Powell said that they were engaged on work of national importance, and that they were three weeks' behind in their jobbing work. The Tribunal decided to have a report prepared with regard to all the electricians in the town, and the appeals were respite for this purpose.

Before the Wilts. Appeal Court, exemption was claimed for L. Horne (28, C2), electrician at Chute Standen, Andover. The appeal was refused.

At Bexley, the manager of the U.D.C. tramways (Mr. H. P. Stokes) appealed for conditional exemption of four motormen, one a discharged sailor. It was stated that the Council had taken over the working of the Dartford tramways, which meant extra work, while an efficient service for munition workers was necessary. Three of the men were given conditional exemption, and the case of the other, a Class A man, was adjourned.

At Hastings, the Tramway Co. appealed for the retention of a motorman (24, C3). Three months were granted, the man to join the Red Cross.

At Oxford, the Military applied for the withdrawal of a certificate of conditional exemption granted on March 13th, 1916, to H. G. Barrett (31, Class A), lately engaged with Messrs. Hill, Upton & Co., electrical engineers. When he left the firm his badge was taken away, and he was now ordered to join up in a month.

East Kent Appeal Court has granted exemption until November 6th to G. H. Hawkins, electrician at Denton Court Estate.

Guildford Tribunal has given a final month to W. H. Dann (33, C1), electrician at the County and Borough Halls.

New Zealand.—H.M. Trade Commissioner in New Zealand (Mr. R. W. Dalton) writes, under date July 25th, that owing to a recent labour dispute at Wellington, the gas supply for all purposes has been restricted, and this has led to a large increase of orders for the installation of electric lighting, heating, cooking, &c., appliances. Householders and business people turned to electricity as a substitute or stand-by for their various requirements; and electrical engineers and suppliers of electrical goods experienced a rush of business. According to the local Press, the sale of electric cookers, heaters, kettles, smoothing irons, &c., constituted a record, and, further supplies of such articles being difficult to obtain, stocks are now low. For some time past the only market open to New Zealand buyers for the purchase of electrical goods has been the United States, but now even that source is becoming uncertain.—*Board of Trade Journal*.

DAMAGES ON FAILURE TO COMPLETE A CONTRACT.

[BY OUR LEGAL CONTRIBUTOR.]

THERE is little doubt that the exigencies of the times have given rise to a large number of cases in which those who sell or buy machinery have been compelled for one reason or another to commit breaches of contract.

A manufacturer may have given a large order for electrical machinery before or in the early days of the war. Suddenly, through the intervention of the Ministry of Munitions, the normal course of business at the factory of the buyer is entirely altered. He is unable, or unwilling, to take delivery. Assuming that the prospect of matters being interfered with by the Government was not provided for in the contract, what are the rights of the parties?

With a view to assisting those who are in the position of persons whose contracts have been broken, it is proposed to examine the decision in a case heard in the Court of Appeal. It involved consideration of the apparently simple problem: What is the measure of damages when a trader fails to take delivery of machinery which he has ordered? As a general rule, of course, the failure to take delivery is due to "failure" in the larger sense; and if that is the case, the trader must fain be content with whatever dividend may be paid in the bankruptcy.

Let us assume the occurrence of a case in which the property in the goods has not passed to the buyer. If the property has passed the remedy is obvious; the seller can sue for the whole amount due without deduction of any kind. But if there has been a mere failure to take delivery, the damages must be assessed on certain well-recognised principles. If there is a ready market for the goods, little difficulty arises. Suppose a man had undertaken to deliver a machine on March 1st for £100, and the purchaser were to announce on February 25th that he cannot take delivery. If the buyer was able to find another person willing to buy on March 1st for £100, it is clear that the seller would suffer no loss, and no damages would be awarded to him by the Court. But if he were only able to sell for £95, his damage would be £5, and so on. Now, take the case where there is no available market, and the goods are thrown on the seller's hands. In that case the damage which he sustains might be very much more severe. Indeed, it is possible to conceive a case where, in the event of a purchaser failing to accept delivery of a piece of machinery of a highly special type, its only value to the seller when thrown on his hands would be the value of old iron.

A case in point is in *re Vic Mill, Ltd.* (1913), 1 Ch. 465. The Vic Co. had ordered certain machines to be made by Messrs. Arundel & Co., a firm of engineers. The order having been given, the company went into voluntary liquidation, and were unable to accept delivery. The engineers, as creditors, put in a claim in the liquidation for the profit which they would have made had they been allowed to deliver. Upon this basis, they claimed £167 13s. 6d. As the liquidator rejected their claim, the registrar of the winding-up court was called upon to inquire what was due. As the various machines embodied in the order were on a slightly different footing, it is necessary to inquire what they were. They were in two classes. Class I consisted of four quick-traverse winding frames, which had been completed before the date of the winding up. These were retained by the engineers, and were then somewhat altered and sold to other customers at a price less than the contract price. Class II comprised machines which would have been wholly or partially manufactured by the engineers, on which they had done no work, but for some of which they had purchased subordinate parts ready made, which they afterwards used in fulfilling other orders. The loss of profit claimed on Class I amounted to £162 19s., and on Class II to, roughly, £1,000. The engineers claimed the whole of this. As regards the winding frames, the registrar found that they had been altered at a cost of £5, and resold at a price which was £23 less than the amount the company had agreed to pay. He therefore awarded £28. As regards the machines in Class II, they would be for the most part built up out of stock. There was no evidence that the engineer's works had been wholly or partially stopped in consequence of their not manufacturing these machines, or that the orders on which they were engaged were less remunerative than those under consideration. The registrar held that though prospective profits must be taken into account, it could not have been as much as £1,000, and awarded £250. The judge to whom the registrar's finding was referred over-ruled him, and declared that the engineers were entitled to the loss of profit as they had themselves estimated it, and the Court of Appeal confirmed the judge's decision.

The judgment of Lord Justice Hamilton in the Court of Appeal is very instructive. He said, as to the goods in Class I:—"The registrar thought he had evidence to the effect that the loss was only £250, but he had none. Consequently his assessment of £250, though not in itself surprising as a matter of business, was one unsupported by any evidence

before him. It is true that there is no evidence that the creditor's works were wholly or partially stopped in consequence of their not manufacturing these machines. If that had been so there might have been a claim for some proportion of the overhead charges attributable to the period when the works were at a standstill, when charges were running on, and nothing was being made against them, because the appellants, the buyers, would not perform their contract. It is true that he found that there was no evidence that the orders on which the works were employed were of a less remunerative nature than the orders in respect of which the claim for damages was made. Had that been so, it might have been an alternative means of measuring the damages—that, whereas during such and such a time they would have been working at a profit of 35 per cent. on their turnover, they were obliged to work for somebody else, and could get no more than a profit of 30 per cent. The affidavits fairly read show that the claimants' works were sufficiently large, and their equipment sufficiently ample, to enable them to perform this contract in addition to all the others that they did perform. . . . As the evidence stands, there was a *prima facie* case that the makers could have made this profit as well as the profits on all the other contracts they had. There was not only no evidence to rebut that, but no suggestion to the contrary was made in cross-examination. It is tolerably clear that the point really fought was whether or not there was an available market in which the goods might have been sold—a point which disappears by the admission that there was no such available market."

Dealing with the winding frames, on which the engineers claimed £162 19s. for loss of profit, his Lordship pointed out that there the duty of the engineers in the circumstances was to act reasonably. There was no available market. If the goods had been broken up, or sold by auction for what they would fetch, the consequences to the buyers would have been worse than they were. He then proceeded:—"It so happened that, after the repudiation by the Vic Mill, another customer of the makers was prepared to place an order with the engineers for frames of that kind, and somewhat of those dimensions. They might have taken that order, fulfilled it, made their profit on it, and dealt with the frames left on their hands in any reasonable way they chose. They did, in fact, at a small cost, adapt the frames on their hands, and with them fulfilled the order of this other customer, and so made their profit on his contract. To that extent the buyers in the present case got the benefit of the accident that another customer came forward. That was a reasonable mode of mitigating the damages, but it by no means follows that the damages are confined to the cost, a trivial one, of adapting the machines to the needs of the second customer, and the loss on re-sale to him, which was only £23, making £28 in all. The fallacy of that is in supposing that the second customer was a substituted customer, and that, had all gone well, the makers would not have had both customers' orders, and both profits. In fact, they did, acting reasonably, and, I think, very likely more than reasonably in the interests of the Vic Mill, content themselves with earning the profit on the second contract at the cost of adapting the machines, which has been taken at £5; but they are still losers of the profit which they would have made on the Vic Mill contract, because they could, if they had been minded, have performed both contracts, and have made profits on both the contracts but for the breach by the Vic Mill of their contract."

In the result, the Court of Appeal held that the engineers were entitled to the full amount claimed.

A discussion of the converse case may also be instructive. Suppose that a manufacturer has undertaken to deliver machinery, and, owing to reasons which he cannot control, but for which the law holds him responsible, he supplies an inferior article. What is the measure of the damages which he must pay?

The case of the British Westinghouse Electric and Manufacturing Co., Ltd. v. Underground Electric Railways Co., which was decided by the House of Lords in 1912, involved a discussion as to the measure of damages where the manufacturer has failed to provide a satisfactory machine. The material facts may be very briefly stated. In 1902 the British Westinghouse Co. (who may be conveniently referred to as "the claimants") contracted to supply certain steam turbines and turbo-alternators to the Underground Electric Railways Co. (hereinafter called the respondents) for £250,000. Payments were to be made by instalments from time to time. Eight steam turbines and eight motor generators were delivered from 1901 to 1906, the respondents paying £159,439 3s. 2d. on account of purchase price. In spite of certain agreed reductions, a large balance of the purchase price was still outstanding when the proceedings presently referred to were commenced. All the machines proved to be defective in design and efficiency, and failed to comply with the contract and specifications, but the respondents, while reserving their rights, continued to use them for supplying power to their railways. In 1907 the claimants, with the consent of the respondents, who still reserved their rights, removed and experimented with one of the machines, with a view to seeing whether it could be put in order, but the experiments failed. Finally, the respondents made arrangements to substitute for the claimant's turbines "Parsons machines," of different design and manufacture.

The claimants having sought to recover the unpaid balance of the purchase price, the matter was referred to arbitration. At the hearing before the Hon. Alfred Lyttelton, the respondents counter-claimed damages, and alleged that, as part of the damages, they were entitled to the sums expended on the Parsons machines, as the purchase of those machines "mitigated or prevented the loss and damage which would have been recoverable from the claimants if the respondents had continued to use the claimant's defective machines in the future." The claimants, on the contrary, alleged that as the commercial life of their machines had expired at the date of the purchase of the Parsons machines, no further damages were recoverable from them after the date when the Parsons machines were procured. The arbitrator stated a special case for the opinion of the Court upon these questions. The Lord Chief Justice, after reviewing the facts above set forth, said: "*Prima facie*, it seems to me the questions to be considered as to the measure of damages are: (1) What would be the natural life of a properly constructed machine; and (2) what would be the damages for having to work the defective Westinghouse machines. If the respondents had not put in the Parsons machines, the measure of damages would have been much larger. When a man is relying on breach of contract, he must do what is reasonable not to make the damages greater than they would otherwise be. Here the cost of the Parsons machines is a matter which the arbitrator must take into consideration. It would not be right to adopt the contention that because Parsons machines had so much improved in 1908, 1909, and 1910, the Westinghouse machines had come to an end of their commercial life."

What he found is stated by Lord Haldane in his judgment in the House of Lords (1912, A. C., at p. 688), where he says:—"The arbitrator appears to me to have found that the effect of the superiority of the Parsons machines and of their efficiency in reducing working expenses was, in point of fact, such that all loss was extinguished, and that actually the respondents made a profit by the course they took. They were doubtless not bound to purchase machines of a greater kilowatt power than those originally contracted for, but they, in fact, took the wise course in the circumstances of doing so, with pecuniary advantage to themselves. They have, moreover, used the appellant's machines for several years, and had recovered compensation for the loss incurred by reason of these machines not being, during these years, up to the standard required by the contract. After that period, the arbitrator found that it was reasonable and prudent to take the course they actually did in purchasing the more powerful machines, and that all the remaining loss and damages was thereby wiped out."

This case affords a striking illustration of the statement (which so often shocks the non-legal mind) that law is the embodiment of common sense. The railway company did what must, in practice, have been their imperative duty. The machines having failed, they were bound to keep their trains running. Instead of tinkering with old plant, they bought of the very best, with the result that their position both present and future was vastly improved. As the damages in the long run were thus reduced, they were not allowed to recover them from the Westinghouse Co. The case serves to remind one of that principle of the law of contract which says that a man whose contract is broken must not sit down under his loss. For instance, in the case of a sale of goods where the buyer refuses to take delivery, the seller is bound in all cases to take any reasonable steps which are open to him to reduce his loss, and if it is shown that upon the occurrence of the breach the seller might have gone into the market and sold to better advantage than he could have done by waiting until the contract date for delivery, his damages may, it seems, be reduced accordingly.

BUSINESS NOTES.

Book Notices.—"The Housing Question as Affected by Recent Legislation." Reasons for Repeal of Part I of the Finance (1909-10) Act, 1910. London: The Land Union. Price 1s.

"Electrical Measurements." By F. A. Laws. London: Hill Publishing Co. Price 21s. net.

"Principles and Practice of Electrical Engineering." By A. Gray. London: Hill Publishing Co. Price 12s. 6d. net.

Bankruptcy Proceedings.—F. BROWN, electrician (formerly a partner in Hugh Bros. & Brown), Llanelly. Trustee released September 21st.

Liquidations.—NAYLOR BATTERY CO., LTD.—A meeting is called for October 31st to hear an account of the winding up from the liquidator, Mr. H. Everett.

ALFRED HERBERT (FRANCE), LTD.—A meeting is to be held at Coventry on November 8th to hear an account of the winding up from the liquidator, Mr. D. M. Gimson.

M. & G. TRUCK & ENGINEERING CO., LTD.—A meeting is called for November 13th, at 124-127, Minories, London, E.C., to hear an account of the winding up from the liquidator.

Catalogues and Lists.—MESSRS. BOVING & CO., LTD., 56, Kingsway, London, W.C. 2.—New pump catalogue of 52 pages, containing particulars of the general design and types of their

pumps. Excellent half-tone pictures accompany the descriptions of low-pressure, medium-pressure, and high-pressure pumps, also medium-pressure pumps for hydraulic mining, and stationary and sinking vertical pumps. The firm has made extensive arrangements for testing in the presence of clients. We understand that at the present time the total output of the driving motors for the firm's high-pressure multi-stage turbine pumps is above 15,000 H.P.

MESSRS. PASS & SCAVOIR, Inc., Solway, New York.—80-page illustrated and priced catalogue of their handy electric wiring devices.

MESSRS. PECKHAM, DUCAMP & CO., 90, Charing Cross Road, London, W.C. Eight-page illustrated price list of Osram lamps of various types, &c., showing advanced prices for a number of lines.

Sterling Football.—On Saturday last, on the grounds of the Sterling Athletic and Social Club at Dagenham, Essex, football matches were played on behalf of the St. Dunstan's Hostel. In the Ladies' Match, "Sterling v. Brocks," the Misses Joy and Crystal Burney "kicked off" at 2 p.m., and at 3.30 "Sterling v. Clarence" (the East and South-East London Munition Workers' Football League Match) was played. In the first match "Sterling" scored 4 goals and Brocks 0, and in the second the scoring was "Sterling" 4 and Clarence 2. Mr. Guy Burney, the managing director of the Sterling Telephone and Electric Co., Ltd., has been elected a vice-president of the East and South-East London Munition Workers' Football League.

LIGHTING AND POWER NOTES.

Aberdeen.—In his annual report, Mr. Bell, the city electrical engineer, refers to the considerable increase in the industrial use of electricity in the area, and mentions that an electric steel furnace will shortly be in use in the city. In three years the department has handled a 78 per cent. increase in motor H.P. connected, and the power units sold last year (9,250,000) represent a 97 per cent. increase on the previous year, some 14,000 H.P. of motors being supplied. The lack of railway connection for coal supply, which was planned when the works were laid out, has been acutely felt, and it is noted that about 15s. 3d. in the £ in works costs is due to coal. It is interesting to note that the 14,000 H.P. of motors now supplied represents about 42½ per cent. of the estimated power requirements of the present area of supply. The local shipyards are now considerable power users, and about 1,405 electrical utensils for heating and cooking were hired out by the department. It was found necessary to extend the buildings for a new 5,000-KW. turbine set, and new substations have been provided in York Place and Torry. It is noted that the 3,000-KW. turbine set, since it was installed in 1913, has generated 44,378,000 units out of the total of 50,914,000 units generated in the station; a 500-KW. converter has been delivered for the York Place sub-station, and a 350-H.P. electrically-driven pump is being erected at the generating station. The plant capacity of the generating station is 7,760 KW., and the maximum load was 6,162 KW., the load factor being 26 per cent. The year's working resulted in a small deficit (£345); the charges were, however, reduced by 5 per cent. on the previous year, and a serious increase in working costs was met. The reserve fund stands at £39,304.

Bacup.—PRICE INCREASE.—The Corporation electricity department announces that, in consequence of the increase in the price of coal and other charges, the charges for current supplied will be increased from January 1st. For lighting the advance will be 10 per cent. and for power and heating 15 per cent. Consumers who have a coal clause in their agreements will not be affected.

Blackpool.—VEHICLE BATTERY CHARGING.—The Electricity Committee is considering the report of the engineer (Mr. C. Furness) on the desirability of installing a motor-generator and switchgear at the electricity works to meet the forthcoming demand for charging electrical vehicles.

The output of electricity for July and August reached 949,464 units, an increase of 21,918; and for the year to the end of August the increase was 199,515 units.

Bolton.—PROPOSED LOAN.—The Electricity Committee has approved a report of the electrical engineer as to the proposed plant extensions at the Back-o'-th-Bank generating station, and has decided to request the Finance Committee to make application to the L.G.B. for sanction to borrow £60,000 for carrying out the work. The extensions have been rendered necessary owing to the increased demand for electrical power.

Bournemouth.—PRICE INCREASE.—After conference with the Bournemouth and Poole Electricity Supply Co. as to the revision of the rates chargeable for the supply to the Corporation, an increase of 22½ per cent. has been recommended.

Bradford.—PRICE REVISION.—The Electricity Committee has now adopted a resolution under which, in addition to other revisions, a 10 per cent. increase will apply to the flat rate consumers. The recommendations, as now to be submitted to the Council, are:—Power consumers having maximum demands of under 5 KW. and power consumers on the restricted hour rate shall pay an additional amount in accordance with the price of coal on the same basis as power consumers having maximum demands in excess of 5 KW. (At present, this means an addition of 20 per cent.) The accounts of all other classes of consumers which are not subject to adjustment in accordance with the price of coal

(with the exception of the tramways department) shall be increased by 10 per cent. For heating and cooking purposes current shall be supplied at a flat rate of 3d. per unit, plus 10 per cent. to consumers who are already taking supplies of electricity for other purposes at the premises for which the supplies for heating and cooking are required.

Castlere (Co. Roscommon).—E.L. PROPOSALS.—A meeting of residents has formed a Committee to take steps for the introduction of public electric lighting. The cost is estimated at £2,000.

Chatham.—PRICE INCREASE.—The Kent Electric Power Co. announces that the price of electricity will, as from October 1st, be increased to 6d. per unit for lighting, and 1½d. per unit for power; to £1 2s. 6d. per quarter for radiators, and special rates by 10 per cent., subject to the existing advance of 33½ per cent.

China.—According to an American Commerce Report, the city of Amoy, the island of Kulangsu, Chioh-be, Changechow, and Chuanchow are all equipped, or being equipped, for electric supply. The Amoy Electric Light and Power Co., a Chinese concern, installed two 100-kw. turbine plants and two water-tube boilers, with a three-phase, 60-cycle, 2,300-volt transmission and 110-volt house service by means of transformers near customers' premises. In 1915 a 300-kw. turbine set was added, with two additional boilers. A total of 16,000 16-c.p. equivalent lamps is supplied and 300 fans are on the circuits, as well as 400 street lamps of 16 c.p. size, a number which is to be increased to 600 in the near future.

On Kulangsu Island, a British concern runs a 75-kw., 220-volt A.C. plant, which is, however, overloaded, and a Japanese company is understood to be seeking to put in a plant.

At Changechow a Chinese company, the Chagma Electric Light and Power Co., has been organised to put in 50-kw. and 30-kw. gas-engine driven sets; the supply will be at 440-220 volts, direct current. At Chioh-be the plant consists of two 37-kw. generators, to supply at 220 volts, 3,700 16-c.p. lamps; Chuanchow has a 75-kw. gas-driven set, supplying at 110 volts, direct current, some 3,000 lamps, and it is understood a 150-kw. generator is to be added to the equipment, which is all Japanese.

Other cities in the Amoy district and Fukien province are discussing similar plants, for which the Japanese, who have adopted the extremely liberal credit system of the Germans, are strong competitors.

Continental.—RUSSIA.—It is reported that the employees of the Kharkov E.L. Co. recently arrested the directors and managers of that concern, having decided to imprison them until higher wages were granted.

Darwen.—The borough electrical engineer, town clerk, and Councillor Thornley have been appointed to represent the Council at any meetings held in connection with the suggested inter-connection of the various electrical undertakings in East Lancashire.

Dover.—The installation of prepayment meters is to be discontinued, as the supply with them in face of the high price of meters does not give a profitable return.

East Ham.—YEAR'S WORKING.—For the year ending March 31st last, the gross profit on the electricity undertaking was £4,667, against £6,266 in the preceding 12 months. The decrease is represented by £1,896 increase in expenditure, less £297 increase in income. After paying interest on loans, &c., there was a deficiency of £244, as compared with a profit on the previous year of £1,902. The deficiency at the close of the year, including the deficit brought forward from previous years, and allowing for the balance of depreciation of renewals fund, was £3,606.

Epsom.—TAR OIL.—On the recommendation of the acting electrical engineer, the U.D.C. has decided to convert a Diesel engine for burning tar oil, which can be obtained at £5 14s. per ton, against from £10 11s. to £17 11s. per ton. This will save £1,000 a year.

Halifax.—WAGES.—The Corporation employees in the electricity, gas, highways and other departments, who are at present in receipt of wages 9s. a week higher than pre-war rates, have put in an application for payment which will bring them to 15s. a week above pre-war rates, and also ask that, in the event of any further increase of wages being conceded to the engineering industry, the same wages shall be given to the Corporation employees. The Finance Committee recommends that the application be declined, as the question of wages was referred to, and decided by the Committee on Production, last month.

Haslingden.—The electricity department made a loss of £298 during the last financial year, instead of the estimated profit of £200.

Hlford.—LOAN APPLICATION.—Application is to be made to the Treasury for a loan of £5,792, the first repayment instalment falling due one year after the termination of the war. The General Electric Co., Ltd., whose tender has been accepted for two 250-kw. rotary converters, insisted on the insertion of a clause in the contract providing for the adjustment of the amount in the event of the manufacturing cost being increased as a result of direct instructions from the Government. The clerk was directed to communicate with the L.G.B. on the matter, intimating that should such an event arise, the Council will anticipate the Treasury reimbursing the Council the extra cost so incurred.

India.—According to *Capital* (Calcutta), of August 3rd, the disappointing quality and quantity of supplies of coal in the

North and West of British India has caused consideration to be given to the possibilities of using hydro-electric power as a substitute in industries and undertakings. At Bombay motive power is obtained from the Western Ghats, and in the Punjab it is proposed to obtain water power from the canals. The Bombay undertaking already provides the mills of Bombay with about 40,000 electric H.P. The undertaking is being extended, and is expected to supply all the power required by the Bombay mills, tramways, and Port Trust railway, as well as to provide for the lighting of the city.

The hydro-electric plant at Amritsar, which has been set up recently by the Punjab Irrigation Department, is a similar project, but on a much smaller scale. At present the power is made use of to irrigate fields for agriculture, and to drive machinery in one of the workshops of the Irrigation Department. It is expected that this irrigation from wells will reduce at the same time the subsoil moisture, and so make the city less malarious.

Not only is it probable that, in regions where coal is scarce in British India, hydro-electric power will supplant steam to a large extent in the conduct of industry, but, if the price of Indian coal continues to rise, as is expected, it is also likely that electricity will be generated from coal on a much larger scale than hitherto in all the large towns of India, and utilised for public and domestic services as well as for industries.—*Board of Trade Journal*.

Kirkheaton.—PROVISIONAL ORDER.—Having received notices from the Huddersfield Corporation and the Electrical Distribution of Yorkshire, Ltd., of their intention to apply for a provisional order authorising them to supply electricity within the urban district, the U.D.C. has decided to invite representatives to meet the Council to discuss the matter.

London.—HACKNEY.—YEAR'S WORKING.—The report of the Corporation electricity undertaking for the year ended March last shows a total sale of 15,302,372 units, or nearly 69 per cent. increase on the previous year; this large increase was due mainly to power supply, for which some 12½ million units were sold; bulk supply to Poplar also accounted for 748,000 units, but in other directions there was a falling off. Altogether 18 million units were generated, and about 35,000 purchased from Poplar under the interconnection arrangement. The total revenue for the year was £88,050; the total expenditure, £50,478; and the gross balance £37,572, as compared with £24,252 in the previous year. Loan charges amounted to £30,032, and there was a surplus of £5,290 as compared with a deficiency (the first recorded on a complete year) of £8,265 on the previous year. The reserve fund at March 31st amounted to £25,340, after charging thereto the loss, £4,774, in respect of a breakdown to a 600-kw. set.

It is remarked that the large scheme of extensions was completed early in the year, and the effect of the efficient plant is shown in the cost of energy: working and management cost amounts to 75d. per unit, as against 84d. in the previous year, while the all-in cost, 1'23d. per unit, is the lowest yet recorded. The decreased average cost is, of course, also due to the increased power supply, some 1,491 motors of 12,370 H.P. being connected, as against 1,381 motors of 8,770 H.P. in 1915-16. Roughly 16 million of the total units generated were A.C.; the maximum load was 7,951 kW. and the load factor 22 per cent.

BETHNAL GREEN.—The B.C. has received sanction from the L.C.C. to the borrowing of a sum of £1,000 for the provision of further house services in connection with the electricity undertaking on the usual condition.

The B.C. has been recommended to add 33½ per cent. to all consumers' accounts in respect of electrical energy supplied from October 1st.

Manchester.—PROPOSED LOAN.—The City Council is being recommended to apply to the L.G.B. for sanction to borrow £20,000 for additional electricity mains, due to the demands of consumers engaged on special work.

Preston.—The National Electric Supply Co. has notified consumers that in future the minimum consumption of current chargeable per quarter is to be 25 units.

Rathmines.—YEAR'S WORKING.—The year's working of the Council's electricity undertaking for the year ended March 31st last shows a total revenue of £15,762, a total expenditure of £10,003, and a gross profit of £5,759. Interest and sinking fund charges amounted to £7,678, leaving a deficit on the year's working of £1,919, which with £1,157, the debit balance brought forward from the previous year, makes a total deficit of £3,076.

Stalybridge.—COAL CLAUSE.—The Joint Electricity Board has decided that the coal clause for power supply shall be raised from 15d. to 2d. from January 1st next.

Stoke-on-Trent.—LINKING-UP.—In connection with the proposed linking-up of Stoke, Newcastle, and Leek for electricity supply purposes, the Stoke-on-Trent Electricity Supply Committee has authorised the engineer to prepare a scheme, jointly with the engineer of Newcastle-under-Lyme, upon that authority confirming the conclusions arrived at by the respective chairmen and vice-chairmen.

Templemore (Co. Tipperary).—PROPOSED E.L.—At a meeting of the Urban Council, Mr. McDonnell gave notice to move that a public electric lighting scheme be adopted.

Todmorden.—SUGGESTED BULK SUPPLY.—At the last meeting of the T.C., it was reported in connection with the Council's application to the L.G.B. for sanction to borrow £10,000 for extensions at the electricity works, that the Ministry of Munitions had replied suggesting linking-up with a neighbouring power station.

Walthamstow.—The Finance Committee of the U.D.C. recommends that the recommendation of the Electricity Supply and Lighting Committee be amended so that the charges for current supplied for public and private lighting be increased by a further 13½ per cent., making 33½ per cent. in all, and for power and heating by a further 15 per cent., making 40 per cent. in all.

It is proposed that prepayment consumers be charged an equivalent of a further 5 per cent. upon the sum taken from the meter. The electrical engineer is to enter into negotiation with those consumers who have period contracts, with a view to their paying an increased price for energy without prejudice to the terms of their contracts.

Wharfedale.—Mr. Woodhouse, engineer to the Electrical Distribution of Yorkshire, Ltd., waited upon the Guiseley District Council, last week, in reference to the company's proposed application for a Provisional Order; he said arrangements had already been come to with Rawdon and Otley, and the company were now approaching the Burley-in-Wharfedale Council and the Wharfedale Rural Council, the latter in respect of Menston. Mr. Woodhouse stated that the conditions had so greatly changed since the time of the agreement with Otley that he could not give an undertaking as regards the terms to Guiseley without consulting his directors.

TRAMWAY AND RAILWAY NOTES.

Australia.—The N.S.W. Government, after consultation with the Railway Commissioners, has decided to increase the fares on the Government tramways; whether this will be done by shortening the length of the sections, or by raising the fares on those already in existence, has not been decided. The latter is considered the most probable, as the Commissioners recognise that businesses have grown up around long recognised tramway sections, which they would be sorry to disturb.—*Sydney Evening News*.

Blackpool.—On the recommendation of the general manager (Mr. C. Furness) the Tramways Committee has authorised the provision of new cross-overs from west to east on the tramway immediately opposite the North Pier. The work is to be proceeded with during the coming winter.

The Tramways Committee has approved a scheme for the doubling of the track between the Hippodrome and Abingdon Street, including the erection of an ornamental shelter at the junction of Abingdon Street and Church Street.

The Tramways Committee has also agreed to the erection of a combined tramway shelter and bureau, with clock tower, opposite Foxhall Square.

Doncaster.—CHEAP TICKETS ABOLISHED.—The Corporation has decided to abolish all workmen's dinner tickets, coupons, and other cheap return tickets on the tramways, owing to increased working expenses, higher wages, and cost of material.

East Ham.—YEAR'S WORKING.—The gross profit of the Corporation tramway undertaking for the year ended from March 31st last was £4,493, which showed a decrease on the previous 12 months of £6,094, made up by £2,774 decrease in income, plus £3,320 increase in expenditure. At the close of the year, after charging interest and repayment of loans, there remained a deficiency of £2,395.

Haslingden.—YEAR'S WORKING.—There was a profit of £495 on the working of the tramway undertaking for the past financial year, after paying £308 to the Accrington Corporation in view of the latter's deficit.

Hebden Bridge.—A conference is to be held between representatives of the Halifax Corporation, the Todmorden Corporation and R.D.C., and the Hebden Bridge U.D.C. to consider the proposal to join up the Halifax tramways with the Todmorden Corporation motor-buses.

Hove.—The Board of Trade has extended to August, 1918, the time under the Corporation Act for the completion of overhead equipment and other apparatus for working trolley vehicles on certain routes.

Ilford.—The tramway manager having been appointed on a Sub-Committee of the Municipal Tramways Association to consider the standardisation of overhead equipment, informed the Tramways Committee of the Council that he was the only member of the Sub-Committee in the South of England, and the meetings would probably be held in Yorkshire; permission to attend these meetings was given.

Lancashire.—TRAMWAY WAGES AWARD.—The award of the Committee on Production in last week's arbitration between 19 Lancashire and Cheshire tramway undertakings and their employes has been received during the week end, and the result is another substantial increase of war wages for the 17,000 to 20,000 tramway workers affected, involving a big extra charge upon the local undertakings. The whole of the workers, male and female, over 18 years of age, will receive an advance of 3s. for a six days' week, and those under 18 obtain 1s. 6d. The total war advances for a six days' week is now 12s. for men, 9s. for women, 5s. 6d. for boys under 18, and 4s. 6d. for girls under 18. The award makes the bonus payable for overtime as well as for the ordinary working wages, as owing to shortage of staff a large amount of overtime is being worked; this is welcomed by the workers. The award

takes effect from the first pay day in September. The towns concerned in the increases are Manchester, where nearly 5,000 workers are affected; Salford, where the increased charge is estimated at £9,000 a year; Accrington, Ashton-under-Lyne, Blackburn, Birkenhead, Bolton, Burnley, Bury, Colne, Darwen, Oldham, Preston, Rochdale, Stockport, Wallasey, Warrington, Wigan, and the areas covered by the Stalybridge Joint Tramways Board and the South Lancashire Tramways Co. A leading tramway official in Manchester declares that as the advances will mean a big strain upon the departments, the possibility is that there will be a general increase of tramway fares throughout Lancashire.

Leeds.—Interviewed, last week, in regard to the Coal Controller's suggestion that economies might be effected by curtailment of some public services—as, for instance, early and late cars—Mr. J. B. Hamilton, the general manager, stated that the service there had already been curtailed so much that further steps in that direction were hardly likely, and it was at the instance of the authorities that special early morning and late evening cars were running. The whole question of the service, both as to number of cars and the number of people who drive and conduct them, was now engaging the attention of the Committee. The present service was not quite adequate for the number of people who wish to travel.

London.—The L.C.C. is making the following modifications in the availability of transfer and workmen's tramway tickets, commencing on October 3rd:—

1. Transfer tickets will only be issued for journeys where no through cars are run. Passengers who can make their journey without a change are requested to take a through car. Passengers who hold transfer tickets must change at the point indicated on the fare bills; such tickets will not be accepted at other points.

2. Workmen's tickets will only be available for the second journey between the same points as on the first journey.

These changes are made to overcome operating difficulties caused by war conditions.

Newcastle-on-Tyne.—RATING APPEAL.—The Tramways Committee has issued another report relative to the assessment of the tramway undertaking for the poor rate. The Assessment Committee has intimated its willingness to reduce the assessment for the three past years to which the Corporation had objected, but the rates have not been amended, and the Tramways Committee has been forced, as a last resource, to appeal to Quarter Sessions, or lose its remedy, and appeals are pending in respect of the poor rates made for 1915, 1916 and 1917. The Tramways Committee is advised that the rates do not conform, and cannot be made to conform, with the valuation list. The hearing of the appeal was fixed for to-day.

At the invitation of the general manager of the tramways, representatives of the local shipbuilding and engineering yards on the Tyne and the Trade Unions concerned, met to consider the complaints as to the inadequacy of the service of workmen's cars, and the fact that the local Tribunal is considering the wisdom of cancelling the exemptions of some of the men employed on tramway repairs and maintenance. After discussion, it was decided that the general manager should draw up a statement as to the position of the tramways, and that it should be supported by the firms and Trade Unions represented, so that the matter might be brought urgently before the Ministry of Munitions, that the situation might be relieved, or, at all events, that the staff should not be further depleted.

TELEGRAPH AND TELEPHONE NOTES.

Japan.—The Japanese Diet has voted a large appropriation for the extension of the telephone system in Japan.—*T. and T. Age*.

Telephone Development of the World.—Europe, which had 3,910,000 telephones at the beginning of 1914, had at the beginning of the current year probably 4,180,000, made up as follows:—

Great Britain (including emergency stations) ...	812,000
Russia (January 1st, 1916) ...	400,000
Sweden (271,797 at January 1st, 1916) ... (say)	288,000
Denmark (150,000 at January 1st, 1916) ... (say)	165,000
Norway (94,000 in January, 1915) ... (say)	100,000
Netherlands (78,743 at January 1st, 1914) ...	100,000
Switzerland (January 1st, 1917) ...	104,000
Spain (36,660 at January 1st, 1915) ... (say)	50,000
Austria (170,000 at January 1st, 1915) ...	170,000
Germany (pre-war) ...	1,421,000
France (pre-war) ...	310,000
Italy (pre-war) ...	95,000
Belgium (pre-war) ...	51,000
Hungary, the Balkans, Portugal, Luxemburg, &c. (pre-war) ...	114,000
	4,180,000

Great Britain has increased from the pre-war figure of 774,000 and even if the "emergency stations" be eliminated, a small increase is still shown. London, despite statements in the Press to the contrary, has increased from 259,000 to 269,538.

Asia had 303,000 telephones at the beginning of 1914. Since then there has been an increase of 7,000 in Japan, 6,000 in Siberia

and about 2,000 in Corea, Manchuria, and Formosa. We may safely put the total for Asia at 340,000.

There were 59,500 telephones in Africa in 1914. The figures for South Africa had increased by 4,000 by the beginning of 1916. There were at least 66,000 stations in Africa at the beginning of this year.

There are 11,300,000 telephones in the United States. Canada had 533,090 in June, 1915. The total for North America is at least 11,920,000.

In South America there were about 170,000 telephones in 1914, and there cannot be less than 230,000 stations working at present.

Official figures show that there were 168,416 telephones in Australia on June 30th, 1916. New Zealand had 58,796 and Hawaii 7,000. Total, 234,000.

In January, 1913, there were about 13,500,000 and in 1914 14,500,000 telephones in the world. At January, 1917, there must have been close upon 17,000,000.—W. H. GUNSTON, in the *Telegraph and Telephone Journal*.

CONTRACTS OPEN AND CLOSED.

OPEN.

Morecambe.—October 15th. Electric Traction Committee. Supply of electrically-driven omnibus. See "Official Notices" to-day.

CLOSED.

Accrington.—Electricity and Tramways Committee. George Hargreaves & Co.: 500 tons of coal per month for a year, at existing prices, subject to any increase or decrease fixed by the Coal Controller.

Barrow.—T.C.:—

Steam tube-cleaning apparatus.—Boiler Tube and Flue Cleaner Co., Ltd., £173.
Switchgear.—British Thomson-Houston Co., Ltd., £303.
Graving-dock switchgear.—Ferranti, Ltd., £383.
Switchgear.—Ferranti, Ltd., £330.
Transformer.—Ferranti, Ltd., £369.
Cables.—B.I. & Helsby Cables, Ltd., £1,718.

Bexhill-on-Sea.—T.C. 1,000 tons of Manners' washed peas or Shipley peas, for the electricity works: Myers, Rose & Co., 28s. 7d. per ton, carriage paid in truck at Bexhill.

Dublin.—Corporation Electricity Committee. Green economiser: G. N. Haden & Sons.

November 1st. G.N. Railway Co. (Ireland). Six or twelve months' supply of general stores (including several electrical items). See "Official Notices" to-day.

Erith.—U.D.C. H. Friday & Sons: Extensions to electricity works.

Ilford.—U.D.C. Accepted tenders (the lowest in each case):—

General Electric Co., Ltd.—Converting plant, £2,459.
W. T. Henley's Telegraph Works Co., Ltd.—Cable, £1,432.
Albion Clay Co., Ltd.—Conduits, £526.

Walthamstow.—U.D.C.:—

Tudor Accumulator Co., Ltd.—Renewal of contract for maintenance of battery at the Sanatorium for ten years, at £28 per annum.

FORTHCOMING EVENTS.

Salford Technical and Engineering Association.—Saturday, October 6th. At 7 p.m. At the Royal Technical Institute. Lecture on "The Panama Canal," by Mr. R. Barker.

Chief Technical Assistants' Association.—Saturday, October 6th. At 3 p.m. At Tavistock Hotel, Covent Garden. Discussion on "Recent Developments in respect of Organisation of Staff in Electric Light Undertakings."

University of London University College. Wednesday, October 10th. At 7 p.m. At Gower Street, W.C. Lecture on "The Engineering Plant in Large Hotels," by Mr. A. H. Barker.

Birmingham and District Electric Club.—Saturday, October 13th. At 6.30 p.m. At the Swan Hotel, New Street. Ladies' night.

NOTES.

Women Tramway Employees Assaulted.—At the Huddersfield Police Court, last week, Edward Downs, stoker, was fined 10s., and ordered to pay 10s. witnesses' expenses, on a charge of assaulting Emily Bradley, tramcar conductress, on September 7th, the defendant being a passenger on a car on the Leeds Road route, on which the complainant was on duty. Mr. Proctor (deputy town clerk), who prosecuted, said the girl conductresses on that route were insulted almost every day, and the Tramways Committee hoped the Bench would deal with such cases very firmly.

Exports to China.—The *London Gazette* for October 2nd contains a further list of persons and bodies in China to whom exports may be consigned.

Educational.—UNIVERSITY OF LONDON. UNIVERSITY COLLEGE.—Prof. J. A. Fleming, F.R.S., will deliver a public lecture on "The Work of a Telephone Exchange," on Wednesday, October 17th, at 5.30 p.m., and a course of six lectures on "The Principles of Modern Telegraphy," on Fridays, at 5 p.m., beginning October 26th, 1917. The public lecture is open without fee or ticket. The course is open both to members and non-members of the University. Fee, £1 11s. 6d. Application for tickets of admission to it should be made to the Secretary, University College, Gower Street, W.C. 1.

Volunteer Notes.—COUNTY OF LONDON VOLUNTEER ENGINEERS (FIELD COMPANIES).—Headquarters, Balderton Street, Oxford Street, W. 1.

Orders for the week, by Lieut.-Colonel Clay, V.D., commanding:—

Officer for the Week.—Second Lieut. P. Bowden.

Monday, October 8th.—Drill and Elementary Bridge Construction for No. 3 Company, Left Half Company, 6.30. Signalling Class, 6.30. Recruits' Drill, 6.30.

Tuesday, October 9th.—Headquarters closed.

Wednesday, October 10th.—Drill and Elementary Bridge Construction for No. 1 Company, 6.30.

Thursday, October 11th.—Drill and Elementary Bridge Construction for No. 2 Company, 6. Signalling Class, 6.30. Ambulance Class, 6.30.

Friday, October 12th.—Drill and Elementary Bridge Construction for No. 3 Company, Right Half Company, 6.30.

Sunday, October 14th.—Commandant's Parade for work at Esher. Parade 8.15, Waterloo Station, opposite No. 10 Platform.

Musketry.—The Range at Belvedere Road will be open every Tuesday, Wednesday, and Thursday evening from 5.30 to 7.

Medical Examination.—The Medical Officer will attend at Headquarters for this purpose every Thursday at 6.

(By order) MACLEOD YEARSLEY, Capt. and Adjutant.

The Question of Combination.—In view of the interest which is being taken in the Government recommendation to our manufacturers to combine in their operations in readiness for after-the-war conditions, in competition with other countries, the remarks of Sir J. E. Johnson Ferguson, at the annual meeting of Messrs. Bolekow, Vaughan & Co., Ltd., may be quoted. He said that during the last few months they had heard a great deal about the advantages of combination. Some gentlemen had held up the United States Steel Corporation to their admiration, and asked them all to sink their individuality in one concern. Others, again, had extolled the advantages to be derived from copying the method of the German *Verband*. He, personally, did not agree with a great deal of what those gentlemen said. Small concerns, he admitted, would not be able to live in the competition of the future, but they could not describe Bolekow, Vaughan & Co. as a small concern, and it would require very conclusive evidence of the advantages to be derived by the shareholders before he would be disposed to recommend such a change as was advocated by these gentlemen. There were, however, two directions in which he thought useful developments might be made by arrangements amongst manufacturers. A great deal of useless changing of machinery might be avoided, and in that way by continuous running over a long period without a change, the output of machinery might be considerably increased. The same policy which had led to standardised ships being built should be much more largely extended than it was now to all other classes of production. The other direction in which he thought the iron and steel manufacturers of this country might, with advantage to themselves and to our national trade, act together, was that of securing the control of some of the undeveloped sources of supply. If Germany lost Alsace-Lorraine, and he supposed there was not one of them who could contemplate a termination of the war with any other result, she would lose her principal domestic source of iron ore supply. They all knew how vigilant the German Government was to foster and protect the interests of its manufacturers. They might naturally assume, therefore, that one of the very first steps it would take, after the close of the war, would be to try to secure the control of some of the principal iron ore fields of the world. The principal of those fields were far too big and important for any one individual concern to tackle, and the only way in which our interests could be protected was by the formation of a company representing the consumers, and possibly the merchants, of this country, to acquire and develop some of these supplies, and it seemed to him that if there ever was a case in which it was desirable for the Government to interest itself, this was such a case.

Fused Silica.—Israel Rosenblum, of Swampscott, Mass., has patented a method of producing articles of fused quartz in an atmosphere of nitrogen in graphite crucibles. The method is based upon the discovery that if a transparent quartz tube is slipped over a graphite rod and heated to a temperature between 1,400° and 1,600° Centigrade in a nitrogen atmosphere, a compound of silicon, nitrogen and carbon is formed, which acts as a protective coating over the graphite rod, and prevents further action on the graphite by the quartz. As the melting point of the compound of silicon, nitrogen and carbon, when once formed, is far above the temperature needed to render the quartz plastic, which is about 1,800° Centigrade, it follows that this compound acts as a protective layer, not permitting the quartz to be contaminated by the graphite. In practice, illuminating gas may also be used.—*Met. and Chem. Engineering*.

Dangers of Gas Lighting.—A serious accident recently occurred in India from an unusual cause. A gas cylinder came adrift from underneath the coach of a passenger train whilst running on the Madras and Southern Mahratta Railway between Biccavol and Anaparthi, due to one of the supports failing. The cylinder appears to have been fully charged with gas, and when it fell at one end on to the permanent way, the bogie of the moving vehicle caught it, crushed and forced it up through the floor of the carriage, where it exploded, partially wrecking the carriage and seriously injuring several of the occupants.—*The Locomotive*.

Decimal Coinage.—In issuing a pamphlet dealing with the existing British system of coinage and the proposed method of reform, which we have already noticed, the Decimal Association states that its efforts are now reinforced by the recommendations of the Institute of Bankers and the Association of Chambers of Commerce, all three bodies being in agreement that the desired change can best be accomplished by retaining the £ sterling as the monetary unit, and dividing it decimally, a course which would leave the values of all our gold and silver coins unchanged. It is pointed out that the purchasing power of the penny has completely changed during the war, and that the inflexibility of our subsidiary coinage has been one of the causes accentuating the high prices of daily necessities, which have been the root of so much industrial unrest; the present proposed changes, instead of being against the interests of the industrial classes, will in reality be of advantage to them. One has only to recall the many instances of the prices of halfpenny goods and services being raised to a penny, and of penny goods being raised to three halfpence for lack of an intermediate coinage, to realise the truth of the statement.

These advances of 100 per cent. and 50 per cent. respectively have been made when perhaps 20 per cent. would have reimbursed the sellers for their increased cost, and the introduction of new subsidiary coins, having values intermediate between our present halfpenny and penny and between our penny and three halfpence, would accordingly be a great boon to the consumers of "penny-worths" in any form.

It is certain that the pre-war level of prices cannot be restored for a long time to come (if ever), and that the provision of an enlarged range of low-denomination coins in closely graduated steps would accordingly afford much relief to our hard-pressed people, while enabling the seller to get a fair increase of price for his article. It is the aim of the Association simultaneously to provide the desired relief and to confer the benefits of decimal coinage upon the nation, thereby removing a burden which for years has oppressed all classes. Expressions of opinion on the subject will be welcomed by the Association.

Electrode Cooling.—A simple arrangement of the water cooling on electrodes, introduced by the writer some time ago, on the Heroult furnace at the Hussey-Binns Steel Co. plant, has worked very satisfactorily. The accompanying sketch, showing the arrangement as applied to the middle electrode, gives the principle.

The cooling water comes through the armoured hose (1) to distributing box (2), fastened on the outside of the columns for the electrode-holders. Only three pipes go out from the distributing box—one to each electrode, each of which is furnished with a regulating valve. Where the pipe passes the roof-ring a piece of rubber hose (3) is inserted for insulation, and connected with a

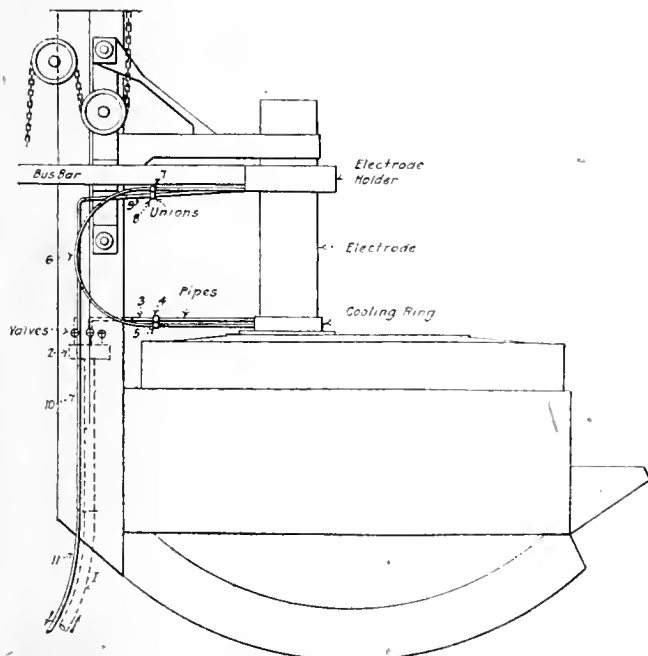


FIG. 1.—ARRANGEMENT FOR WATER COOLING.

union (4) to the pipe which goes to the cooling ring. The return pipe from the cooling ring is connected with a union (5) to the rubber hose (6), which is sufficiently long to allow for total electrode movement and some surplus to prevent kink. This rubber hose is again, by means of union (7), fastened to the pipe leading to the electrode-holder, and the return pipe from this is, by means of union (8) and rubber hose (9), connected to the downfall pipe (10), which is fastened to the electrode carriage. From the pipe (10) the armoured rubber hose (11) leads to the common waste-water box.

The advantage of the arrangement is that all pipes on the furnace can be very easily drained in case of cold weather, when the furnace is out of operation, and freezing of the water is to be feared. Disconnection of the unions of the armoured feed hose (1) and waste hose (11) will give complete drainage.

In case muddy river water is used for cooling, it is advisable not to thread the ends of the pipes on which the hose from the cooling rings are fastened. This avoids danger when, after a clogging up, steam will be suddenly developed in the cooling ring, causing the hose to blow off.

A further advantage is that very little rubber hose is used, and only three valves are to be operated by the furnaceman.—HAAKON STVRI, in *Mel. and Chem. Engineering*.

Aeronautical Institute of Great Britain.—The membership of this Institute, which is now nearly 1,000, has recently been re-classified, and it is hoped that the Associateship, which is open to accredited members of the public, will be largely availed of by the rank and file of the industry, for whose benefit a special course of aeronautical engineering instruction will be organised.

New Allied Conference in Paris.—According to Reuter (quoted in the *Times*), an inter-Ally Conference to deal with the treatment of enemy goods in occupied territory will meet in Paris on October 8th.

Practical Experiences with Tough Rubber Compound Cables.—In the last line of the article by Mr. W. Ellerd-Styles, on page 292 of our last issue, the word "brushes" should read "bushes."

Appointments Vacant.—Assistant mains superintendent (45s.) for the Rochdale Corporation Electricity Department; shift engineers for Eccles Corporation and Stepney B.C. See our advertisement pages to-day.

The Kensington and Notting Hill Arbitration: Award.—With reference to the arbitration proceedings in respect of the Kensington and Notting Hill Electricity Supply Companies, which were reported in the *ELECTRICAL REVIEW* in July last, we understand that the arbitrator has issued his award, finding in favour of the Kensington and Knightsbridge Co. on all points, subject to the decision of the Court on the legal construction of the agreements, and other points of law.

A French Exhibition of Industries.—The French nation are tackling in a very practical manner the question of rendering themselves independent of German and Austrian manufacturers. No society has been more active in this campaign than the Société d'Encouragement pour l'Industrie Nationale, of Paris. Last June the society organised, and held at their headquarters, a representative exhibition of French products. The exhibits included: (1) articles which previous to the war were not manufactured in France at all; (2) goods which prior to the war were manufactured in areas now in enemy occupation, but which have since been manufactured in regions without the Army zone. Over 71 firms showed exhibits, and the experimental electrical section was well represented. A number of manufacturers are now giving their attention to the production of glasses suitable for electric lamps, and have succeeded in turning out a satisfactory article as the exhibits demonstrated. Blown glass-work for such articles as Geissler tubes, &c., was shown. Particular interest was shown in some specimens of the Coolidge tube which one French manufacturer has taken up enthusiastically, and which, as Prof. Fery points out, is likely to assume great importance in the future in connection with the radiographic examination of metals.

A representative series of ebonite goods was shown. This class of article France obtained largely from Germany before the war, but it is now demonstrated that she can turn out articles which will answer the purpose just as well. As is the case with England, the French are taking steps to ban German-made magnetos altogether. A number of types were shown by various motor manufacturers and others. Small electric motors, too, are now being manufactured in France for a variety of purposes. For obvious reasons, very little was shown in the way of heavy electrical machinery or instruments. When practically every firm in France is engaged on war work, it is most praiseworthy to find that many are able to show that in the efforts of that country towards reconstruction, they are not neglecting the practical measures necessary in attaining the desired end. The French society mentioned above, from whose *Bulletin* for July—August these notes are compiled, is rendering signal service.

German Enterprise in Switzerland.—In *l'Industrie Electrique* it is stated that Germany is specially interested in the electrical and mechanical industries, metallurgy, construction, and financial groups controlling these industries, in Switzerland. In electricity, the Berlin group represented by the A.E.G. disposes of more than 275,000 H.P., and a capital of over 600 million fr., of which 340 millions are represented by shares, and 308 millions by loans. The Siemens group controls 310 million fr. German, or Swiss-German, *personnel* plays an important part in the administration of the enterprises in which German capital participates: thus, the Banque des Chemins de Fer Orientaux de Zurich includes, amongst 17 directors, 8 Germans and 1 Austrian; the Banque pour Entreprises Electriques, in Zurich, includes 16 Germans and only 7 Swiss; the Metallgesellschaft, of Basle, 9 Germans to 6 Swiss.

Electrical Smelting of Iron Ore.—It is announced that a new electrically-operated iron smelting plant has been built, and has commenced operations, at the Porjus Falls, this being the first attempt to treat North Swedish iron ore on the spot. The first furnace to be started is said to be producing 8 tons daily, and the output is to be raised to 20 tons per day by the starting of a second iron pyrites furnace. The erection of a third furnace to produce chrome and other alloy iron is also in contemplation.

The Industrial League.—We have received from Mr. H. Scholey, hon. secretary of the Industrial League, a pamphlet describing its objects and methods, and containing a number of appreciative extracts from Press comments. The League is the outcome of a series of small meetings of employers and prominent Labour leaders held during the past two years, with the object of bringing employers and workers together in friendly relationship—perhaps the most important and urgent necessity of the time. Its mission is chiefly an educational one, and its mode of operation is the dissemination of information with a view to enabling employers and workers better to understand each other's position with regard to social and industrial questions. Considerable success has already been achieved in this direction at the London meetings, and the League proposes to establish local Associations of the same character in large centres of industry throughout the country, which would be affiliated to the parent body and assisted in carrying on their work. It is essential to secure direct contact with the workers, and this will be effected through the medium of the Trade Unions and men who are closely associated with Labour. Both employers and workers will be represented on the General Committee, which is in process of formation. The League will work in co-operation with all Associations which have similar aims: its position is epitomised in the following general statement:—

Having regard to the fact that the war will leave the nation burdened with a huge debt, it is necessary to increase the general output of the community, and it is of vital importance that greater and more friendly co-operation shall exist between employers and employed.

It is essential, first, that the social conditions of the people should be elevated; secondly, that the greatest possible output be obtained in every industry; and, thirdly, that all industries, small as well as large, should be encouraged in every possible manner.

Agreements should provide for every willing worker, wages that will assure a certain and secure existence for himself and his dependents. A guaranteed minimum wage is therefore essential to the workers in every industry.

To encourage output, rates of wages should provide that the exercise of superior skill should be fully rewarded.

Considerable funds will be required to carry out its objects, and subscriptions (£1 per annum for individuals, £2 for firms) and donations are invited by the hon. treasurers, Mr. G. J. Wardle, M.P., and Mr. Lee Murray. Mr. J. J. Ames shares with Mr. Scholey the office of hon. secretary, and the address of the League (*pro tem.*) is 56, Victoria Street, S.W. 1.

Household Coal Distribution Order, 1917.—Owing to doubts as to the scope of the order, buildings not used as private dwelling houses (such as schools, hospitals, bakehouses, public halls and institutions, offices, &c.) have largely failed to make out requisitions for the assessment of their supplies of coal, coke, or other fuel commencing October 1st, so as to comply with the terms of the Order. As it is not desirable that a difficulty of this kind should in many cases interrupt the usual supplies to such buildings, registered coal merchants may continue their deliveries during the month of October, even although they hold no certificate authorising the supply. The merchants should at once give notice to their customers calling attention to this failure on their part to complete the necessary requisitions, so that the supply may be regularised as quickly as possible. It should be noted that where a supply of coal, coke, or other fuel is used partly for industrial purposes and partly for heating, cooking, or domestic purposes, a requisition will be required for such part of the supply as comes within the scope of the Order. The Order comes into force on October 1st, with regard to all buildings used as a private dwelling house or dwelling houses, and no extension of time is permitted in their case.

Coal Wagons.—The *Times* states that it is now confidently expected that the Controller of Coal Mines will have a sufficient number of railway and privately-owned coal wagons at his disposal by October 15th to remove all ground for anxiety about the conveyance of coal from the collieries to the various depôts established throughout the country. In this work the Controller has had the loyal co-operation of all the railway companies.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station and Tramway Officials.—Mr. H. BARSON has been appointed charge engineer at the Dover Corporation electricity works, *vice* Mr. A. H. Jones, resigned.

The Liverpool City Council is being asked to grant a large number of increases in salary to Corporation officials, the total amounting to something like £3,500 a year. Included amongst them are the following:—Tramways Department: Mr. C. W. Malins, general manager, from £1,250 to £1,500; Mr. T. Cook, engineer's assistant, from £400 to £500, rising 12 months later to £550; Mr. T. Ridyard, rolling stock and works superintendent, from £300 to £500, rising in 12 months to £550. Electricity Supply Department: Mr. H. Dickinson, city electrical engineer, from £1,500 to £1,600; Mr. P. J. Robinson, superintendent engineer of stations, from £500 to £700, and to be appointed chief engineer's assistant; Mr. L. Breach, assistant electrical engineer, from £370 to £425, and

to be appointed engineer's assistant, City Lighting Department: Mr. A. G. Smith, lighting engineer, from £500 to £550. The proposals have met with some criticism outside the Council, and Ald. Burgess has given notice of motion that all suggested increases of salaries over £1,000 a year be deferred for 12 months.

The Kingston-on-Thames Lighting Committee recommends that the salary of the electrical engineer (Mr. T. A. Kingham) be increased by £50 a year, with a further increase of £25 a year hence.

General.—Electrical men will receive with interest the announcement that Lord Rhondda has recognised the organising ability of Mr. H. B. RENWICK, managing director of the County of London Electric Supply Co., Ltd., and has appointed him to act as Director of Feeding Stuffs at the Ministry of Food. Mr. Renwick will be charged with the duty of organising the supply and distribution of oil cakes and other cattle food. At Lord Rhondda's special request the directors of the County Co. have agreed to loan Mr. Renwick's services for the purpose mentioned.

Mr. WM. LUNN, A.M.I.E.E., who returned from California, U.S.A., in the fall of 1915, has left Messrs. R. W. Blackwell and Co., Ltd., to take up a position as electrical surveyor with the Norwich Union Fire Insurance Society, Ltd.

At Morecambe, last week, Mr. OSWALD G. COOK, electrical engineer under the Royal Engineers, at a military power station, was married to Miss Hannah Hardill, daughter of Mr. Wm. Hardill, of Messrs. Wm. Hardhill, Sons & Co., Ltd., Netherfield Foundry, Cleckheaton.

Mr. J. FLANAGAN, of Bolton, has been appointed electrical engineer to the Tees Side Bridge & Engineering Works, Ltd., Middlesbrough.

The directors and staff of the Midland Electric Light and Power Co., Ltd., have presented an inscribed gold watch to Lance-Corporal A. J. WHITEHEAD, Signalling Company, R.E., who recently gained the Military Medal for good work in the field.

For his services in having the Dublin & Lucan Electric Railway placed under Government control, the manager, Mr. D. McDOWALL GROSART, has been presented, on behalf of the shareholders and users, with a gold watch and a cheque.

Roll of Honour.—Major GORDON SPENCER MARSTON, an electrical assistant with Messrs. Berry, Skinner & Co., who enlisted as a private in the Royal Engineers at the beginning of the war, and obtained a commission after being wounded in 1915, was mentioned in a dispatch by Sir Douglas Haig for excellent and exceptional work. He has now reached the rank of temporary Major, and has been granted the Military Medal.

We regret to learn that Lieut.-Col. ROBERT WHITEHEAD HAMMOND, Royal Fusiliers, died on September 30th of wounds received two days previously. Lieut.-Col. Hammond was the only son of the late Mr. Robert Hammond. He was an Associate Member of the Institution of Civil Engineers, a Member of the I.E.E., and was a partner with his father in the consulting engineering firm, Robert Hammond & Son.

Lieutenant A. J. ADAMSON, R.G.A., accountant to the Oxford Electric Co., Ltd., has been killed in action.

Private S. BISHOP, London Regiment, and Driver H. SCOTT, R.F.A., both formerly in the general office of the India-Rubber Co., Silvertown, have been wounded in France.

Gunner J. ILLINGWORTH, who was employed by the Phoenix Dynamo Co., of Bradford, has died of wounds received in action.

Private J. WHALLEY, Machine Gun Corps, who has been killed in action, was employed by Messrs. Dick, Kerr & Co., Preston.

First Air Mechanic S. HALL, R.F.C., has gained the D.C.M., for conspicuous gallantry. His wireless station came under heavy fire, and the aerial was shot down three times, but he re-erected it on each occasion, eventually restoring communication with his aeroplane. Before joining the Army he was a telegraphist at the G.P.O., Manchester.

Lance-Corporal F. BALDWIN, Signalling Corps, R.E., and attached to the cable section, has been awarded the Military Medal for repairing telegraph wires under heavy fire. He was employed as a linesman at the Burnley Post Office.

Private R. ROGERSON, Lancashire Fusiliers, who has been killed in action, was for 10 years employed by Messrs. I. Frankenburg & Sons, Ltd., cable manufacturers, Salford.

Private W. CAVSTICK, Scots Guards, has died from wounds received in action. He was employed in the Blackpool Corporation electricity department as a cable layer.

Rifleman H. EMMENS, Rifle Brigade, killed in action, was employed by the British Westinghouse Co., Ltd., Trafford Park.

Mr. J. WILKINSON, wireless telegraphist in the R.N.V.R., has been killed. He was employed by the British Westinghouse Co., Ltd., Trafford Park.

Signaller B. G. ALLDAY, of the K.O. Royal Lancaster Regiment, whilst serving as a wireless operator in the signalling section on August 6th, conducted himself with such gallantry as to earn the commendation of the officer commanding. He was a Blackpool-Lytham tramway employee.

Private H. E. WHETTON, Lancashire Fusiliers, who has been killed in action, was employed by the British Westinghouse Co., Trafford Park.

Private D. BRADSHAW, who is wounded, was employed by the St. Helens Cable & Rubber Co., Ltd., Warrington.

The Military Medal, for carrying dispatches under heavy shell fire, has been awarded to Private A. BRENS, London Regiment, a member of the staff of the Croydon electricity works.

Lance-Corporal W. J. FUSSELL, R.E., an electrician with Messrs. R. Kendall & Sons, of Bath, has fallen in action.

Gunner A. E. TAGG, R.F.A., who was engaged at Stafford with Messrs. Siemens Bros., Ltd., has fallen in action.

Gunner E. J. HEDGECOCK, R.G.A., who has fallen in action, was engaged at the Dover Corporation electric light works.

Mr. REGINALD DODD, W.O., R.N.A.S., who has lost his life by drowning, served his articles at the Canterbury municipal electricity works under Mr. Blascheck, and later held an appointment with the Tramway Co. at Sheerness.

Second-Lieutenant R. B. GASKIN, Northumberland Fusiliers, who has fallen in action, was on the staff of Messrs. Aiton & Co., of Derby.

Sapper F. A. BUTTON, R.E., who has died from fever at Basra, was on the staff of the Brouley (Kent) Electric Light Co.

Captain R. H. UNTHOFF, R.E., who was before the war chief electrical engineer to Messrs. Pilkington Bros., Ltd., of St. Helens, has been wounded in action.

Private F. C. FOSKETT, employed by the Birmingham electric supply department, has been killed in action, aged 19.

Second-Lieutenant N. C. WHITTALL, R.F.C., a member of the staff of Messrs. Elliott Bros., Ltd., was killed in action on September 13th.

Private N. DENNIS, aged 21, an employé of the Halifax Corporation tramways, has been awarded the Military Medal for bravery. He was wounded on the day on which he earned his award.

Private A. CAMERON, employed in the electrical department of the Glasgow Corporation car works at Coplawhill, has been killed in action.

Obituary.—Mr. JOHN HESKETH.—We regret to learn from the Australian papers that are to hand this week, that Mr. John Hesketh, A.M.I.C.E., M.I.E.E., chief electrical engineer to the Commonwealth Postal Department, passed away in July, after an illness of several months, at the age of 49 years. As many of our readers will remember, Mr. Hesketh went out from this country in 1896 under engagement to the Queensland Government for the purpose of organising that State's telegraph and telephone service. Ten years later, says the *Australian Statesman*, the postal, telegraph, and telephone services of the various States having in the meantime been taken over by the Commonwealth Government under the federation scheme, Mr. Hesketh was appointed chief electrical engineer to the Commonwealth, and it is due to him that the telephone and telegraph systems have been remodelled. "Amongst other changes brought about by him, he was responsible for the introduction of the common battery system in telephone working and the adoption of the toll system of subscription. His official and professional career was marked by enthusiasm for his work and readiness to assist young men who showed themselves capable of a similar attachment to it, and a desire to rise in their profession by merit, and not to rely upon promotion by right or seniority. His loss will be very great to the department." He was the local hon. secretary and treasurer of the I.E.E. Several years ago Mr. Hesketh was sent by his Government to America on a tour of investigation, and it was as a result of that visit that the change over to common battery working was made. He held a commission in the Australian Engineers, and since the outbreak of war he had acted in an advisory capacity to the Defence Department on telegraphic and telephonic questions. Of the two sons of the deceased gentleman, one left Australia several months ago for work on munitions in England.

Mr. E. H. JOHNSON.—We read in an American contemporary that Mr. Edward H. Johnson, aged 72 years, a former telegraphist, and for many years associated with Mr. Thomas A. Edison in the introduction of the latter's early inventions, recently died in New York. Mr. Johnson was instrumental in introducing automatic telegraphy, and was at one time president of the Magnetic Club. He was one of the most prominent figures in electrical circles from 1875 to 1900, since which time his health had failed him.

Will.—The late Sir GEORGE WHITE left £185,000 gross, and £137,000 net personality.

NEW COMPANIES REGISTERED.

J. B. & J. Atherton, Ltd. (148,540).—Private company. Registered September 26th. Capital, £1,000 in £1 shares. Manufacturers, merchants, importers and exporters of, and contractors for, fuel oil, ammonia, cresote salts, fuel of all kinds, and for all kinds of motive power, coal, coke, breeze, and peat merchants, manure and chemical manufacturers, mechanical and electrical engineers, &c. The subscribers (each with one share) are:—J. B. Atherton, 12, Sandringham Drive, Liverpool, merchant; J. Atherton, Hurst House, Huyton, near Liverpool, merchant. The first directors are:—J. B. Atherton and J. Atherton. Solicitor: F. F. Gaskell, 71, Lord Street, Liverpool.

T. B. Watson & Son, Ltd. (148,546).—Private company. Registered September 26th. Capital, £6,000 in £1 shares. To take over the business of plumbers, electricians, and sanitaries and heating engineers carried on by T. B. Watson, at Stockton-on-Tees and Middlesbrough, as T. B. Watson and Son. The subscribers (each with one share) are:—T. B. Watson, 13,

West End Terrace, Stockton-on-Tees, electrical engineer and plumber; H. C. Watson, New Clyde Terrace, Stockton-on-Tees, electrical engineer and plumber. The first directors are:—T. B. Watson and H. C. Watson. Solicitors: Townsend & Bertrand Watson, Stockton-on-Tees.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

British Miniature Electric Vehicles, Ltd.—Issue on September 14th, 1917, of £1,000 debentures, part of a series of which particulars have already been filed.

Foster Construction Co., Ltd.—Issue on September 24th, 1917, of £600 debentures, part of a series of which particulars have already been filed.

Burt, Escaré & Denelle, Ltd.—Satisfaction to the extent of £1,500 between January 1st and August 18th, 1917, of debentures dated December 31st, 1915, securing £7,500.

CITY NOTES.

Manaos Tramways & Light Co., Ltd.—The report for the year ended April 30th last states that the economic conditions in the Amazon valley did not compare unfavourably with those which obtained during the preceding year, and the result indicates, says the *Financial Times*, a gradual return to prosperity in this district. Brazilian exchange improved slightly in the course of the year. The loss on remittances from Manaos was £12,231, against £13,093. The gross earnings from all departments exceeded those of last year, being £120,387, as compared with £110,524, while the operating expenses increased from £76,172 to £82,511. The net operating revenue carried to profit and loss account increased from £34,352 to £37,876. After providing for debenture interest, sinking fund, interest on loan, London office expenses, sundry charges, and loss in exchange, there remains a balance of £6,628. The directors recommend transferring to contingencies reserve £3,000, making a total of £26,725, to transfer to renewals reserve £3,000, making £30,000, and to carry forward £628.

Automatic Telephones (Australasia), Ltd.—The report for the year ended June 30th shows that the company is prosperous. The credit balance is £6,416, out of which a dividend of 10 per cent. will absorb £6,250, but it was proposed only to pay 1s. per share in August, and another 1s. in six months, or as the directors may determine. The reason for this is that, since the year closed, orders for 7,300 new lines have been accepted, which will tax the financial resources of the company in times like these. The orders are for Sydney, Melbourne, and Christchurch, N.Z. The company have 25,000 lines in operation in Australia, and 1,500 in New Zealand at the present time.

Halifax & Bermudas Cable Co., Ltd.—The net balance for the year ended June 30th, 1917, is £19,650, as against £12,745 in the preceding year. The interim dividend of 3 per cent. is followed by a further equal payment, both free of income-tax, leaving £16,650 to carry forward. The balance to credit of revenue account, which was £9,210, has been debited with £1,500 applied to dividend and £2,202 expended in repairs, and credited with £16,650 surplus revenue of the year, and it now stands at £22,158, subject to excess profits duty. The cable worked efficiently during the year. Mr. H. F. Russell has been elected a director in place of the late Mr. W. M. Kent.

Marconi International Marine Communication Co., Ltd.—The directors announce that allotment letters in respect of the issue of 250,000 new shares have been posted. The issue having been largely over-applied for, applicants receive an allotment equal to five-sixths of their holding, applications for less than that proportion being allotted in full.

British Electric Transformer Co., Ltd.—Interim dividend of 6 per cent. per annum (7 1/5d. per share), less income-tax, on ordinary shares for half-year.—*Financial Times*.

Stock Exchange Notice.—Application has been made to the Committee to allow the following to be quoted in the Official List:—

Melbourne Electric Supply Co., Ltd.—Further issue of £150,000 5 per cent. consolidated debenture stock.

Kalgoorlie Electric Power & Lighting Corporation, Ltd.—Dividend on the preference shares at the rate of 4 per cent. per annum for the six months ending September 30th.

Shawinigan Water & Power Co.—Dividend of 1 1/2 per cent. for the quarter ended September 30th on the common shares.

Switzerland.—Messrs. Brown, Boveri & Co., of Baden, have lately increased their capital from £1,250,000 to £1,440,000.

Callender's Cable & Construction Co., Ltd.—Interim dividend at the rate of 10 per cent. per annum on the ordinary shares for the half-year, the same rate as a year ago.

Fraser & Chalmers, Ltd.—The directors, with Treasury sanction, have been inviting applications for £100,000 6 per cent. first mortgage debentures of £100 each at 93 1/2.

Montreal Tramways Co.—For the year ended June 30th last, while the gross passenger earnings show the satisfactory increase of 14.45 per cent. over last year, operating expenses increased by 24.14 per cent. The total expenditure on upkeep was \$1,359,931, against \$897,470 last year. After deducting bond and loan interest \$858,542, interest on debenture stock \$800,000, contingent account \$350,000, and estimated war tax \$110,000, there is a surplus balance of \$77,473.

Direct West India Cable Co., Ltd.—For the year ended June 30th, 1917, the net result is a balance of £27,374, against £11,705 for the previous year. The interim dividend of 3 per cent. is followed by a further equal payment, both free of income-tax; leaving £21,674 to carry forward. The balance to credit of revenue account, which was £54,719, has been debited with £1,350 applied to dividend and £6,394 expended on repairs, and credited with £21,674 surplus revenue, and it now stands at £71,680, subject to excess profits duty. The cables worked efficiently during the year, but the insulation of the Bermudas-Turks Island section remains low. Mr. H. P. Russell has been elected a director in place of the late Mr. W. M. Kent.

Companies to be Struck Off the Register.—The following are to be struck off the register within three months unless cause is shown to the contrary:—

Clearstone Antiseptic Telephone Drum, Ltd.
Electrolysers, Ltd.
Electromechan Co., Ltd.
Grip Nuts, Ltd.
Metallic Alloys, Ltd.
Tyrone Power Co., Ltd.
Universal Electric Contracts, Ltd.
Volta Instrument Co., Ltd.

STOCKS AND SHARES.

TUESDAY EVENING.

Most of the business this week has been in the air. Stock Exchange markets have been interfered with, mainly through the interruption caused to the postal services. This has extended to telegraphs as well as to letters; and, in addition to this, perhaps there was not quite so much desire to scout for business as there is in the ordinary way. When energies are directed mainly towards getting everything cleared up as soon as possible by the early hours of the evening, it is natural that business should go slowly.

The appearance of the new War Loan is another factor making for quietude amongst investment stocks. So far, the public have hardly become familiarised with the terms of the new issue, although no doubt its attractions will be more prominently set forth soon. The Stock Exchange is no whit disturbed; Consols even improved a little on the appearance of the prospectus. Great interest is shown, of course, as to the success which the loan is likely to achieve.

Want of trade in the Home Railway market is the principal feature there. The sudden rise in popularity of the Tubes and Undergrounds has not sufficed to stiffen prices. Metropolitans are $\frac{1}{2}$ lower at 23 $\frac{1}{2}$. Districts and the Underground group hold their previous levels; and the rise in the Central London trio of assented stocks is well maintained.

During the last day or two something of a feature amongst industrials has been the weakness of Canadian securities. This has affected more particularly those of Canadian railway companies, but others are sympathetically influenced, the reason being that, in spite of the apparent prosperity attendant upon most of the undertakings, working expenses show a still more remarkable development, and increase instead of diminish. The railway companies are clamouring for power to raise their freight rates; and the industrial concerns will no doubt take steps to meet in other ways the constant rise in the costs of production. But for the time being Canadians are out of favour, and prices are depressed.

Home shares are more popular. There are no changes to record this week amongst the issues of the home electricity companies, but, on the other hand, there are very few shares to be obtained, and there is nothing which makes more greatly for market stagnation than scarcity of supply. It will be noticed from our lists that at the present quotations a return of 6 $\frac{1}{2}$ -7 per cent. can be obtained from such shares as Bromptons, Charing Cross preference, Chelseas, and South Metropolitan preference; but when a would-be buyer comes to inquire for shares, he is met so often with the reply that there are none on offer that he gives up the quest and puts his money into something else.

Amongst the foreign issues, Mexicans continue to mark time, although there is a good deal of hesitation displayed in regard to most of the stocks in this market, including those of the utility companies. News and rumour alike seem lacking. The inventive genius of the journalists who specialise in Mexican matters lies fallow; and, in the absence of any

kind of stimulus, the market has relapsed into a state of torpor.

Brazils are moving closely along the path set by the course of exchange, and this just lately has been a little erratic. Consequently, Brazil Tractions remain weak at 46. British Columbia preference has fallen 2 to 40 $\frac{1}{2}$; and although there is not much doing in the market, we are able to state that active measures are being taken by those who have in hand the protest against the apparent intention of the Municipality of Vancouver to enter into competition with the British Columbia Electric Railway.

The cable market is steady, with Globe ordinary and preference quoted ex dividend. Both shares have recovered part of the amount taken off the price. Anglo-American preferred is within a point of par; but West India and Panamas reacted to 13. Oriental Telephones are 1/16 better, and Great Northern Telegraphs rose $\frac{1}{4}$. The activity in Marconis is continued, and the parent shares have improved another 1/16 to 3 $\frac{1}{2}$, while Americans are strong at 20s. 3d. Canadians, however, loiter around 10s. 6d.

The manufacturing list is quietly good. Babcocks rose to 35/16. British Aluminium ordinary have recovered to 32s. 6d. ex dividend. British Insulated at 14 $\frac{1}{2}$ are the same price ex as they were cum; and British Westinghouse preference hardened to 3 $\frac{1}{2}$, following upon their rise of 5/16 last week. General Electrics are again 10s. to the good at 17 $\frac{1}{2}$, and the only decline in the list is a fall of 10s. in Henleys, due to a couple of hundred shares coming in on account of a deceased holder. Rubber shares are reasonably steady, notwithstanding a decline in the price of the raw material; and there is a fair amount of strength shown by shares in the armament group.

SHARE LIST OF ELECTRICAL COMPANIES.

		Dividend		Price	Rise or fall this week.	Yield p.o.
		1915.	1916.	Oct. 2, 1917.		
Brompton Ordinary	.. ..	10	9	6 $\frac{1}{2}$	—	26 18 6
Charing Cross Ordinary	.. ..	5	5	8 $\frac{1}{2}$	—	6 9 0
do. do. 4 $\frac{1}{2}$ Pref.	.. ..	4 $\frac{1}{2}$	4 $\frac{1}{2}$	8 $\frac{1}{2}$	—	6 18 4
Chelsea	.. ..	4	8	2 $\frac{1}{2}$	—	6 9 1
City of London	.. ..	8	8	12 $\frac{1}{2}$	—	6 4 3
do. do. 6 per cent. Pref.	.. ..	6	6	10 $\frac{1}{2}$	—	6 18 5
County of London	.. ..	7	7	11 $\frac{1}{2}$	—	6 6 10
do. do. 6 per cent. Pref.	.. ..	6	6	10	—	6 0 0
Kensington Ordinary	.. ..	7	6	5 $\frac{1}{2}$	—	6 14 8
London Electric	.. ..	8	8	8 $\frac{1}{2}$	—	5 6 8
do. do. 6 per cent. Pref.	.. ..	5	4	8 $\frac{1}{2}$	—	4 12 4
Metropolitan	.. ..	8	8	8 $\frac{1}{2}$	—	7 4 0
do. 4 $\frac{1}{2}$ per cent. Pref.	.. ..	4 $\frac{1}{2}$	4 $\frac{1}{2}$	7 $\frac{1}{2}$	—	5 14 6
St. James' and Pall Mall	.. ..	8	8	7	—	7 5 6
South London	.. ..	6	5	2 $\frac{1}{2}$	—	6 10 8
South Metropolitan Pref.	.. ..	7	7	21/6	—	6 5 8
Westminster Ordinary	.. ..	7	7	6 $\frac{1}{2}$	—	6 5 8
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	.. ..	8	8	99	+ $\frac{1}{2}$	6 1 0
do. Def.	.. ..	83/8	1 $\frac{1}{2}$	2 $\frac{1}{2}$	—	8 10 5
Chile Telephone	.. ..	8	8	7 $\frac{1}{2}$	—	6 11 4
Cuba Sub. Ord.	.. ..	6	6	8 $\frac{1}{2}$	—	6 8 4
Eastern Extension	.. ..	8	8	14 $\frac{1}{2}$	—	6 7 9
Eastern Tel. Ord.	.. ..	8	8	148 $\frac{1}{2}$	—	6 7 9
Globe Tel. and T. Ord.	.. ..	7	7	13 x d	+2/-	6 7 8
do. Pref.	.. ..	6	6	10 $\frac{1}{2}$ x d	+2/-	6 15 8
Great Northern Tel.	.. ..	22	24	58	—	6 6 4
Indo-European	.. ..	15	13	64 $\frac{1}{2}$	—	6 18 8
Marconi	.. ..	10	15	3 $\frac{1}{2}$	+ $\frac{1}{4}$	4 9 0
Oriental Telephone Ord.	.. ..	10	10	8 $\frac{1}{2}$	+ $\frac{1}{4}$	8 0 6
United R. Plate Tel.	.. ..	8	8	6 $\frac{1}{2}$	—	6 16 4
West India and Pan.	.. ..	8d.	6d.	1 $\frac{1}{2}$	—	9 11 0
Western Telegraph	.. ..	8	8	14 $\frac{1}{2}$	—	6 10 4
HOME RAILS.						
Central London, Ord. Assented	.. ..	4	4	60 $\frac{1}{2}$	—	6 12 8
Metropolitan	.. ..	1	1	23 $\frac{1}{2}$	—	4 5 1
do. District	.. ..	Nil	Nil	16 $\frac{1}{2}$	—	Nil
Underground Electric Ordinary	.. ..	Nil	Nil	1 $\frac{1}{2}$	—	Nil
do. do. "A"	.. ..	Nil	Nil	6 $\frac{1}{2}$	—	Nil
do. do. Income	.. ..	6	4	82 $\frac{1}{2}$	—	4 17 0
FOREIGN TRAMS, &c.						
		Dividend				
		1915.	1916.			
Adelaide Sup. 8 per cent. Pref.	.. ..	6	8	4 $\frac{1}{2}$	—	6 3 1
Anglo-Arg. Trams, First Pref.	.. ..	5 $\frac{1}{2}$	5 $\frac{1}{2}$	8 $\frac{1}{2}$	+ $\frac{1}{4}$	8 14 0
do. 2nd Pref.	.. ..	5 $\frac{1}{2}$	—	6 $\frac{1}{2}$	—	7 8 9
do. 5 Deb.	.. ..	4	4	46	—	8 4 8
Brazil Tractions	.. ..	6	6	9 $\frac{1}{2}$	—	12 4 10
Bombay Electric Pref.	.. ..	5	5	40 $\frac{1}{2}$	—2	Nil
British Columbia Elec. Rly. Pice.	.. ..	Nil	Nil	30	—	8 10 0
do. do. Preferred	.. ..	Nil	Nil	27 $\frac{1}{2}$	—	Nil
do. do. Deferred	.. ..	Nil	Nil	4 $\frac{1}{2}$	—	Nil
do. do. Deb.	.. ..	4 $\frac{1}{2}$	4 $\frac{1}{2}$	50	—	Nil
Mexico Trams 5 per cent. Bonds	.. ..	Nil	Nil	44 $\frac{1}{2}$	—	Nil
do. 6 per cent. Bonds	.. ..	Nil	Nil	40	—	Nil
Mexican Light Common	.. ..	Nil	Nil	52 $\frac{1}{2}$	—	Nil
do. Pref.	.. ..	Nil	Nil	31 $\frac{1}{2}$	+ $\frac{1}{2}$	Nil
do. 1st Bonds	.. ..	Nil	Nil	46 $\frac{1}{2}$	—	—
MANUFACTURING COMPANIES.						
Babcock & Wilcox	.. ..	16	16	9 $\frac{1}{2}$	+ $\frac{1}{4}$	4 11 0
British Aluminium Ord.	.. ..	7	10	13 x d	+ $\frac{1}{2}$	6 3 1
British Insulated Ord.	.. ..	17 $\frac{1}{2}$	20	14 $\frac{1}{2}$ x d	+ $\frac{1}{2}$	7 0 4
British Westinghouse Pref.	.. ..	7 $\frac{1}{2}$	7 $\frac{1}{2}$	3 $\frac{1}{2}$	+ $\frac{1}{4}$	4 15 10
Callenders	.. ..	20	20	14 $\frac{1}{2}$	—	6 18 0
do. 5 Pref.	.. ..	5	5	4 $\frac{1}{2}$	—	6 1 8
Castner-Kellner	.. ..	22	22	8 $\frac{1}{2}$	—	6 8 0
Edison Swan, fully paid	.. ..	—	—	1 $\frac{1}{2}$	—	Nil
do. do. 4 per cent. Deb.	.. ..	4	4	72 $\frac{1}{2}$	—	6 10 4
Electric Construction	.. ..	7 $\frac{1}{2}$	7 $\frac{1}{2}$	1	—	7 10 0
Gen. Elec. Pref.	.. ..	8	8	10 $\frac{1}{2}$	+ $\frac{1}{2}$	5 15 8
do. Ord.	.. ..	10	10	17 $\frac{1}{2}$	—	6 14 8
Henley	.. ..	25	25	15 $\frac{1}{2}$	—	7 16 8
do. 4 $\frac{1}{2}$ Pref.	.. ..	4 $\frac{1}{2}$	4 $\frac{1}{2}$	4	—	6 12 6
India-Rubber	.. ..	10	10	13 $\frac{1}{2}$	—	6 5 6
Telegraph Con.	.. ..	20	20	89	—	6 8 1

* Dividends paid free of income-tax.

THE HIGH-TENSION MAGNETO.*

(Continued from page 311.)

AEROPLANE-TYPE MAGNETOS.

THE greater number of the magnetos built in this country since the outbreak of war have been used on aeroplanes. This means that the British magneto industry, from the moment of its inception, had to contend with the most difficult problem of all, because an aeroplane magneto has to operate under more severe and exacting conditions than obtain on any form of motor vehicle.

The mantle of responsibility was borne during the early stages of the war by the firm of Thomson Bennett, in Birmingham (who, to their credit, were struggling to create a magneto industry before the war); the B.T.H. Co., in Coventry; and the M.L. Magneto Syndicate, in Coventry. More recently many newcomers have joined the industry, with the result that at the present moment there are no fewer than 15 manufacturers engaged on this most important work.

Special credit is due to the three manufacturers named above, and in particular to Mr. E. A. Watson, technical director of the M.L. Mag-

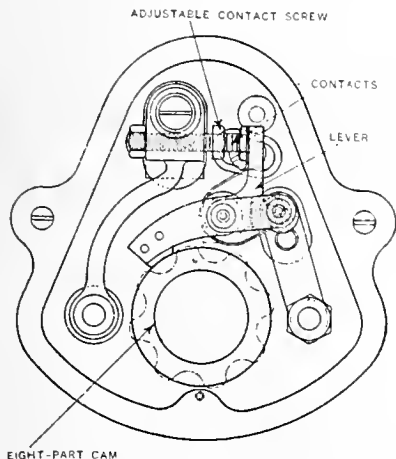


FIG. 4.—CONTACT-BREAKER OF B.T.H. A 8 S MAGNETO.

neto Syndicate, and Mr. J. D. Morgan, of the Marks and Clark laboratory and consulting engineer to the firm of Thomson Bennett.

As evidence of what has already been done, the author briefly describes in his paper some of the aeroplane-type magnetos that

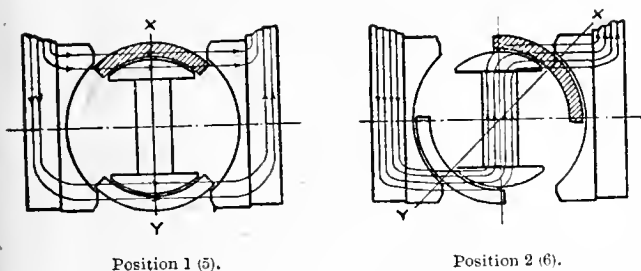


FIG. 5.—FLUX CHANGES IN B.T.H. TYPE A 8 S MAGNETO.

are now being produced in very large quantities by the three manufacturers mentioned.

The M.L. Magneto Syndicate type A.D.S. magneto, which is of the rotating-armature single-cylinder type intended for use on

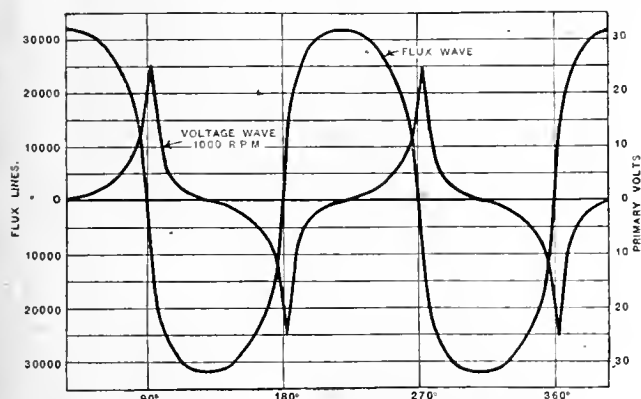


FIG. 6.—FLUX AND VOLTAGE WAVES, A 8 S MAGNETOS.

rotary engines of the Gnome, Mono-soupape, Clerget, or similar types, is based on the original Bosch D.A.L. design, but has been

* Abstract of paper read by Mr. A. P. YOUNG, A.M.I.E.E., before the AERONAUTICAL SOCIETY.

improved in many respects. The chief modifications which have been found necessary have been in connection with the contact breaker and the cams, as these machines have to run at a very high speed, from 2,500 to 3,500 R.P.M. Consequently, the whole Bosch design of flat cam, which gave rapid acceleration of the contact-breaker arm, has been given up, and the cams now fitted are made to a correctly-shaped profile, which is ground out on machines specially designed and constructed for the purpose.

In addition, it has been found necessary to increase the length of opening the primary circuit, in order to give time for the spark to die out when the machine is working at a high speed. This alteration has completely removed a trouble experienced with the D.A.L. type, of mistiring if the engine were inclined to be oily.

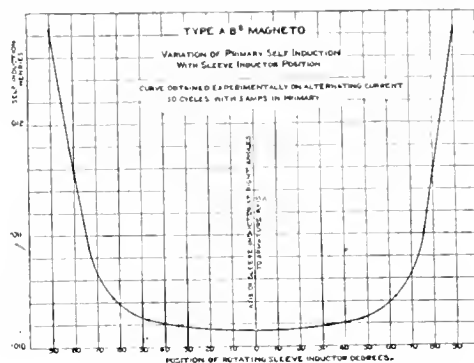


FIG. 7.

and has removed the necessity, previously apparent, for very close and careful setting of the plug points. It has also increased the life of the contact-breaker arm and the platinum points, and has made the machine suitable for use at much higher speeds. The cam is made from a continuous ring of steel, very carefully ground inside and out in order to ensure absolute concentricity.

The Thomson-Bennett type A.D.4 magneto is a four-cylinder machine of the rotating armature type, corresponding in size to the Bosch type Z.U.1 magneto used extensively in this country during the years preceding the outbreak of war. The Bosch design has been simplified, chiefly in respect of the construction of the bearing for the half-speed wheel, but many of the other features have been retained.

The B.T.H. eight-cylinder type A 8 S magneto is of the sleeve inductor type with fixed armature. It is designed to give four sparks per revolution, and is therefore fundamentally different from the ordinary rotating-armature type of magneto, which cannot give more than two sparks per revolution. The sleeve inductor rotates at engine speed. A six-cylinder machine (type A 6 S) is

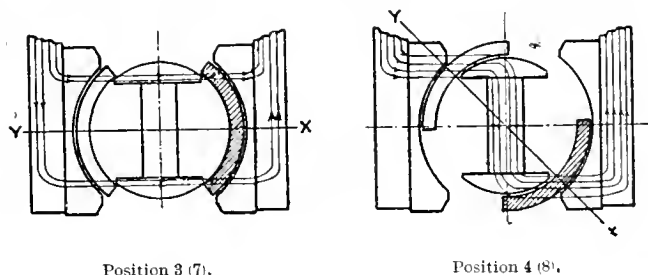
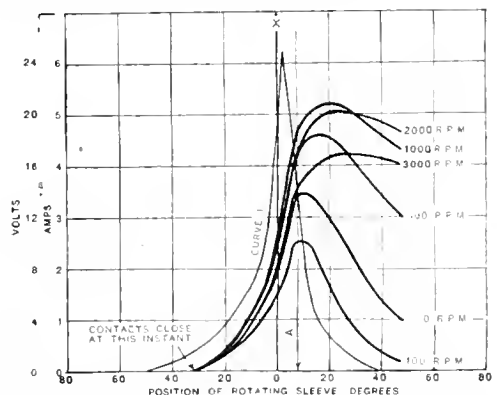


FIG. 8.—PRIMARY CURRENT CURVES.

also built on the same principle, designed to run at three-quarter engine speed, but this differs from the eight-cylinder machine only in respect of the distributor and gearing.

The contact-breaker is shown in detail in fig. 4. A pivoted



Curve 1, Open-Circuit Primary Voltage Curve for 1,000 R.P.M. OX represents Axis of Fixed Armature position of Break. A, for full advance.

steel bell-crank lever arm carries at one end a fibre block which is actuated by the rotating eight-part hardened steel cam rigidly fixed to the distributor brush spindle, while at its other end the

movable platinum contact screw is secured. A very strong steel spring fixed at one end to the contact lever arm, and at the other end to the base plate, serves to force the movable contact tightly against the adjustable fixed contact when the cam is not in engagement with the fibre heel.

It is clear that the contacts are opened eight times during each revolution of the cam shaft, which rotates at half the speed of the sleeve inductor, thus giving four breaks per revolution of the latter—as desired.

It is evident from the illustrations in the paper that the manufacture of such a magneto on a large scale must have been attended with considerable difficulties, because there are no fewer than 397 parts of different design, and a total of 860 parts are actually used in the construction of one machine. Bearing all this in mind, it is

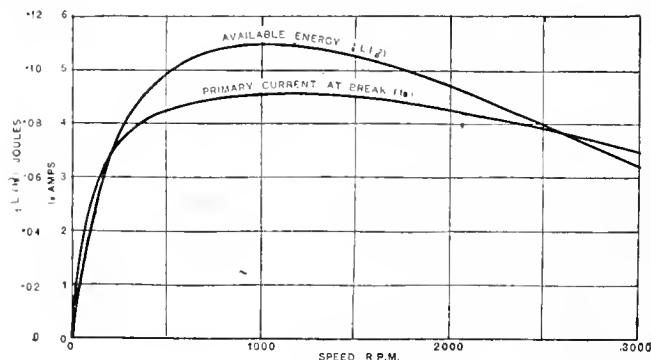


FIG. 9.

very gratifying to know that magnetos of this type are being produced in very large quantities under the guidance of Mr. R. Dumas.

Fig. 5 gives diagrams corresponding to different sleeve positions 45° apart, and on each diagram, the approximate flux distribution between the magnet poles is shown. Considering positions 1 and 3 (equivalent also to 5 and 7), it will be noted that in each case the flux through the armature core is zero. Furthermore, for the intermediate forms 2 and 4 (also 6 and 8), the direction of the flux through the core is alternately positive and negative; that is, in position 2 the flux flows upwards, and in position 4 downwards. In other words, the flux through the armature core reverses its direction four times during each revolution of the sleeve, giving four sparks per revolution. A magneto of this type is sometimes

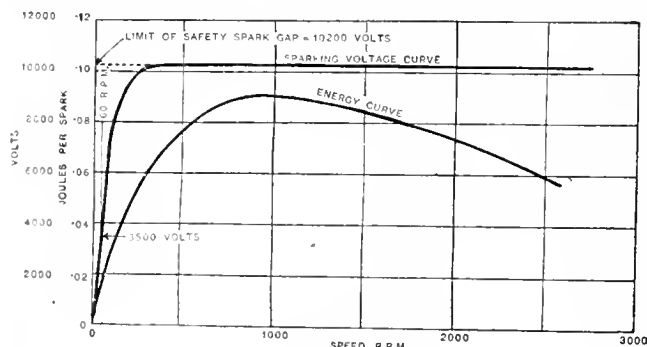


FIG. 10.

called a two-cycle machine. The flux wave, plotted in fig. 6, crosses the zero line at four points 90° apart, which correspond to the sleeve positions 1, 3, 5 and 7.

The maximum value reached by the flux wave is approximately 32,000 lines. This is the actual flux which links itself with the primary and secondary windings carried by the fixed armature core. Assuming a leakage coefficient of 1.4, the magnet flux works out at 45,000 lines.

The flux density in the magnets = 5,900 lines per sq. cm., and in the armature core 8,500 lines.

These figures are very high for an inductor type of magneto, although they are lower than the figures worked to in a magneto with rotating armature. The difference is accounted for by the fact that in the type "A" magneto—as in all inductor-type machines—there are four air-gaps in that portion of the magnetic circuit lying between the pole faces, as compared with only two gaps in the two-spark rotating-armature type of magneto. The increased reluctance due to the larger number of air-gaps naturally means that the available flux is smaller, using magnets of corresponding size and strength.

Having determined the flux wave, it is easy to compute the induced voltage wave resulting from the rotation of the sleeve, assuming that the contact-breaker is inoperative and the primary short-circuited; or the flux wave can be calculated from the voltage wave, as in fig. 6, in which the voltage wave is reproduced from an oscillogram at 1,000 R.P.M.

In the secondary coil a voltage is induced by the rotation of the sleeve, which conforms in shape to the primary voltage wave, but the maximum voltage is higher in the ratio of the windings, which

in this magneto is very high, the maximum secondary voltage being about 3,000 volts at very high speeds. The maximum value is reached just after the sleeve has passed position 1, fig. 5, which the author calls the "dead centre," the phase displacement being 3° .

The author has plotted the primary current curves for six speeds, ranging between 100 and 3,000 R.P.M., on the basis of the open-circuit primary voltage, fig. 6, and the primary self-induction curve, fig. 7.

These curves, fig. 8, show that the maximum value of the primary current increases with the speed, very rapidly at low speeds, but hardly at all when the speed is high. In fact, at abnormally high speeds the maximum value will actually fall off, owing to the damping caused by the eddy currents induced in the

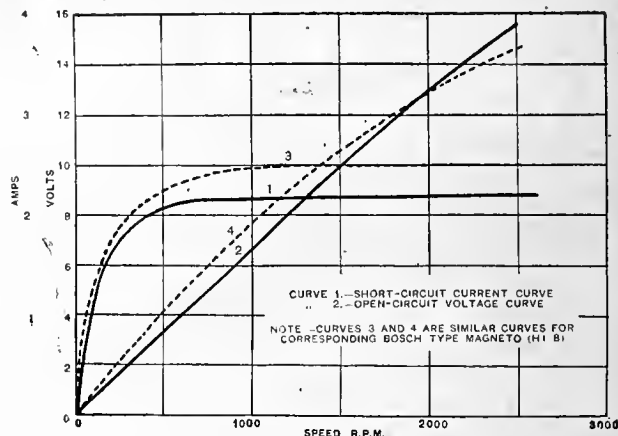


FIG. 11.

rotating iron segments, which have the effect of preventing the flux in the stationary armature core rising to its proper maximum value after each reversal. It is important to note also that the maximum point on the current curve is, as it were, displaced forward in the direction of motion as the speed is increased.

The difference between the curves corresponding to the fully advanced position of the timing lever (fig. 8), and to the fully retarded position respectively at any particular speed is very small. For full advance the position of the rotating sleeve at "break" is shown on fig. 8 by the dotted line A, and by determining where this line intersects the six curves, the maximum current I_b for each speed can be found. For the fully retarded position of the timing lever, the contacts close at 17° instead of 32° , and the "break" is at

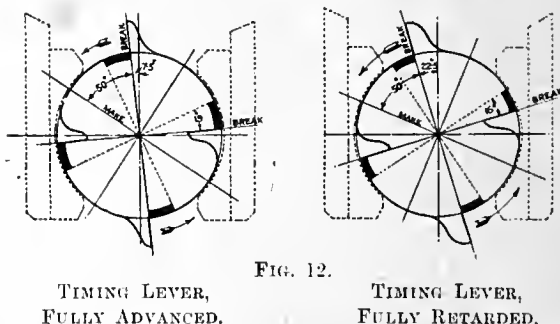


FIG. 12.

TIMING LEVER,
FULLY ADVANCED.TIMING LEVER,
FULLY RETARDED.

$22\frac{1}{2}^\circ$ instead of $7\frac{1}{2}^\circ$. The maximum voltage is proportional to I_b , and by plotting the latter against the speed, a curve representing the variation of voltage with speed is obtained (fig. 9); the upper curve represents the variation in the maximum available energy with the speed ($\frac{1}{2} L I_b^2$).

Maximum sparking voltage and spark energy curves obtained by experiment are plotted in fig. 10.

Experiment has shown that under normal working conditions a new sparking plug requires about 3,500 volts to cause a spark to jump between the electrodes when the piston is in the firing position and the compression is about 80 lb. per sq. in. It is therefore interesting to note that this voltage is given by the magneto at the very low speed of 60 R.P.M., the point being indicated on the curve. The normal running speed is 1,800 R.P.M. The energy output per spark was determined by a calorimetric method, and was about 80 per cent. of the calculated value (fig. 9), the remainder being dissipated in the iron masses in the magnetic circuit and in the windings. Oscillograms reproduced in the paper show that the actual value of I_b agrees substantially with the calculated value in every case.

On determining the value of the armature core flux, it is found to diminish gradually as the speed is increased, due to eddy currents set up in the masses of iron, which cause the energy curve to drop at about 1,000 R.P.M.; this effect can be reduced more readily in the polar inductor type of magneto by careful attention to the design. The rotating-armature type of magneto standardised by Bosch is a very bad offender from this standpoint; in one of the Bosch Co.'s latest magnetos, at 1,000 R.P.M., the flux fell off 23 per cent.

In fig. 11, curve 2 shows the relationship between the R.M.S. value of the open-circuit primary voltage, and curve 1 the short-circuit

primary current, with the speed. The shape of the voltage curve, which would otherwise be a straight line, shows that the armature core flux falls off as the speed increases. The dotted curves 3 and 4 relate to a Bosch magneto of corresponding type. A very good idea of the probable operation characteristics of a magneto can be gathered from the value of the open-circuit primary voltage at a definite speed; the B.T.H. Co. measure the voltage of every magneto at 2,000 R.P.M. immediately after magnetising, with and without the secondary short-circuited, and the values must not fall below a fixed

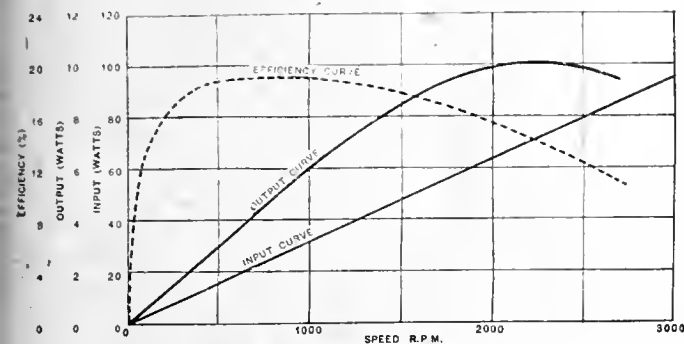


FIG. 13.

minimum in the latter case, or drop more than a certain percentage in the former. A large percentage drop indicates that the magnets have low coercive force.

Fig. 12 shows some oscillograms which have been plotted in the form of circle diagrams, the duration of the H.T. spark being indicated; the diagram enables one to form a mental picture of the growth of the currents induced in the primary and secondary during one revolution of the sleeve inductor.

Fig. 13 gives curves showing the variation of driving power, and output, in watts, and the efficiency, with the speed.

(To be continued.)

REVIEWS.

Advanced Text-book of Magnetism and Electricity. By R. W. HUTCHINSON, M.Sc., A.M.I.E.E. London: University Tutorial Press. In two volumes. Price 8s. 6d. complete.

The issue of a comprehensive advanced manual of magnetism and electricity from the pen of the joint author of Davidge & Hutchinson's "Technical Electricity" is an event of some interest to the student of physics. It is, perhaps, unfortunate that the publication should occur when the number of such students is so seriously depleted by the claims of war-work at home and abroad. The fact that Mr. Hutchinson's book is to be regarded as a kind of lineal successor to Dr. Wallace Stewart's "Higher Text-book of Electricity and Magnetism" also raises our expectations with regard to it.

In his preface the author states that the aim of the book is to give "a clear and comprehensive account of the main principles of the subject based on accurate scientific definitions and embodying the distinctive results of modern research." Both the experimental and theoretical sides of the work have been fully treated, and great care has been taken to deal adequately with the many difficulties which, in the present state of our knowledge, must necessarily arise in connection with the theoretical explanations of the various phenomena. The scope of the book is that of the final degree examinations of the universities, and consequently a knowledge of the subsidiary mathematics up to and including the notation and first principles of the calculus has been assumed throughout. Although intended for advanced students some of the elementary sections are treated at length, and there is no doubt that, as the author anticipates, the student who feels that he already has a sound knowledge of these fundamental principles will appreciate a revision on scientific lines.

The first volume deals with magnetism and electrostatics. Some of the earlier sections in both of these subjects are reminiscent of Stewart's "Higher Text-book," but even these elementary and fundamental matters have been brought thoroughly up to date and reference has been made to recent research.

The first two chapters in both subjects are entitled "Fundamental Phenomena" and "Fundamental Theory." The former gives an introductory survey of the whole subject

from an experimental point of view, and the latter deals with the mathematical basis on which subsequent chapters depend. There is very little that we have been accustomed to regard as inseparably connected with Sir J. J. Thomson's "Mathematical Theory" that Mr. Hutchinson has not covered, and in many cases he has extended the usual mathematical investigations to special cases, and given proofs and definitions which will be appreciated by students for their neatness and brevity. A few notable examples of this perspicuity of diction combined with scientific accuracy of definition may be mentioned. Section 88, on field strength, unit field, tubes of force, and induction, deals with the intricacies of Maxwell tubes, tubes of induction, and Faraday tubes in a very masterly manner; forces between small magnets and magnetic shells are also well done, and the development of the idea of potential in both magnetism and electrostatics leaves nothing to be desired.

Chapter III, on magnetism, deals with magnetic measurements. All the usual magnetometric methods are given, but it is remarkable that the measurement of magnetic fields by search coils, bismuth coils, and the methods due to Du Bois and Lippman are not even mentioned, the only methods of measuring field strengths given being those of the deflection and oscillation magnetometers.

The remaining chapter on magnetism, that on terrestrial magnetism, is a very complete treatment of the subject. The dip circle is usually dealt with at length in such manuals, but it is seldom that the Kew magnetometer receives a fair share of attention. Here, however, the methods of determining all the magnetic elements are very carefully described and illustrated, and some account is also given of magnetographs and the question of variations in these elements. An interesting paragraph outlines the various theories of terrestrial magnetism and the present-day attitude towards them.

In addition to the chapters already indicated, the electrostatics section includes important chapters on condensers and capacity, instruments (from the historic Coulomb balance to the most recent forms of electrometer), measurements (including the important experiments of Silow, Aron and Cohn, and Boltzman and Hopkinson on specific inductive capacity), and atmospheric electricity.

The second volume deals with electro-dynamics. The earlier chapters on cells and the properties of currents are thorough expositions written along the usual lines. The author is particularly clear and exact in his statements concerning units—a subject in which a little knowledge is a very dangerous thing—and he deals very fully with the more recent theories and experiments concerning the chemical effects of the current, even concentration cells and the Lippman electrometer receiving a fair share of attention. The chapter on thermo-electricity is one of the best in the book and incidentally reveals by its methods and nomenclature the author's *alma mater*!

A separate chapter is devoted to electrical measurements, and a further chapter to the measurement of inductance. The concluding paragraph of the latter is worth quoting, because it tells us at once that Dr. Hutchinson is *not* one of those teachers who forget that they were once students:—

"The student who works through the preceding tests will come to the conclusion either that he is a poor experimenter, or that the apparatus is wrong—probably the latter. Both conclusions may possibly be correct, but the methods are nevertheless troublesome and unsatisfactory at the best. Newer methods, depending on the employment of alternating currents, are being developed." He then mentions briefly the methods depending on Campbell's vibration galvanometer.

It is, of course, expected of such a text-book as this that it will not only deal with the principles and practice of magnetism and electricity as they were understood by our fathers, but that it will also give introductions to those great outlying tracts of knowledge which are now of such gigantic importance as to merit whole literatures of their own. Such are alternating currents, electrical oscillations and waves, the passage of electricity through gases, and radio-activity and the electronic theory.

It is to these subjects that Mr. Hutchinson devotes the last 180 pages of his second volume. He gives brief historical accounts of each subject, discusses the principles, and describes the chief experiments, and refers to the directions along which controversy and research are proceeding. The whole of this part of the book appears to us to be above criticism, and no student will regret the source of his first instruction in these matters if he reads from this book. The author would be the last to claim any finality for the views expressed in these chapters, and the student may be warned against dogmatism in approaching these borderlands of physical knowledge. Mr. Hutchinson has given a fair statement of the condition of electrical theory as it is to-day—to-morrow will have theories of its own.

Every chapter in the book has a series of exercises at the end, many of which are taken from university examination papers, including the honours papers. There is also an appendix of useful tables, and a brief bibliography. Both volumes have some striking features, and, what is of far greater importance, they lack no essential of a sound and useful text-book. The two parts are not sold separately, but the price charged for the complete work is extremely moderate.—P. H. S. K.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

FRANCE, ALGERIA, AND TUNIS.—The Ministerial Decree of April 13th restricting the importation into France and Algeria of goods from foreign countries has been modified by further Decrees, dated July 8th and 13th, the effect of which is to make it necessary for French importers to obtain a special licence from the "Comité des dérogations aux prohibitions d'entrée" of the Ministry of Commerce, for merchandise other than that specified (food products, manures, fuel, agricultural machinery, &c.) which was not actually shipped prior to July 9th.

Under a Presidential Decree of June 15th fees are now being charged for both import and export licences in France. For imports other than by parcel post and for imports by parcel post, consisting of 10 parcels or more, the fee is 5 francs per licence; for less than 10 parcels by parcel post, the fee is 50 centimes per parcel. Similarly, in the case of export licences the fees are 2 francs per licence and 20 centimes per parcel, respectively.

Fees at the same rates are being charged in Tunis as from July 1st.

TRANSIT OF GOODS THROUGH FRANCE TO SWITZERLAND, ITALY, AND SPAIN.—It has been officially announced that the transit arrangements for goods sent *via* France to Italy and Spain have now been made similar to those in force for goods going to Switzerland. Goods which are not prohibited to be exported from the United Kingdom to Italy and Spain, but which are prohibited to be exported from France to those destinations, can now be sent under the "pink certificate" S. 45 B, which will satisfy the French Customs authorities, and will ensure that the goods shall not be detained by them. The certificates are handed to the master of the ship conveying the goods to France, with a notice stating that they must be delivered to the Customs authority at the port of discharge, and that failure to do so may lead to the detention of the goods.

Applications for licences in respect of such consignments should be addressed to the War Trade Department, and special attention should be drawn to the fact that the goods figure on the French list of prohibited exports, and that it is proposed to ship the consignment to Italy or Spain *via* France, and not direct by sea. In the case of Spain, however, the arrangement will not apply to consignments of goods which exceed half a ton in weight.

A full statement of the regulations now in force respecting the transit through France of goods sent from the United Kingdom to Switzerland, Italy, and Spain, *via* France, is published in the official *Board of Trade Journal*. Firms interested should consult the *Journal*, or they can obtain full information from the Department of Commercial Intelligence, 73, Basinghall Street, E.C. 2.

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

- 13,282. "Sparking plugs." E. T. COTTINGHAM & F. W. A. SMITH. September 17th.
- 13,286. "Electric furnaces." H. EICHELLS, H. A. GREAVES, AND T. H. WATSON & CO. September 17th.
- 13,311. "Armatures for dynamo-electric machines." BRITISH WESTINGHOUSE ELECTRIC & MANUFACTURING CO. (Westinghouse Electric & Manufacturing Co., U.S.A.). September 17th.
- 13,318. "Electric ignition apparatus for internal-combustion engines." G. E. TURNBULL. September 17th.
- 13,328. "Electric furnaces and apparatus for regulating variations of current and distribution of heat in a furnace, and in refining steel, &c." E. C. R. MYRKS (Soc. Anon. Italiana G. Ansaldo & Co.). September 17th.
- 13,331. "Holders for electric incandescent lamps." C. WIRT. September 17th.
- 13,332. "Mechanism for limiting movement in electro-mechanical cranes, drawbridges, dam gates, &c." ALLMÄNNA SVENSKA ELEKTRISKA ARTIFERFABRIKEN AND F. H. LINDBLOM. September 17th.
- 13,344. "Means for securing shade covering to electric filament lamp." A. SCHROFIELD. September 18th.
- 13,353. "Magnetic seaplane torpedo." W. J. RHODES. September 18th.
- 13,358. "Electric tramway trolley wire finder and trolley wheel adjuster." D. A. HALPIN & R. LANCHESTER. September 18th.
- 13,369. "Sparking plugs for combustion or explosion motors." G. A. PARVARI. September 18th.
- 13,378. "Sparking plugs for internal-combustion engines." E. ALLEN, AUTOMATIC TELEPHONE MANUFACTURING CO., F. W. MAYES & A. C. SPENNER. September 18th.
- 13,386. "Distributors for high-tension ignition systems." G. S. HOLLAND. September 18th.
- 13,392. "Telephone systems." AUTOMATIC ELECTRIC CO., U.S.A. September 18th.
- 13,399. "Electrical and mechanical apparatus for direct-current motors." G. PARVARI. September 18th. (Italy, October 9th, 1916.)
- 13,406. "Manufacture of composite bimetallic articles." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). September 18th.
- 13,407. "Liquid rheostats." IBERIAN ELECTRIC CO. (Cutler-Hammer Manufacturing Co., U.S.A.). September 18th.
- 13,420. "Accumulator electrode grids." APEX ELECTRIC ACCUMULATOR SYSTEMS & S. WILKINSON. September 18th.
- 11,425. "Speed-controlled electrically-operated machines." H. H. JEFFCOTT. September 19th.
- 13,441. "Apparatus for electrolysis of water." K. KIMURA. September 19th.

- 13,451. "Sparking plugs, &c." T. CROSSBEE & SONS AND H. R. WILKS. September 19th.
- 13,462. "Electric arc carbons." W. THOMPSON. September 19th.
- 13,463. "Aerial illumination." W. THOMPSON. September 19th.
- 13,469. "Manufacturing electric incandescent lamps, &c." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). September 19th.
- 13,473. "Rectification of alternating currents of electricity." S. A. POLLOCK. September 19th.
- 13,474. "Electric water heaters." W. J. SIMS. September 19th.
- 13,475. "Electric thermostat." W. J. SIMS. September 19th.
- 13,476. "Electric changing switch." W. J. SIMS. September 19th.
- 13,520. "Electric flash lamps." C. R. HALL. September 20th.
- 13,527. "Armature without commutator for direct-current machines and single-phase motors." O. LICHTI. September 20th.
- 13,536. "Magnetic induction wire." C. H. BLAYTON. September 20th.
- 13,541. "Telephone exchange systems." WESTERN TELEGRAPH CO. September 20th. (U.S.A., September 22nd, 1916.)
- 13,542 & 13,543. "Means for supporting electrode-filaments in ionic tubes for use in wireless telegraphy, &c." O. DUDLEY & OSRAM-ROBERTSON LAMP WORKS. September 20th.
- 13,544. "Electric furnaces." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). September 20th.
- 13,547. "Electroplating apparatus." G. T. POTHOFF. September 20th.
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- 13,615. "Electric switches." C. G. BENNETT & H. GARDE. September 21st.
- 13,616. "Electromagnetic lockout switch." R. P. BOSSEM AND A. WEST AND CO. September 21st.
- 13,627. "Security or locking devices for electric incandescent lamps." BENJAMIN ELECTRIC, LTD., & E. FOWLER. September 21st.
- 13,631. "Electrical distributors." F. L. HOLLISTER. September 21st.
- 13,633. "Keyed interrupter or cut-out for electrical installations or appliances on motor cars, &c." C. F. T. CLAXTON & E. J. CLAXTON. September 21st.
- 13,677. "Ampere-hour meters." BRITISH WESTINGHOUSE ELECTRIC & MANUFACTURING CO. (Westinghouse Electric & Manufacturing Co., U.S.A.).
- 13,681. "Detective and protective devices for electric cables." C. J. BEAVER, E. A. CLAREMONT & A. F. W. RICHARDS. September 22nd.

PUBLISHED SPECIFICATIONS.

1916.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

- 7,444. ENGINE-STARTING SYSTEMS. C. F. Kettering & W. A. Chryst. May 25th, 1915. (100,541.)
- 12,044. ELECTRICAL FUSES AND PARTS PERTAINING THERETO. A. Crawford and W. Preston. August 25th, 1916. (109,072.)
- 12,045. ELECTRICAL FUSE BOARDS OR SYSTEMS. A. Crawford & W. Preston. August 25th, 1916. (109,073.)
- 12,074. DISTANCE AND SPEED INDICATORS FOR SHIPS. K. T. F. Jung. August 25th, 1915. (101,297.)
- 12,229. ILLUMINATING APPARATUS. W. J. Davis. January 3rd, (103,106.)
- 12,231. INDUCTION ELECTRIC MOTORS. G. Pestarini. August 29th, 1916. (109,087.)
- 12,236. PROPULSION OF SHIPS AND SIMILAR VESSELS. H. de M. Snell. August 29th, 1916. (109,089.)
- 12,267. COAL AND LIKE CUTTING MACHINES. F. E. Van Slyke. August 30th, 1916. (109,092.)
- 12,316. TROLLEY POLES FOR ELECTRIC CARS AND THE LIKE. T. Warsop. August 31st, 1916. (109,098.)
- 12,350. SYSTEMS OF ELECTRIC MOTOR CONTROL. British Thomson-Houston Co., H. C. Hastings & H. F. Farmer. August 31st, 1916. (109,101.)
- 12,710. AERIALS FOR USE IN WIRELESS TELEGRAPH OR TELEPHONE SYSTEMS. C. D. J. Dunning. September 7th, 1916. (109,111.)
- 13,142. ELECTRIC BATTERY CELLS. C. Kelway-Bamber. September 15th, 1916. (109,122.)
- 14,041. WINDINGS OF ELECTRIC INDUCTANCE COILS AND OTHER APPARATUS. British Thomson-Houston Co. (General Electric Co., U.S.A.). October 3rd, 1916. (109,129.)
- 14,843. RANGE FINDERS. Metropolitan Carriage, Wagon & Finance Co., W. G. Wilson & W. A. Tritton. October 19th, 1916. (109,138.)
- 15,237. ELECTRIC JOINT-MAKING WASHERS. C. J. Beaver & E. A. Claremont. October 27th, 1916. (Addition to 10,023/16.) (109,142.)
- 16,518. INTERRUPTERS FOR IGNITION DYNAMOS. C. T. Mason. June 19th, 1915. (Divided application on 8,584/16.) (102,268.)
- 18,506. ELECTRIC INCANDESCENT ARC DEVICES. British Thomson-Houston Co. (General Electric Co., U.S.A.). December 27th, 1916. (Cognate application on 18,507/16.) (109,188.)

1917.

- 177. CONTACT MAKER AND INTERRUPTER FOR ELECTRIC IGNITION SYSTEMS. W. J. Mellersh-Jackson (Phillips-Brinton Co.). January 4th, 1917. (109,193.)
- 4,573. APPARATUS FOR STARTING ENGINES, MORE PARTICULARLY HEAT ENGINES. Akt. Brown, Boveri & Cie. April 18th, 1916. (105,910.)
- 7,636. APPARATUS FOR PROTECTING ELECTRIC INSTALLATIONS. G. Giles. May 27th, 1916. (109,237.)
- 9,571. WINDING OR HAULING MACHINERY. Siemens Schuckertwerke Ges. June 10th, 1916. (Addition to 101,407.) (107,766.)

Packing Glassware.—American cut glass, especially the cut glass with silver trimmings, is winning an enviable place in the Peruvian market. Shipments of plate glass are liable to have dropped upon them at any time a ton or two of other goods; the Belgian manufacturers have demonstrated that glass can be packed to meet this condition. The only thing to do is carefully to pack the product tightly in a light case, which must be enclosed for export in an outside case of strong lumber, made large enough so that an ample cushion can be provided on all sides of the inside case that contains the glass. This cushion will receive the shock of blows, and distribute the impact.

Instead of having the ends and sides of the inside case parallel to the outer one, it is preferable that it should lie diagonally, so that two opposite corners may touch the outside case, and two other opposite corners have an ample cushion. In this manner, it is said, glass can be packed for export to any point along the coast, without the least danger of breakage.—*Scientific American*.

THE ELECTRICAL REVIEW.

VOL. LXXXI.

OCTOBER 12, 1917.

No. 2,081.

ELECTRICAL REVIEW.

Vol. LXXXI.]

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Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has
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Subscription Rates.—Per annum, postage inclusive, in Great Britain,
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Cheques and Postal Orders (on Chief Office, London) to be made payable to
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THE IMPORTANCE OF INDUSTRIAL INFORMATION.

In his recent speech to the Library Association, Dr. Addison, the Minister for Reconstruction, clearly indicated that he appreciated the importance of the ample provision of serviceable industrial information for the use of men who are competent in a particular business. Trade and technical journalists who, through good and bad report, have made this their specialised vocation may welcome this recognition of their service by those who are leading in the work of preparation for a period of efficient reconstruction. During the past three years, when the country "has been handicapped to a tragical degree by the absence of necessary scientific and industrial information of a serviceable kind," the technical and trade journals have been enabled to play a more important part in the national organisation than was ever before their privilege. Those which have been directly dealing with the electrical, engineering, and other munitions industries which have been serving the national purposes in "an engineer's war," know well enough how valued their assistance has been by thousands of professional men and by hundreds of thousands of other workers, not only when given in the form of published articles, but also in the form of private correspondence in which funds of expert information have been freely drawn upon by the editor and imparted to the inquirer. This may be described as direct national service helping materially in the efficient and expeditious equipment of works, the installation and running of plant, and speeding up the output of munitions of war. In addition to this, as our own experience has shown, established journals have been turned to not once or twice, but hundreds of times by those in Government Departments who knew where they could ascertain essential information which was not in the archives of our pre-war Governmental intelligence departments. The large number of men of technical qualifications and industrial and commercial experience who, leaving their private callings, have taken up employment on war service in some department or other requiring their specialised knowledge and abilities, have known just where to put their hands on the trade journal editor who could help them, and this information, passed on by them to permanent civil service officials, has raised the prestige of the specialised organs very materially both in the present and for the future. It may still be felt that the usefulness of this branch of service has not been adequately recognised by some in high authority, but the fact remains that one of the best servants of the State, working more or less silently and often quite unobtrusively, though always most eagerly, has been the technical Press.

Dr. Addison, in his speech, showed that in order to pay for the war it is necessary for the different trades and industries of the Allies to organise more and more for the production and dissemination of useful and necessary information. He urged the great trades to take up the question of promoting scientific research in particular industrial processes, and in this connection he considered that the public libraries could perform valuable work by placing information useful to the industries of various districts, at the disposal of the communities in those districts. Here it will be recognised that the technical

and trade Press and books have an important function to fill. We believe we are correct in stating that technical books relating to all matters having any bearing on war productions have been in enormous demand during the war, and the needs of the future, when technical study and manufacturing are able to return to a more normal course, will be very considerable. Nothing can supersede the work of the competent author of all kinds of technical literature. This point was recognised by other speakers at the meeting of the Library Association, which had before it several resolutions dealing with the establishment of commercial and technical libraries. Mr. MacAlister remarked that while commercial libraries were quite a recent development, we had always had technical libraries in some form. He suggested, however, that they needed to be developed in several directions to become efficient aids to the arts and manufactures of this country. He mentioned that the possibilities of the technical library in aiding research, discovery, and invention had never been fully realised in England; we fully agree with this statement, which we commend to the notice of British manufacturers.

In how many engineering works in this country will be found a library of technical books, selected under competent advice, and comprising the best and most up-to-date treatises and works of reference bearing upon the particular branch of industry concerned? Where such a library exists, are its resources available to the technical staff, the designers and draughtsmen, and the accountants of the establishment, or are they locked up in the manager's room and jealously withheld from the hands of his subordinates? There may be on a shelf in the D.O. a few well-thumbed and dilapidated old friends such as Unwin's "Machine Design," Rankine's "Civil Engineering," and so on, but these only serve to emphasise the lack of an adequate modern reference library; and even if the books were there, would the draughtsmen be permitted to consult them freely and often, without incurring reproof for "slack-ing"?

It is our contention that in every such establishment a well-equipped technical library should be provided and carefully kept up to date, and that the engineering staff should be encouraged to make full use of it in the performance of their duties. The provision of duplicate copies of standard works, to be lent to the men for home study, would also be a wise procedure, and would abundantly repay the cost, comparatively trifling to the firm, but prohibitive to the junior members of the staff. The example of the Institution of Electrical Engineers, which has added to its magnificent collection of books a lending library for the use of its members, is well worthy of emulation; the system has proved highly successful, many hundreds of books being borrowed each year.

An Electroculture Committee.

DURING the past year or two considerable attention has been given in this country to the possibilities of electroculture in the shape of increased and improved crop production, and, in addition to the recognised experimental stations, many more or less experienced investigators have installed apparatus with a view to personally exploring what has for many years been an attractive, though little known, branch of electrical science. The war has undoubtedly been responsible for the sudden accession of interest in this subject, as in agriculture generally, but it has also added to the difficulties naturally attendant on such a situation. We have, for instance, often felt, and privately urged, that adequate steps should be taken to secure (1) co-ordination of effort amongst those engaged in these experiments, (2) that any neces-

sary knowledge gained by past experience in the operation of such installations should be in the possession of all investigators, and (3) that the results obtained and all essential data connected with the year's work should in every case be tabulated, so that they can readily be utilised in the interests of future progress. The case is distinctly one where the co-operation of all directly concerned will advance matters in the national interest, and for this reason the movement which is now understood to be taking shape for constituting a committee under the Board of Agriculture, on which engineering, scientific, and agricultural interests will be represented, with a view to securing the above object, as well as deciding on suitably-priced standard apparatus, and promoting investigation of the technical problems involved in the application of the electric discharge, must be regarded as a logical one, though somewhat unexpected.

Unfortunately, our experience of committees formed under the wing of a Government Department has been, up to the present, disheartening—the Board of Trade Electrical Committees are typical—and it would appear to be too much to expect that a department with a record such as that of the Board of Agriculture will not automatically follow established precedent, and in effect delay, instead of facilitating progress.

That the Board should support the formation of a committee in the public interest is a right and proper thing, but it should be understood that the results of its deliberations will be accessible to the public at any time, and that the Board's only interest is that of a Department of State paid by the public to receive and act on any recommendations made by the Committee.

The Board should exercise no control whatever over the findings of the Committee, and it should be a *sine qua non* that investigators, acting on behalf of the latter, have no proprietary interest in the results of their labour other than that to which they may be legally entitled.

The Board of Agriculture has for some years interested itself in a small way in electroculture, but we would ask whether it is not a fact that during the past year or so, public interest having been aroused, and the need for expert guidance having arisen, the Board's advisers—presumably with its concurrence—have obstructed rather than assisted the development of the movement, which is intended to place electroculture on an industrial rather than a laboratory basis?

To put the matter plainly, we question the utility of the proposed committee—which can only cover ground which is clearly within the scope of the existing I.M.E.A. Committee on the Development of Electricity in Agricultural Areas—and we hesitate to accept its suggested objects at their face value. The I.M.E.A., through its Agricultural Committee, has done more to promote the use of electricity in farming during the past six months than a Government departmentally-controlled committee would have accomplished in three years. This, together with the fact that the proposed committee will deal only with electroculture—which in itself will not for a few years be of so much importance to the farmer as the general applications of light and power—leads one to suggest that, instead of the Board going out of its way to form an overlapping committee to deal with matters already occupying the attention of an existing and much more practical body, it should give its whole support to the latter with a view to developing it into what it will, if its objects, mentioned in our issue of March 23rd last, are secured, become naturally, viz., a National Agricultural-Electrical Committee, with sub-committees representing all the various interests involved—electrical, scientific, agricultural, manufacturing, governmental, &c.

THE "EMPRESS WORKS" OF MESSRS. E. BROOK, LTD., HUDDERSFIELD.

AMONGST the younger firms engaged in the manufacture of electric motors, the firm of E. Brook, Ltd., occupies a

September 7th the firm had made 17,446 machines, aggregating upwards of 348,000 H.P., and the new works are already fully employed. The area occupied by the establishment is about $2\frac{1}{2}$ acres, 1,800 sq. yd. being available for extensions. The machine shop measures 168 ft. \times 163 ft., and has a floor area of 3,043 sq. yd.; iron and brass



FIG. 1.—IRON FOUNDRY.



FIG. 4.—WINDING BAY.

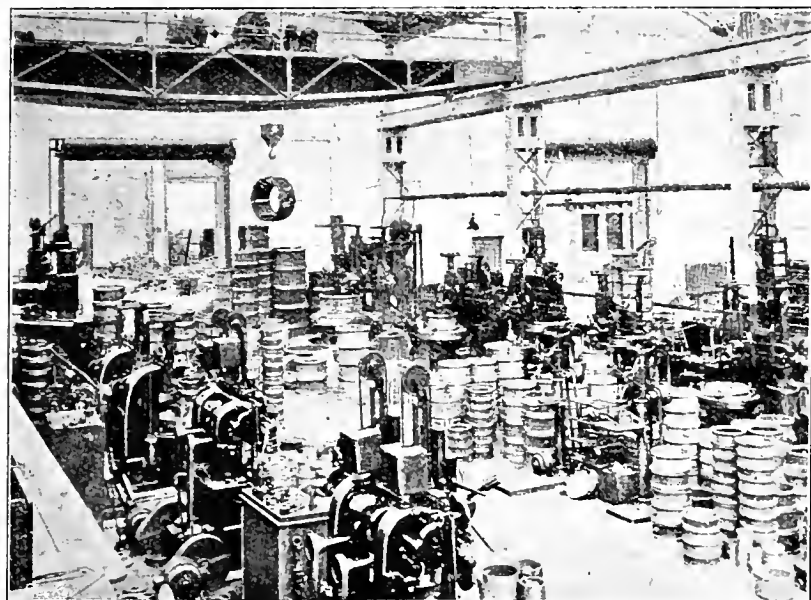


FIG. 2.—BORING AND TURNING MACHINES AND LATHES.

foundries are provided at the rear of the machine shop, the former covering an area of 120 ft. \times 10 ft., and the latter 40 ft. \times 25 ft., with a modern equipment of moulding machines, compressed air and sand-blasting plant, &c.

The accompanying views show the interiors of some of the departments, which are equipped with a variety of lathes, planers, boring and turning machines, radial drills, &c., in most cases with a separate motor driving each machine. The main bays are traversed by electric cranes, and portable cranes are provided in the winding shops, as well as electric lifts to the higher floors.

The test room is provided with a switchboard and transformers, which enable motors to be tested with one, two, and three-phase current at from 50 to 800 volts, 45 to 100 cycles per second; special braking appliances have also been installed to facilitate test runs.

prominent position. It was founded at Huddersfield in 1904, for the purpose of making single-phase motors and starting gear, and, from small beginnings, quickly developed, new premises being occupied in 1905 to accommodate the growing business, which was extended to include the manufacture of three-phase motors in the following year. Branch workshops and show-rooms were also opened at Leeds and London in 1911 and 1912, and numerous agents were appointed in British and Dominion centres.

In 1915 it was decided to erect a new works on up-to-date lines at Longroyd Bridge, and the factory was completed in May last, though the offices and some of the smaller buildings were not finished until last month. Provision has been made for the manufacture of motors up to 200 H.P., with an output of 50 motors of various sizes per week: up to

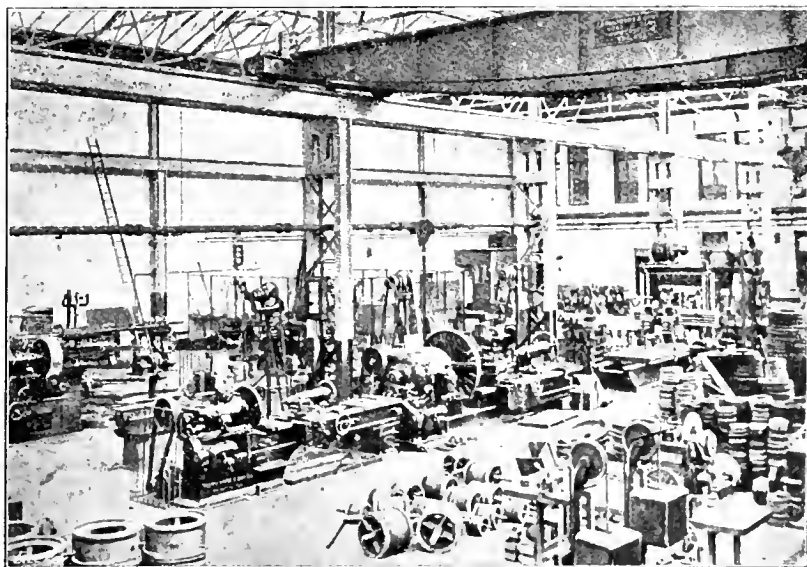


FIG. 3.—LARGE LATHES AND PLANERS.

The buildings are heated throughout on the low-pressure hot-water system, and in other respects special attention has been devoted to the welfare of the employes, with whom the management have always maintained most cordial and kindly relations: a canteen is provided, with hot-water supply and

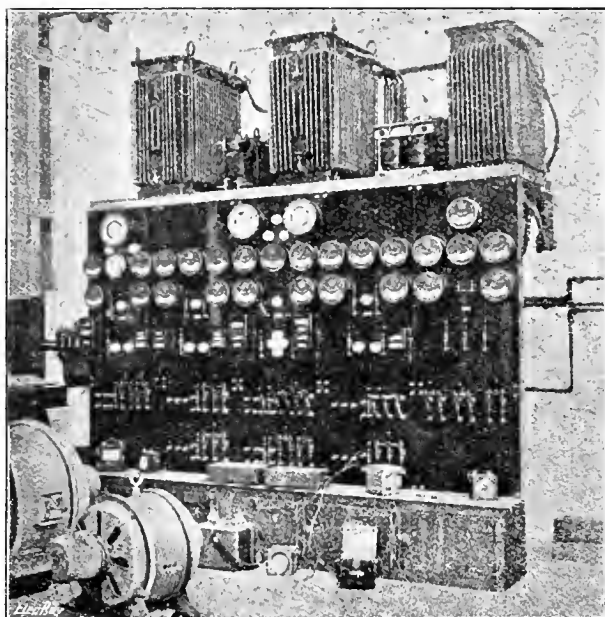


FIG. 5.—TESTING SWITCHBOARD.

a well-equipped kitchen, comfortable dining rooms, and lavatories, and meals are served to about 100 employes daily: in addition, the canteen is opened for half an hour



FIG. 6. CANTEEN KITCHEN.

during the morning and again in the afternoon for light refreshments.

The new works were designed by Messrs. J. B. Abbey and Son, architects, Huddersfield, and were erected under their supervision; on Saturday last they were formally opened by Mrs. Ernest Brook, in the presence of a number of visitors.

Electric Steel Manufacture in Denmark.—A company has been formed in Denmark, with a capital of 600,000 kronen, for the manufacture of steel from scrap, which is being melted and refined, with a little new iron added. It is said to be the same process which the Krupp works use for the manufacture of their best guns. To commence with, the new undertaking will confine its work to the production of smaller articles, machine parts, &c. Scrap is said to be available in sufficient quantities, but up to now it has principally been exported to Sweden. The new company, consequently, is fairly independent of foreign supplies, which is a very important point under the present circumstances. Operations will commence probably by the end of November, and work is expected to be in full swing by the beginning of the new year. — *Engineering.*

THE FIXATION OF ATMOSPHERIC NITROGEN.

NITROGEN is one of the four elements indispensable to animal and vegetable life, and the average adult consumes from 10 to 20 grammes per diem in one form or another. It is a curious fact, however, that the majority of plants cannot abstract (or "fix") gaseous nitrogen from the atmosphere, but have to draw their supply of this element from nitrates in the soil. Nitrates thus consumed may be replenished by natural manures, but the tendency is to use, more and more extensively, artificial fertilisers containing nitrogenous compounds made by the fixation of atmospheric nitrogen. In addition to the practically illimitable demands of agriculture for nitrates, chemical industries use ever greater quantities and varieties of nitrogen compounds. The old conception of nitrogen as a particularly inert element has had to be modified since the electric furnace showed it to combine readily with many substances at temperatures exceeding 1,000° C., with the formation of compounds which have many valuable applications.

Sources of Nitrogen.—Nitrogen compounds exist in small quantities in the soil, and are a product of vegetable decay. A very small quantity of nitrogen (about 12 lb. per acre per annum in this country) is carried into the soil by rain, in the form of dissolved compounds produced by electrical discharges. The activity of various bacteria is responsible for withdrawing much larger quantities of nitrogen from the atmosphere, but still not nearly enough for the needs of modern agriculture (for instance, an average crop of wheat withdraws from the soil about 535 lb. of nitrogen per acre). The guano deposits in Peru and on the island of Majorca are exhausted, and it is unlikely that the Chilean nitrate beds would last for more than another century or so at the pre-war rate of consumption; nor is it likely that any other natural deposits of similar magnitude will be discovered. In view of the rapidly increasing consumption of nitrates, it is of immediate importance to see that artificial means are available for producing the whole of the requisite supply.

One industrial source of fixed nitrogen lies in the distillation of coal. The latter contains 1 to 1½ per cent. of nitrogen, and during distillation in a closed retort, 15 to 20 per cent. of this nitrogen is converted to ammonia. From 100 tons of coal there may be obtained about 1·2 tons of ammonium sulphate, containing 20 to 21 per cent. of nitrogen. This sulphate may be converted easily into nitric acid (for use in making explosives, dye-stuffs, perfumes, &c.), or it may be used as a fertiliser, and is then readily converted to nitrate in the soil. For some time this was the only industrial source of fixed nitrogen, but the quantity thus available is limited (especially whilst so much coal is burnt without by-product recovery), hence the attention which has been paid to fixing nitrogen from that inexhaustible reservoir, the atmosphere.

The world's production of sodium nitrate has ranged from 2,000,000 to 2,700,000 tons per annum since 1908; and the production of ammonium sulphate increased steadily from 852,000 tons in 1908 to 1,610,000 tons in 1913, since when no statistics are available. The increasing cost per ton of these materials formed an additional incentive to the synthesis of nitrates from atmospheric nitrogen, and great advances have been made in the technique of producing nitrogen compounds since the war brought about such an unparalleled demand for explosives. But for the proficiency attained by Germany in this respect, the war would have been ended before this by lack of explosives in the Central Empires. Germany imported more than 500,000 tons of Chile nitrates during the first half of 1914, but it is probable that none of the belligerents will import much Chile nitrate after the war. In other words, the fixation of atmospheric nitrogen is an established industry, meeting or capable of being extended to meet all requirements.

Fixation Processes.—Confining our attention simply to processes which are of proved industrial value, these may be divided into three main groups:—(1) Processes for the direct oxidation of atmospheric nitrogen—*e.g.*, Birkeland-Eyde, Schoenherr, and Pauling processes; and the Haussner process for exploding compressed gases. (2) Combination

of nitrogen with hydrogen to form ammonia, as in the Haber process. (3) Fixation of nitrogen on metals or metallic compounds—*e.g.*, Franck & Caro's process for fixing nitrogen on calcium carbide; and Serpek's process for fixing nitrogen on aluminium. Whilst the processes of group (1) yield nitric and nitrous acids directly, those in groups (2) and (3) lead to ammonia—*via* cyanamide or nitrates. Since nitric acid and its salts are of great importance, methods have been devised for oxidising ammonia and obtaining nitric acid with almost full theoretical efficiency.

Although almost the whole practical development of fixation processes has occurred during the past ten years, there were about 388,000 tons of nitrogen fixed during 1916, equivalent to about 2,450,000 tons of 15½ per cent. nitrate, a production equal to, or greater than, that of Chile nitrate during the same year. Before the American Electrochemical Society in April, 1916, the world's production of fixed nitrogen was stated as follows:—

Tons of fixed nitrogen in—	1913.	1915.
Oxidisation by arc	16,915	27,570
Haber process	7,300	54,430
Calcium cyanamide	59,490	190,000
	83,705	272,000

The data for 1915 are approximate, and certainly represent an underestimate; production was more than doubled during the year, and at the beginning of 1916 about 1 million H.P. was used for the synthetic fixation of nitrogen.

Direct Oxidisation Processes.—Although Franck and Caro's patents concerning the fixation of nitrogen on calcium carbide date from 1898, the manufacture of calcium nitrate by direct oxidisation of nitrogen was only brought to industrial perfection about the same time as the cyanamide processes. During 1903 the first Birkeland-Eyde equipments, of 25 and 150 H.P. respectively, were set to work, and since then the production of calcium nitrate by this process has increased continuously, and now amounts to 200,000 tons per annum.

At high temperatures (1,000° C. and over) nitrogen combines with oxygen to form nitric oxide (NO), but the action is reversible, and the speed of decomposition is considerably greater than the speed of formation. The concentration of nitric oxide in air exposed to suitable temperature (developed by the electric arc), is determined by the principle of mass-action, and, in order to reduce the proportion of decomposition, the air is blown quickly past the arc; once the gases reach a zone at 1,200° C., or lower temperature, the loss by decomposition of the oxide becomes comparatively small. Using air as raw material, the concentration of nitric oxide when equilibrium is established in the reversible action is 0·35 per cent. at 1,811° C. (absolute), 0·98 per cent. at 2,195°, 2·02 per cent. at 2,580°, 3·57 per cent. at 3,000°, and 4·39 per cent. at 3,200°. Equilibrium is never attained in practice, and gas leaving the furnace rarely contains more than 1 or 1½ per cent. of NO (Birkeland-Eyde, 0·5 per cent.; Schoenherr, 1·75 per cent.; Pauling, 1·2 per cent.).

The theoretical efficiency with air at the temperature of the electric arc (about 3,600°) is about 10 per cent., and on this basis 1 kw.-hour should provide 180 grammes of nitric acid and 1 kw.-year of 8,000 hours should yield 3,170 lb. of acid. In point of fact, industrial furnaces yield only about 1,230 lb. of nitric acid per kw.-year, corresponding to 3·9 per cent. efficiency, as a maximum. Schoenherr estimates that the energy consumed in his furnace for the oxidisation of atmospheric nitrogen is distributed as follows:—

Formation of NO	3 per cent.
Lost in furnace cooler	40
Lost by radiation	17
Recovered in boilers	30
Given to final cooler	10
	100

If a mixture of equal parts of nitrogen and oxygen be used, instead of air as raw material, the theoretical equilibrium-concentration of nitric oxide is increased by 25 per cent., and is considerably greater in practice: the theoretical production of nitric acid then exceeds

4,620 lb. per kw.-year, but the mixture of pure gases has never been used industrially.

Nitric oxide made as above is oxidised to nitric peroxide by the action of oxygen after cooling the gas to about 40° C. before admitting it to the oxidising towers. The peroxide is converted to nitric and nitrous acids by the action of water, and a residue of gas which cannot be converted to acid, owing to certain instability in the action, is recovered in a soda tower as sodium nitrite, a material which is essential to the dye-stuff industry. The 30 per cent. nitric acid is either concentrated or converted to calcium nitrate, which is a valuable fertiliser.

The Birkeland-Eyde Process.—The furnace used in this process has not been modified in any essential particular since its introduction more than 10 years ago.* The electrodes are placed in a magnetic field perpendicular to their plane, so that the arc is drawn out into the form of a half-disk. Where alternating current is used, the arc is formed alternately as two half-disks, which present the appearance of a complete disk. Single-phase current at 5,000 volts, 50 cycles is employed, and the cylindrical furnace-casing of sheet-iron is provided with perforated refractory bricks which divide the air supply into a number of streams. The electrodes are water-cooled, and a magnetic field of 4,500 to 5,000 c.g.s. lines per sq. cm. is maintained between them. About 10 per cent. of the total energy expenditure is absorbed by the field coils.

Whereas the first Birkeland-Eyde furnaces consumed only 600 kw., later ones consume from 1,000 to 4,300 kw. In the Saahm works there are eight 3,500-kw. furnaces in operation. The diameter of the arc flame in the latter case is about 8 ft. The temperature of the flame exceeds 3,000° C., but in spite of the high temperature to which they are exposed, the electrode ends need changing only once in three or four weeks, whilst the refractory masonry lasts from four to six months. Gases escape from the furnace at a temperature between 800 and 1,000°, and some of the heat which they carry is utilised to raise steam for concentrating the nitrate water obtained in another stage of the process. After leaving the boilers, the gases are cooled to 40° by passage through aluminium tubes on which water is sprayed. In successive towers filled with refractory brick, quartz, or other appropriate material, the cooled gases are oxidised to NO₂, which is combined with water to yield 40 per cent. nitric acid, and the residual gas is recovered in soda towers. The total absorption is about 97 per cent. of the nitric oxides formed. There are various alternative chemical processes for the production of different nitrogen compounds,† but the key process is the fixation of the atmospheric nitrogen. Dilute nitric acid may be concentrated, or combined with ammoniacal liquor to form ammonium nitrate; but it is generally used to make calcium nitrate. The yield of calcium nitrate amounts to 1,900—2,100 lb. per kw.-year, corresponding to 1,000—1,210 lb. of nitric acid.

The development of the nitrate industry in Norway has been extremely rapid, the pre-war progress being as follows:—

Works.	Date.	Total H.P.
Froguerkilem Fabrik	July, 1903	25
Ankerlokken	Oct., 1903	150
Vasmoen and Arendhal	Sept., 1904	1,000
Notodden	May, 1905	2,500
Notodden and Svaelffos	May, 1907	42,500
Notodden, Svaelffos, Lienfos, and Rjukan I	Nov., 1911	200,000
Rjukan II	1913	120,000

All these works are in the district of the R. Telemarken, and the total horse-power utilised for the fixation of nitrogen has increased from 200,000 H.P. in September, 1912, to about 300,000 H.P. at the present day. The Notodden Works produce, per annum, 20,000 tons of calcium nitrate, 4,000 tons of sodium nitrite, and 4,000 tons of ammonium nitrate. The Saahm (Rjukan I) works consumes about 100,000 kw.-years per annum, and pro-

* A detailed description is to be found in the *ELECTRICAL REVIEW*, January 9th, 1914.

† For details of these processes, and for many other chemical data relating to the fixation of nitrogen, reference may be made to *Genie Civil*, Vol. 70, pp. 319, *et seq.*, whence some of our present notes are derived.

duces 70,000 tons of calcium nitrate and 8,000 tons of sodium nitrite, *i.e.*, 1,540 lb. of calcium nitrate and 176 lb. of sodium nitrite per kw.-year, corresponding to 1,100 lb. of 96 per cent. nitric acid. The cost price of calcium nitrate is 86s. to 100s. per ton, and that of nitric acid (36° Beaumé) 150s. to 175s. per ton.

(To be continued.)

THE UTILISATION OF UNDEVELOPED FUELS IN PULVERISED FORM.

A RECENT issue of the *General Electric Review* contained an article on the above subject by Mr. V. Z. CARACRISTI, of the Locomotive Pulverised Fuel Co., portions of which, dealing with the question of steam raising, we reproduce below:—

High rates of combustion are, in large power plants particularly, of extreme economic importance, the capital investment being reduced in direct proportion to the rates of burning; nearly all of the accepted types of boilers are beyond the capacity of the furnace in their ability to utilise the heat generated in the furnace, and particularly when the boiler equipment is supplemented by economisers or other means of utilising the heat lost through high waste gas temperatures. Although owing to the small specific heat of the gases, in combination with the loss of efficiency brought about at low temperatures in the transmission of such heat to the water in the boiler tubes, the high stack temperature is not as great an economic loss as is popularly supposed.

The development work done in combustion through the use of stokers, in combination with under-grate blowers and re-torts, has about exhausted the possibilities in this direction, and a radical departure from the existing practice is necessary in order to utilise to the fullest possible extent the thermal energy of fuel.

The use of fuel in pulverised form offers a basis for further development work in this connection.

The fact that fuels having relatively high volatile contents, when dried and pulverised, are so readily combustible, has

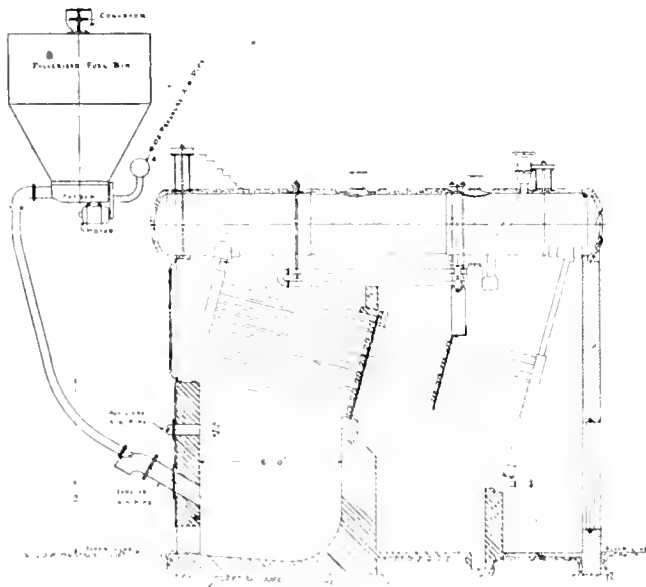


FIG. 1.—BABCOCK BOILER WITH POWDERED FUEL FURNACE.

caused a great many experimental developments in this direction to be failures, particularly when efforts were made to maintain a rate of combustion in excess of that normally obtained through the use of stoker equipment having under-grate blast. It has, however, been demonstrated in service that it is possible to burn to CO₂ more than 98 per cent. of the combustible matter with an excess of air supply of less than 10 per cent., without any deductions for combustible in the ash, this being irrespective of the volatile or ash content of the fuel or the analysis of such ash. This result is being obtained at a rate of combustion equivalent to 175 lb. of coal per square foot of grate area per hour, and without the necessity of increasing the combustion space volume by high boiler setting; the CO₂ contents of the escaping gases under these extreme overload conditions being very close to the theoretic, and the CO content of the escaping gases being nil.

The use of pulverised fuel in stationary boiler plants when the installation is of sufficient size to absorb a reasonable amount of increased capital is justified for the following reasons:—

1. Ability to force the boilers, without loss of combustion efficiency, to a rating which will develop a horse-power for each four or less square feet of heating surface,

2. Greater heating value per cubic foot of furnace volume, eliminating the necessity for raising the boilers in order to secure overload capacity.

3. Reduction of the initial capital investment in the boiler plant on account of the reduction in the amount of heating surface in the boilers necessary to carry a given load under operating conditions.

4. Ability to maintain full steam pressure with low-grade fuels under extreme overload conditions.

5. Ability to utilise from 96 to 99 per cent. of the heating value of the combustible, irrespective of the ash content or analysis.

6. Elimination of grates and mechanical equipment for stoking and the maintenance incident thereto.

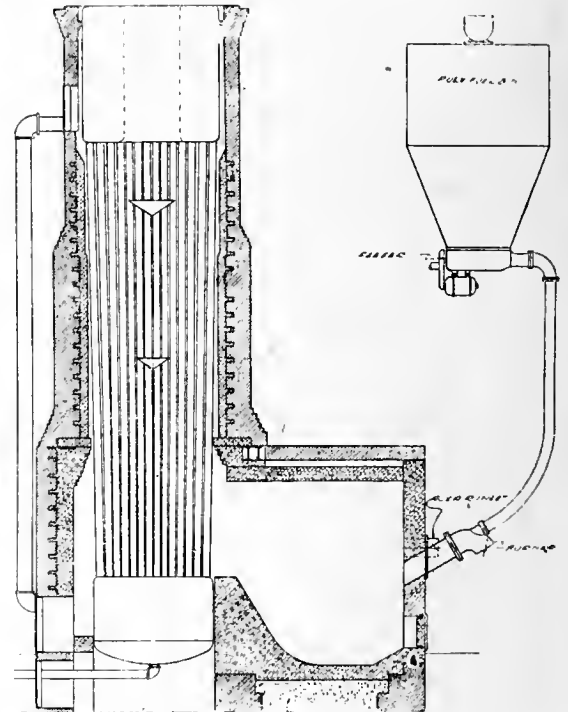


FIG. 2.—CAHALL BOILER WITH PULVERISED FUEL EQUIPMENT.

7. Elimination of draught blowers for the purpose of securing overload capacity.

8. Elimination of operating difficulties brought about by the clinkering of coal on grates, and the resultant loss in boiler capacity during periods of cleaning fires.

9. Ability to quickly take on heavy overload and to cut out the fuel feed when the necessity for such overload has ceased. The cutting out of the fuel feed in a pulverised fuel installation instantly stops combustion and the use of fuel, whereas in a grate-fired installation the amount of coal remaining on the grates is of necessity lost.

10. Elimination of the necessity for keeping banked fires in order to take care of irregular peak loads. With the use of pulverised fuel steam from cold water can be raised to working pressure as quickly as from a banked fire.

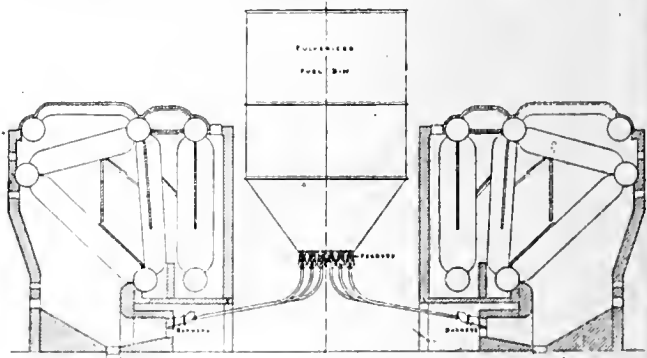


FIG. 3.—BADENHAUSEN BOILERS ARRANGED FOR BURNING POWDERED FUEL.

11. Elimination of smoke from the stack and the consequent freedom from liability under legislative requirements as to the smoke nuisance.

12. Reduction in the size of the buildings necessary to hold the boiler equipment, together with a reduction in the cost of the steam and water piping in the boiler room.

13. Material reduction in the height of the stack, this reduction in height being brought about by the fact that all of the air admitted to the firebox passes direct into the combustion zone, without the necessity of passing through a fuel bed, permitting the boiler to be operated under an overload with less vacuum.

14. Reduction in the cost of operation, brought about by the fact that the feeding of pulverised coal to the furnace requires practically no attention.

15. Reduction in the cost of handling ashes, brought about by the greatly reduced volume.

As an offset to the above advantages may be set up the cost of preparing the fuel for burning in pulverised form.

The expense of properly preparing the fuel may be divided into four divisions:—

First. The expense of crushing the coal, freeing the coal from stray iron, and elevating the same to bins, preparatory to pulverising.

In so far as this equipment is concerned it is the same as would be required in hand or stoker fired installations.

Second. The cost of drying the coal.—With equipment which is commercial the coal can be freed from moisture at a reasonable power and fuel expense. The power and fuel required are greater with lignite than with anthracite or bituminous coal, bituminous coal being more easily dried than either of the other fuels.

Third. The power required to pulverise.—Although accurate figures are not available, the power required to pulverise coal to a fineness necessary for combustion in suspension, with commercial equipment as manufactured at the present time, is from 8 to 9 kw.-hours per ton for bituminous coal and lignite, and from 15 to 17 kw.-hours per ton of coal for anthracite or graphitic coals and coke breeze.

Fourth. The maintenance of equipment necessary to prepare fuel.—The maintenance on the equipment for the preparation of fuel will be approximately, using present com-

An item of prime importance is to operate the firebox under a vacuum. This vacuum can be as low at 15/100 of an inch of water. It is also of importance that auxiliary air for combustion be induced into the firebox in or near the zone of maximum temperature.

Burning pulverised fuel at high rates of combustion and in large volume tends to form a layer of CO₂, preventing the access of oxygen to the unconsumed core of the flame, and unless this core is broken up by cross currents it will pass into the cold area surrounding the boiler tubes, and combustion will not be completed.

The matter of combustion of pulverised fuel within a limited space of firebox is controlled by an element of time, and the slower the passage of gases through the firebox the more efficient the combustion results.

The items which affect the combustion of pulverised fuel are:—

- 1. Volatile contents, affecting the temperature of the flash point.
- 2. The degree of fineness to which the fuel is pulverised.
- 3. The amount of moisture in the fuel.

Low volatile contents can be offset by increasing the fineness of the fuel.

The amount of moisture in the fuel is of only minor importance in so far as combustion is concerned. The reduction of moisture affects the thermal results only slightly, and the combustion practically not at all; from which fact it can be noted that the higher the volatile content of the fuel the less is the expense necessary for pulverising.

The formation of honeycomb and clinker on the heat-absorbing surfaces is brought about largely by the iron con-

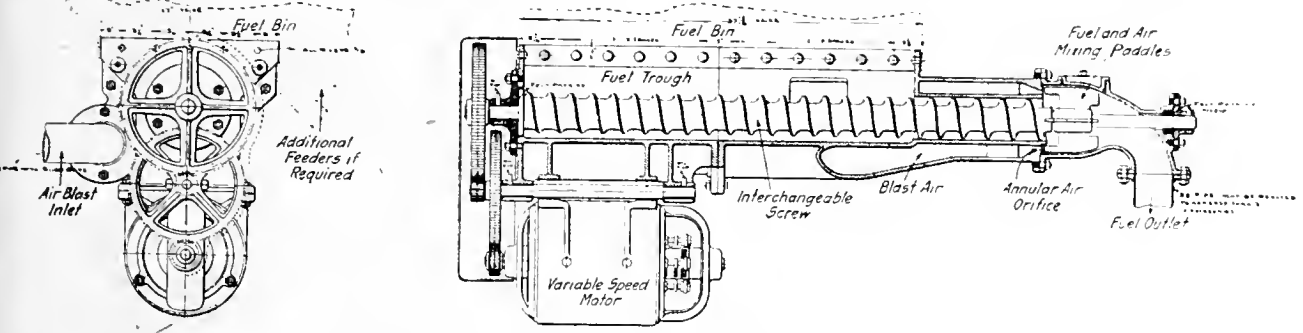


FIG. 4.—PULVERISED FUEL FEEDER.

mercial equipment, from 2 to 3 cents per ton for bituminous and lignite coals, and from 4 to 5 cents per ton for anthracite and coke breeze.

The cost of preparing and pulverising, however, should not be considered as an operating charge. This cost is directly chargeable against the cost of fuel, and in determining the savings which can be effected by means of burning pulverised fuel in suspension, this cost should be added to the cost of the fuel on a B.T.H.U. basis arrived at. When making a comparison of the cost of fuel on a B.T.H.U. basis in terms of evaporating results, when burned on grates and in pulverised form, it is conservative to figure that the combustion results will be from 20 to 30 per cent. better with pulverised fuel. This increase in combustion results will be sufficient to more than offset the cost of pulverising, leaving the difference in saving in cost per B.T.H.U. due to the less price for the lower grade fuel as a net saving.

There is a considerable field for the development of equipment necessary for the drying and pulverising of fuel, but under the present commercial conditions the cost of preparing fuel is not prohibitive, even when considering the use of low-grade fuels having a high ash and low B.T.H.U. content.

When the necessary air for combustion is introduced into the firebox the direction of the flame is toward the openings and the firebrick has to stand the radiation effect of the heat only, and is relieved of the scouring action.

The process of burning pulverised fuel differs from the process of burning gases arising from coal burned on grates or the burning of fuel oil, in the fact that the temperature of the ash in suspension, when burning pulverised fuel, becomes great enough to make the process of combustion self-sustaining, reducing to a minimum the necessity for heat radiating or regenerating refractory surfaces when the velocity of the flames through the combustion space is not too great. It is essential that feeders be of such a design that they will deliver from 3,000 to 5,000 lb. of pulverised fuel per hour; and that the pulverised fuel handled by the feeder will be thoroughly intermingled with the air used as a conveying medium. It is also essential that the velocity of the fuel entering the firebox be less than the velocity of the combustion air surrounding this fuel inlet.

Experience has demonstrated that it is very practicable to burn, within a very limited space, 5,000 lb. of coal per hour fed by one burner, the fuel being converted into gases within the distance of less than 10 ft., provided the incoming mixture is uniformly distributed throughout the cross section area of the delivery pipe, so that a refractory wall located a distance greater than 10 ft. from the fuel inlet will be free from any impinging or cutting action of the flame.

tent in the ash, and can be prevented by a through oxidation of such iron in the combustion zone.

The formation of slag in general will be in direct ratio with the amount of incandescent surface with which the ash in suspension has an opportunity of coming into contact. The ash in suspension which does not come into contact with incandescent surfaces will readily pass out of the stack in extremely minute particles in the form of a very light haze, a small proportion remaining in any eddies which the boiler setting may cause in the passage of the gases to the stack, and the use of horizontal baffles should be avoided.

TRADE IN CANADA.

Influence of Capital.—In his report for the year 1916, H.M. Trade Commissioner in Canada (Mr. C. Hamilton Wickes) draws attention to the relative yearly investment of British, United States, and Canadian capital in Canadian Government, municipal, railway, and corporation bonds during each of the years 1909 to 1916. The estimated figures are as follows:—

Years.	United Kingdom, Per cent.	United States, Per cent.	Dominion of Canada, Per cent.
1909	74.00	3.90	22.10
1910	81.50	1.50	17.00
1911	76.56	6.58	16.84
1912	72.65	11.35	16.00
1913	74.25	13.65	12.10
1914	68.25	19.75	12.00
1915	14.20	42.10	43.70
1916	1.50	64.90	33.60

Last year Canada sold \$316,000,000 of such bonds, of which United States investors purchased \$205,000,000. It will be noted that up to the year 1912 the investment of United States capital was practically negligible, while the United Kingdom supplied about 75 per cent. of Canadian requirements until the outbreak of war. During the period 1909-14 no great effort appears to have been made by the manufacturers and merchants of the United Kingdom to improve their trade in the Dominion as a direct consequence, or as a condition of these immense investments. With the investors of the United States it is different. In the majority of cases it is made a condition of the contract that the funds so advanced shall be expended on plant, machinery, and goods produced

in the United States, and to this end their bankers and manufacturers have combined their efforts. The commercial advantages thus obtained will be difficult to modify so long as present financial conditions prevail.

In Ontario, however, sentiment is strongly in favour of the purchase of Canadian and British goods. This sentiment seems to be taking the place of the more restricted campaign, prominent in 1915, urging the purchase of "Made in Canada" goods.

Complaint is still heard occasionally as to the lack of personal attention given by British manufacturers to the requirements and details of this market, as compared with the attention given by United States manufacturers. There is a personal touch in evidence in United States trading relations with Ontario which helps considerably to increase that country's volume of trade. This personal touch extends to constant effort on the part of manufacturers to obtain orders, following the raising of loans by Canadian borrowers in the United States.

The Ontario Hydro-Electric Commission will again be a large buyer of motors, copper wire, insulators, sluice gates, generators, and power plant during 1917. It has hitherto purchased its current from corporations at Niagara Falls, but has now decided to build its own power generating plant, construction of which will probably be commenced at an early date. The Commission will also be a large buyer in the comparatively near future of electric railway plant and material in connection with a scheme of electric radial railways throughout the Province.

Trading Hints.—The manager of one of the most important metal and hardware firms in the West, in speaking of the desire of his firm to deal more largely in British goods, testified to the value and usefulness of many articles of United Kingdom manufacture. In common with nearly all other business men, however, he spoke of the difficulties attending the development of British trade in Western Canada. It was generally remarked that British firms, with the exception of some striking examples to the contrary, are ill-informed as to what the West can buy and use, and of the terms and conditions which Canadian firms find it necessary to employ in the conduct of their business. Prior to the war, many British manufacturers, quite unconsciously no doubt, gave Canadian buyers the impression that they did not want to effect sales, by their habit of writing back referring inquirers to "an export agency," or, if the orders were accepted, by being dilatory in shipping the goods. Attempts by British firms to open up business in a manner which hindered instead of helping towards the desired end were also remarked upon.

In appointing agents to represent them in Canada, British firms should investigate thoroughly the standing and reliability of the persons whom they contemplate employing.

The majority of Canadian importers, in goods handled directly or indirectly through the retailer, look for credit of 30, 60, or 90 days, customarily extended by the established American manufacturers. It is vain for British manufacturers of such goods to insist on "cash before documents," much less as some do, "cash before shipment." If the United Kingdom trader is to regain the trade which has been partly lost during the war he must ascertain the terms, and be prepared to allow equal terms, as regards credit, with manufacturers of similar goods in the United States.

The use of the cables, when business is being put through, is important. It is to be remembered that the principal centres of industry in the United States are only 12 to 24 hours' distant from Montreal and Toronto, and that business can be closed up by a personal interview between the seller in Chicago and the buyer in Montreal weeks before a letter on the same subject can go back and forth to the United Kingdom.

British shippers should make themselves familiar with Canadian Customs regulations and tariffs. Invoices must always be made out in triplicate and attached to bill of lading, and each invoice must contain the necessary clauses on the back in accordance with Customs regulations. Failure to forward these documents prevents the removal of goods from bond, causing great inconvenience and expense.

In making prices to possible customers, it is a great advantage to quote in Canadian currency, giving the fullest possible details as to terms, discounts, packing (how many in a case, &c.). Such terms as "c.i.f.," "f.o.b.," &c., are used very loosely on this side, and it is advisable—at the risk of what may appear redundancy—to make one's meaning perfectly clear. For instance, "f.o.b. Liverpool" might be rendered free of all possible chance of mistake by saying "Free on board steamer at Liverpool, ocean freight and insurance to be paid by the buyer," or "c.i.f. Montreal" might be made more specific by saying "Cost, insurance, freight to Montreal, delivered ex ship."

Catalogues, price lists, advertising cards, or any printed matter designed to attract the Canadian public should be expressed in dollars and cents, and not in British currency.

United Kingdom firms wishing to open up or extend business in Canada must realise that they have to face strong American competition. In Southern Ontario and Niagara Peninsula this is especially the case, and a large number of United States manufacturers have works or assembling arrangements in that district which are backed by strong selling organisations.

Many wholesale dealers insist that cheapness is by no means

the determining factor in the Canadian market. It gives place to selling capacities, and to the tastes and requirements of the ultimate purchaser. They also complain that United Kingdom travellers are often so engrossed in the superiority of the article they carry as not to realise that intrinsic value is only one factor in the popularity of a commodity, and while the Canadian wholesaler is ready to acknowledge superiority where it exists, he is more concerned to find goods that will sell themselves and entail little or no education of his selling staff or the general public. Manufacturers should make the article the public require, and follow this by organised distributive effort. It should be understood that United States firms send well-trained salesmen into Canada in large numbers, and salesmanship being highly developed in the United States it must be met by selling ability of an equal or higher calibre on the part of United Kingdom manufacturers, particularly by firms wishful to introduce their goods, and also by those who desire to maintain and develop their existing trade.

THE ASSOCIATION MOVEMENT.

By HERBERT H. BERRY.

IN the leading article in the last issue of the *ELECTRICAL REVIEW* tribute is paid to the founders of the Cable-Makers' Association. As I believe there is no official record, I venture to give a short account of the creation and establishment of the existing C.M.A.

Some of the earlier years of my life were spent in acquiring a practical knowledge of the manufacture of electric cables of almost every description. I was fortunate to include in my experience a wide range of work, from a submarine cable which lies to-day across the bed of the Atlantic, down to the smallest leading-in wire used in an electric light installation.

I cannot appraise too highly the utility of my early experiences gained in the workshops and estimating department of Messrs. Siemens Bros., of Woolwich.

In 1894 I started business on my own account, and shortly afterwards, having a desire to turn my early training to account, acquired the sole selling agency in Lancashire, Yorkshire, Cheshire, Birmingham, and the Midlands, for the cables manufactured by the company I had lately left. But alas! competition, internal and foreign, became excessive and burdensome, and manufacturers were faced with the necessity to sacrifice quality or lose their turnover. I realised that a combination of British interests was the only logical outcome, and that good standard quality with a British hall-mark was a goal worth winning.

That was 20 years ago. An earlier effort had been made to bring all the cable makers together, but the result was unsuccessful.

After a preliminary conversation with my old chief, Mr. J. J. Easton, my first interview was with Mr. Alexandre Siemens, who listened sympathetically to my plans, but at the same time expressed the opinion that such a combination of interests in the electrical trade would, if created, have a short life, and, at the longest, last for six months. I was unable to obtain an authoritative statement from him that his company would join any such general movement, but he said he would be willing to discuss the matter further with me after I had interviewed other interested parties. This was not a very encouraging start. I had to plough a lonely furrow, and, incidentally, to bear the whole expense.

During the following weeks I spent my whole time traversing the country, interviewing the parties chiefly interested. One of these at least has, I regret to say, joined the Great Majority; others have retired from active interest in the electrical industry. With one exception, obtained the whole-hearted support of the cable-making trade, and the little opposition that presented itself soon vanished. From that time onward, members of the Cable Makers' Association have developed their manufacturing resources, improved their standards, and attained a degree of prosperity to the general advantage of the whole electrical community. At the period of the outbreak of war the financial records of the electrical cable industry were the envy of the electrical manufacturing fraternity, and the

one bright star in a firmament overclouded through foreign competition upon unequal terms.

I would like to repeat some significant remarks upon this subject made by Mr. James W. Gerard (late U.S. Ambassador in Berlin) in his *Daily Telegraph* articles. They are as follows:—

Combine for Selling Abroad.—The only thing that can maintain a fair price after the war for the products of American firms, miners, and manufacturers, is permission to combine for selling abroad.

With the low wages paid to very efficient working men, who worked long hours, and with no laws against combination, it was always a matter of surprise to me that the Germans, who were in the process of getting all the money in the world, should have allowed their military autocracy to drive them into war.

Trust and Cartel.—I am afraid, after this war, if we expect to keep a place for our trade in the world, that we may have to revise some of our ideas as to so-called trusts and the Sherman law. Trusts or combinations are not only permitted, but even encouraged in Germany. They are known there as "cartels," and the difference between the American trust and the German cartel is that the American trust has, as it were, a centralised Government permanently taking over and combining the competing elements in any given business, while in Germany the competing elements form a combination by contract for a limited number of years. This combination is called a "cartel," and during these years each member of the cartel is assigned a given amount of the total production, and given a definite share of the profits of the combination. The German cartel, therefore, as Consul-General Skinner has aptly said, may be likened to a confederation existing by contract for a limited period of time, and subject to renewal only at the will of its members.

It may be that competition is a relic of barbarism, and that one of the first signs of a higher civilisation is an effort to modify the stress of competition.

The German Courts have expressly said, if prices are so low that the manufacturers of a particular article see financial ruin ahead, that formation of cartels by them must be looked upon as a justified means of self-preservation.

The object of the American trust has been to destroy its competitors; the object of the German cartel to force its competitors to join the cartel.

Closely following the inception of the Cable-Makers' Association, my partner and I deemed it desirable to set on foot a co-operative movement amongst electrical manufacturers of accessories, and, having regard to the initial success of the C.M.A., collaborated with Mr. Bevis, of the General Electric Co., Ltd., who had conceived a similar idea, and we jointly founded the National Electric Manufacturers' Association. It is common knowledge that this Association was finally transformed into the British Electrical and Allied Manufacturers' Association, whose record, achieved since the outbreak of war, under the able secretaryship of Mr. Dunlop, is unparalleled, and must bring lasting and uplifting benefit to the industry.

My principal object, however, in writing now is to state that I am making an effort to co-ordinate the efforts of the many Trade Associations which now exist. As a first step, I have approached the Council of the Institution of Electrical Engineers, soliciting their support, and asking them, as the parent institution, to offer kindred institutions and federations the hospitality of their roof for joint meetings, which it is always desirable should be held upon neutral ground. I am glad to say the Council have favoured the suggestion and taken steps to put the resolution into immediate effect. This is a step for which the whole trade have cause to express gratification, and I am sure the premier Institution will benefit by the broad policy it has decided to adopt.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Electricity Supply Meters and Fuses.

A few suggestions on a somewhat neglected topic may not be out of place. The relation between a supply authority's meters and fuses is a most important matter if the meters are to have their just treatment. In all distribution systems the supply authority has a fuse on each consumer's premises, commonly termed "main" fuse. The main fuse is a protection for the meter so long as the size of the fuse is determined by the current capacity of the meter. A percentage overload should be allowed, say the fuse to be 150 per cent. to 200 per cent. the current capacity of meter, the latter figure to apply to power consumers. Rules to this effect, if not entirely

lacking, are not sufficiently enforced to be made effective. Many main fuses have been found, the fusing current of which was 20 times the full load meter current; by their proportions they seemed capable of protecting the power station only. A piece of 24/30's stranded copper wire, and a large hair-pin, are two recently found "fuses" supposed to be protecting 5-ampere circuits.

Consumers should be encouraged to keep their fuses of a less capacity than the main fuse. This point is practically solved by charging consumers a small fee whenever the main fuse has been burnt out or tampered with. The subject is worthy of serious consideration since a burnt out or damaged meter may cost for repairs anything up to 50 per cent. of its initial price, if at all repairable.

Small meters also suffer ill-treatment, in cases where they are used on lighting loads, the consumer also having a large power load. Almost without exception the lighting meter is connected through the same main fuse as the power meter. A quite common case is a 5-ampere meter connected through a 200-ampere fuse.

Thus the lighting meter is at the mercy of the consumer's fuse, which very often is the first piece of conducting material found that will fit into the fuse holder. Why not a separate main fuse of the required size? The meter is surely worth this small extra outlay. Many cases have occurred where the meter was entirely destroyed.

If the foregoing points were given a little more thought they would considerably reduce meter renewals funds and also relieve meter departments of a good deal of worry. Even small matters should carry weight in the "reconstruction" time.

H. G.

The E.T.U. and the A.E.S.E.

As one who has joined the A.E.S.E. and tried to join the E.T.U. I think my opinion may be of interest.

As to the A.E.S.E., it simply seemed to fizzle out; I was certainly not informed of its being suspended owing to the war.

In regard to the E.T.U., at present there does not seem to be any organisation for dealing with shift engineers in the provinces.

I believe that if only these two associations could amalgamate they would form a really strong union. There is a desperate need for one. The point to remember is that the organisation would have to deal with a number of scattered members.

I think the situation may be summed up in the words, "United we stand, divided we fall."

Shift Engineer.

At last the station engineers have a live organisation—namely, the Station Engineers' Branch of the "Electrical Trades Union." Its membership is very large, and is rapidly increasing. There are three branches in London, and a fourth and fifth will open in a few days. Station engineers' branches have also been established at Birmingham, Glasgow, Liverpool and Manchester.

These facts should convey to those who at present are not members that the station engineer has realised the advantages of allying himself to an efficient and sound body who study his best interests.

The long-dormant A.E.S.E. realise that it is time for them to wake up, but their tactics *re* conferences are certainly not shrewd or well-planned, as an effective organisation will not tolerate any interference of a body that has been asleep for two years.

The "status craze," although it still lingers, is developing broadly on democratic lines, and the station engineer finds that whilst the A.E.S.E. is still yawning, the E.T.U. has drawn up a "Schedule of minimum rates for station engineers," and negotiations are at present in progress for its adoption, combined with a war wage.

We welcome Mr. W. J. Ebhen and his colleagues of the A.E.S.E. to join us as members of the E.T.U., when we can greet them as brothers in effort and brothers in our assured success.

Charles W. Barnes,

Secretary, No. 2 Branch London Station Engineers,
Electrical Trade Union.

Lack of united organisation in the past is the cause of the low money paid to station engineers.

The A.E.S.E. have been in existence, and supported by central station and sub-station engineers, for a number of years without any apparent result regarding a general increase of wages.

The E.T.U. (who have drawn up a trade card for London with definite rates for shift engineers, switchboard attendants and sub-station attendants) after about eight months, have now in London alone the support of about 700 station men of all grades, many of them former members of the A.E.S.E.

The A.E.S.E. have been roused from inactivity through the E.T.U. successfully bringing their trade card before Sir George Askwith, and their resuscitation at this particular time would seem to indicate a recognition of the strength of the E.T.U. station engineers, and a desire to be included in any award the E.T.U. may obtain, without associating with a Union which is open to their (sometimes better paid) assistants.

Since every man in a power station performs his respective and necessary duties, and the shift engineer is dependent on his assistants for the satisfactory running of a shift, there can be nothing derogatory for a shift engineer to be in the same Union with his men. In some stations drivers are appointed shift engineers when vacancies occur, consequently a Union composed of shift engineers alone must be less potent than one embracing all grades of staff.

The shift engineer has status, staff and responsibility and is expected by his chief to be dignified. His remuneration, however,

is neither consistent with the responsibility, commensurate with the danger, adequate for maintaining status, nor compatible with dignity. What discipline could be maintained by a foreman whose men earned more or as much as he? And what dignity could a chief engineer maintain if his salary were not greater than that of his assistants?

The shift engineer's position is very difficult and absolutely anomalous: indeed, I know of no parallel in any other occupation, and the sooner we all unite in one organisation the sooner we may hope for better conditions.

Since both E.T.U. and A.E.S.E. have the same end in view, success would probably be hastened by joint action instead of being at loggerheads as apparently they are now.

October 8th, 1917.

Engineer-in-Charge,
I.E.E. and E.T.U.

Instructions to Meter Readers.

It hardly appears from Mr. Withey's letter that he can have had very much experience in dealing with a staff of meter readers, or of the class of conversation they are likely to have with consumers. I can assure Mr. Withey that such conversation is much more likely to consist of opinions that the meter is 200 per cent. fast, or the voltage 25 per cent. below normal, than of inquiries that would greatly interest the Publicity Department. The business of meter reading, moreover, is one that is usually required to be carried out in the smallest possible time, and the suggestion that meter readers should combine a sort of half-hearted canvass with their proper duties can scarcely be regarded as practicable.

London, E., 5th October, 1917.

G. W. Stubbings.

Accountancy in Small Undertakings.

There has been in the last few years a great increase in the number of village and small town electricity schemes. Many of these are run by small companies of local people, the clerical work being undertaken as a part-time job by some local man with an aptitude that way. An experience of the writer may be of interest in this connection.

In the case under notice the engineer happened to see, quite by chance, a draft of the balance-sheet which the secretary had prepared. He saw that the financial results as presented thereon were very seriously incorrect, and, on looking further into the matter, found one of the items under "Running Expenditure" to be extensions to plant! Further, under the heading of "Repairs and Maintenance" were included scores of pounds' worth of new poles, wires, and meters used in extending a supply to absolutely new customers. The secretary, on being remonstrated with, admitted that all these things were an addition to the assets of the concern, but could not be induced to alter the sheet. At a meeting of the directors the matter was brought up by the engineer in his own interest, as the real maintenance costs had been quite normal, or rather on the low side. In the same case, also, the amount of gross profit had been given to the income-tax collector as net profit, causing the company to pay double what it should have done for three years' running.

All this was admitted by the directors, but the suggestion that a chartered accountant should be paid a fee occasionally to overlook the accounts—a fee which would have been repaid many times over by the money lost to Inland Revenue—was not accepted. The natural effect on that engineer is this—that he feels that, however well he may do in keeping down costs, the credit due to him is liable to be effectually obliterated by faulty accountancy over which he has no control, and he is on the look-out for a position where striving for efficiency will bring him more appreciation.

I do not know whether any others of your readers have encountered this difficulty in these small concerns.

Country Mouse.

LEGAL.

THE KENSINGTON AND KNIGHTSBRIDGE ELECTRIC LIGHTING CO., LTD., AND THE NOTTING HILL ELECTRIC LIGHTING CO., LTD.

The following is a copy of the award of MR. JAMES SWINBURNE, F.R.S., the arbitrator in this case, the hearing of which was reported in the ELECTRICAL REVIEW for July 20th, p. 58.

"With regard to the Kensal Town supply, I find that:—

"1. Clause 3 of the agreement of 1900 means that the respondents are to take from the joint station at Wood Lane all the electrical energy over and above that generated by its own generating station at Bulmer Place that they require.

"2. Though the privileges granted by the Kensington and Notting Hill Act of 1899 were not specifically extended by the Act of 1909 the companies are justified in taking energy from Wood Lane for the supply of fringe consumers: and the agreement of 1900 binds them to do so, as long as any of the stock mentioned in it is outstanding, to the full extent to which they would have been bound had the Act of 1899 specially entitled them to use Wood Lane supply for fringe or outside areas.

"3. The respondents' business is all their supply of electrical energy, including any supply of energy which was not, or is not, duly authorised by Act of Parliament.

"4. The respondents make no secret of taking energy from outside sources; but the claimants did not know, or its officers did not realise, until recently, that this involved any question arising out of the agreement of 1900; and the claimants did not recommend taking outside supply, nor did they condone any infraction of the agreement. The claimants have suffered damage.

"5. By the agreement of 1900, so long as any of the stock shall be outstanding, each of the two companies shall from time to time take from the joint station all such electrical energy, in excess of that generated in its own station or stations existing within what was its statutory area in 1900, as such company may require for the purpose of supplying energy in accordance with the provisions of the principal agreement or such other provisions as may from time to time be agreed upon between the two companies or settled unanimously by the Committee.

"6. In accordance with 1, 2, 3, and 4, the respondents shall pay the claimants the sum of £189 (one hundred and eighty-nine pounds) damages in respect of the supply in Kensal Town in 1909; and in respect of the costs of this branch of the reference, a sum equal to one-tenth of the total taxed costs of the claimants, in the whole of the proceedings before me. But if it should be held that I am wrong in my view of the construction of the agreement concerning the supply in Kensal Town in 1909, the respondents shall not pay the said £189 or corresponding costs and the claimants shall pay the respondents a sum equal to one-tenth of the total taxed costs of the respondents.

"7. In accordance with 1, 2, and 4, the respondents shall pay the claimants the sum of £1,661 (sixteen hundred and sixty-one pounds) damages in respect of the supply in Kensal Town since 1909, including 1916; and in respect of the costs of this branch of the reference, a sum equal to seven-eighths of the total taxed costs of the claimants in the whole of the proceedings before me. But if it should be held that I am wrong in my view of the construction of the agreement concerning the supply in Kensal Town since 1909, the respondents shall not pay the said £1,661 or corresponding costs and the claimants shall pay the respondents a sum equal to seven-eighths of the total taxed costs of the respondents.

"8. With regard to Hammersmith, I find that:—

"(a) It is my duty to deal with this question, and I treat it as if it were a separate arbitration, its cost being 1-40th of the whole taxed costs.

"(b) The supply at Hammersmith is a breach of the agreement of 1900; and Clauses 1, 2, 4, and 5 of this award apply to this case also.

"(c) In accordance with 1, 2, and 4, the respondents shall pay the claimants the sum of £50 (fifty pounds) damages in respect of the supply in the Hammersmith district up to and including 1916; and in respect of the costs of this part of the reference, a sum equal to 1-40th of the total taxed costs of the claimants, in the whole of the proceedings before me. But if it should be held that I am wrong in my view of the construction of the agreement concerning the supply in Hammersmith, the respondents shall not pay the said £50 or corresponding costs, and the claimants shall pay the respondents a sum equal to 1-40th of the total taxed costs of the respondents.

"And I further award that the costs of the award be paid by the respondents if my award of £1,900 damages holds good. If not, it shall be paid by the respondents in the proportion of the damages payable by them, the rest being paid by the claimants."

TRAMCAR PASSENGER'S INTERFERENCE.

At Sunderland Police Court on the 5th inst., Alfred Coates, an electrical engineer, was charged with having interfered with an electric switch on one of the Corporation tramcars. The Deputy Town Clerk said defendant was a passenger on a tramcar, and while the car was running along Kayll Road the motorman felt it coming to a standstill. He went to the back of the car to ascertain the cause and found the conductress holding the defendant. She complained that the defendant had knocked out the switch. Accused was fined 10s.

The British Engineering Standards Committee and Anglo-American Co-operation.

—The American Institute of Electrical Engineers has very cordially accepted the Committee's invitation, and has appointed Mr. H. M. Hobart, M.Inst.C.E., M.I.E.E., as the delegate of its Standards Committee to confer with Sir Richard Glazebrook's Panel Committee on the Standardisation Rules for Electrical Machinery, and it is a pleasure to be able to announce Mr. Hobart's safe arrival in this country. The chairman of the British Engineering Standards Committee, Sir John Wolfe Barry, K.C.B., and Sir John Snell, chairman of the Sectional Electrical Committee, will welcome Mr. Hobart on Wednesday, October 17th, the first day of the Rating Conference.

Moreover, Mr. Hobart's presence in England will afford an opportunity for consultation in regard to the standardisation of electrical apparatus generally, in connection with which much work is being carried out by various Panels of the Committee, especially in respect of motor starters, ship's fittings, fuses, instruments, and instrument transformers, under the direction of Mr. C. H. Wordingham.

As on the previous occasion at the Rating Conference, the Canadian National Committee of the International Electro-technical Commission has invited Mr. A. P. Trotter to represent it.

WAR ITEMS:

From the Front.—A correspondent with the Forces in France writes as follows, under date October 1st:—"I write to acknowledge with my very best thanks the receipt of the REVIEW, which arrives regularly on Monday evening. It is very much appreciated by 15 electrical men here, and every Monday I am reminded by all of them: 'Don't forget to let me see the REVIEW, will you?' All the articles are read and duly discussed, the 'Lighting and Power Notes' are carefully digested, and finally the advertisements are gone through. Before the arrival of the paper I am always prepared to bet that Silvertown advertisement will be on the back cover, Davis & Timmins's on the last page, and so on. It is quite amusing to see how childlike we all become out here. There is some excuse, however, as the life is rather monotonous. We are getting a nightly visit from the Huns at present, and he doses us liberally with scrap iron; he gets a warm reception every time, though, I can assure you. Once again thanking you on behalf of all the electrical men here for your kindness, and hoping it will not be long before we are all buying our own REVIEWS again in dear old Blighty."

Chemical Trades After the War.—The Minister of Reconstruction has appointed a committee to advise him as to the procedure which should be adopted for dealing with the chemical trades after the war. Sir Keith W. Price, of the Ministry of Munitions, is chairman of the Committee. It is stated that Dr. Addison has requested the Committee to conduct their deliberations with a view to the creation of some organisation which should be adequately representative of the trade as a whole, and by means of which the trade may be enabled hereafter to continue to develop its own resources and to enlist the closest co-operation of all those engaged in the chemical industry.

Reconstruction in Russia.—An Economic Council and a Central Economic Committee have been instituted, attached to the Provisional Government, for the purpose of drawing up a general plan of economic and labour organisation and for the elaboration of legislative and other measures for the regulation of the economic interests of the country. A sum of 200,000 roubles is assigned for preliminary expenses. The decisions of the Economic Council must be confirmed by the Provisional Government. The Council will be a permanent and salaried organisation. The Central Economic Committee is to co-ordinate measures introduced by separate departments and institutions for the regulation of the economic interests of the country. It will also co-ordinate measures in the different branches of trade and industry. A full statement on the matter by H.M. Commercial Attaché at Petrograd will be found in the *Board of Trade Journal* for October 4th.

The Machinery Trade After the War.—Notwithstanding the release of a large number of the factories now engaged upon war munitions as soon as peace has been proclaimed, there is some doubt about the ability to replace in anything like sufficient quantity or time the immense amount of machinery that will be required. During the last two years it has been difficult to obtain from European manufacturers new machinery of any kind, while, since the United States came into the conflict, the same lack of ability to fulfil South American orders has been manifest from this direction. Important repairs have had to be postponed, and an enormous quantity of existing machinery will have to be "scrapped" and replaced by entirely new installations. A leaf might well be taken, by our larger manufacturers of machinery and equipment, out of the book of our keen rivals, the North Americans, who, in order to grapple with the unprecedented demand after the war, have already formed among themselves what is known as the "Allied Machinery Construction Corporation," which represents a group of leading, but non-competing, manufacturers of construction machinery, and who, taken together, produce all of the main types of such equipment. The group, however, excludes concrete mixing and distributing plants, steam and other power shovels and excavating machines, trench and ditch-digging machines, grab buckets, hoisting engines, light railway lines, light locomotives, and cars of all types, and a great variety of similar special equipment. We have something of the kind already in the machine tool trade, and further developments would undoubtedly prove beneficial. From the inquiries that have been pouring into the different factories for many months past, and which can only be satisfied in full when normal conditions are again restored, it would appear that the greatest demand for South America will be in the following lines:—Machine tools and sugar-cane machinery, all kinds of labour-saving construction machinery, agricultural machinery and implements. It is thought that a few smart and enterprising travellers, representing the great manufacturers of the specialties mentioned, could do a very prosperous business in both South and Central America if a move in combination were made at the earliest moment. One traveller, for instance, might act as the agent of a dozen, or even more, non-competing firms, thus minimising the expense and securing co-operation for some considerable time to come in the shipping difficulties which will have to be faced and overcome even after the war is over.—*The Engineer*.

The R.F.C.: Women Wanted.—The Women's Army Auxiliary Corps is calling for large numbers of women to work in aircraft repairing depôts, both at home and in France. There are wanted immediately by the Royal Flying Corps 144 fitters (general machine and turners), 52 instrument repairers, 20 acetylene welders, 37 electricians, 12 draughtswomen, 2 tracers, 145 storekeepers for technical stores (knowledge of engine parts and tools), also tinsmiths and coppersmiths. All applications should be made to the Exchanges, where full information will be supplied.

"For Those in Peril on the Sea."—The "Daily Telegraph" is making a Special Appeal on behalf of King George's Fund for Sailors, to which reference was made in our pages a few weeks ago. What we owe to those who go down to the sea in ships in these perilous times, and to the dependents of those who, in the course of duty with the Royal Navy, the Mercantile Marine, and the Auxiliary Services, make the great sacrifice or are maimed—who can count the sum of it? It is by these that we are allowed to have our daily bread, are able to support our forces in the different battlefields, and are protected in our Island Home from invasion. Words cannot express our admiration and our feelings of deepest gratitude, nor can subscriptions to a fund discharge our obligations. Admiration and gratitude our sailors have from all, and right well they know it. Let our readers see to it that through the medium of King George's Fund for Sailors their generosity takes a practical form in the shape of subscriptions sent to the *Daily Telegraph* Office, Fleet Street, E.C.4. The death roll of the sea in the war has been large indeed. In addition to the losses of men with the Fleet, over 6,000 sailors of the Merchant Navy have paid the great price on our behalf, and the call now is for at least a million pounds more to be subscribed to the fund on behalf of those whose bread-winners have passed within the veil. The stringency of the times must not be permitted to stand in the way of the realisation of that total.

Exemption Applications.—Peterborough Tribunal has granted three months' exemption to A. V. Yeomans (24, C3), car cleaner, employed by the Electric Traction Co.

At Morecambe, H. B. Atkinson, electrical engineer, appealed for exemption. It was stated that he had gone into a factory, but he had secured a man to do his electrical work at home. The Mayor remarked that Atkinson was given exemption as he was the only electrical engineer in the town to do certain necessary work, and now he had left it for something else. It looked as though he was playing with the Tribunal. The application was refused.

At Fleetwood, an electrical fitter, one of two C1 men, was given temporary exemption to the end of the year, his employer stating that he had a great many breakdown jobs in hand.

At Ormskirk, the Ormskirk Electric Supply Co. appealed for C. Chester and W. A. Hodson, both single and aged 18, the former B2 and the latter C1, who are employed as electrical engineers and fitters. It was claimed that they were in certified occupations, but the Military Representative questioned whether apprentices could be described as skilled men. For the company, it was stated that at the present time they had two engines broken down, and were "in a terrible mess," and that they had offered £3 a week for men to take their places, but had received no applications. Sixteen men had gone, and if these were taken the works would have to close down. Exemption to the end of the year was granted, the youths to join the V.T.C., the company to make further efforts to obtain substitutes.

The Military Representative appealed against the conditional exemption granted at Burnley to five motormen in the Corporation tramway department. Two of them were given final exemption for six weeks, and the others temporary exemption to the end of the year, open.

Malmesbury Rural Tribunal has given exemption until January 15th to C. A. Harvey (32, C3), electrician on the Earl of Suffolk's estate.

Four months' exemption, with leave to apply again, has been granted to E. W. C. Clayton (C3), electrician at the New Cross Empire.

At Bath, reviews were made of the cases of two drivers with the Bath Electric Tramways Co., Ltd., G. Dicks (40, Class A) and G. Humphries (35, Class A), both of whom held conditional exemption. The Military stated that "substitutes had been found, and the certificates were withdrawn."

Messrs. Edwards & Armstrong, electrical engineers, of Cainscross, appealed at Stroud (Glos.) for F. Marston (30, C1), engineer in charge of the firm's electrical works at Ludlow; J. T. White (28, C1), in charge of the electrical works at Tewkesbury; J. F. Cuddington, R. G. Young, and E. Preese, apprentices; and R. J. Sweeting (31, B3), electrician engaged in the repair of motors. Captain Wood said that the company had done extremely well in supplying men to the Army, and having regard to the fact that they were suffering from shortage of labour, he assented to temporary conditional exemption to March 31st, and this was agreed to.

At Stroud (Glos.), Messrs. T. B. Worth & Co., Ltd., Thripp, appealed for W. Rogers, electrician, passed for general service, and exemption until January 31st was granted.

At Hove, the Military appealed against exemption held by the accountant and chief clerk at the electricity works. He was previously classified B1, but had been put down to C1.

Sir Walter Miéville agreed with a suggestion that the man was doing more useful work in his present capacity than if he was to go into the Army. On Major-General Mason intimating that he would be put into a clerical department in the Army, the Mayor observed: "Why not let him remain, if that be so?" The appeal was refused.

At Broadstairs there was a Military review of the case of a storekeeper (31, Class A) with the Isle of Thanet Electric Tramways & Lighting Co., Ltd. He was granted conditional exemption until an efficient substitute is found, and the Military Representative contended that he was not a skilled man, and therefore not in a certified occupation. The manager of the company, Mr. J. A. Forde, urged that the man was a skilled workman, and in a certified occupation irrespective of age. The Tribunal held that the man was in a certified occupation and indispensable to the company, and they confirmed the certificate of exemption.

Appeals were made at Dewsbury for the principal of a local firm of electrical engineers, aged 23, and for two employés, one an electrical fitter (23) and the other the foreman engineer and turner (31). The firm was stated to be engaged upon very important work, including a contract in connection with a military hospital. The principal was granted exemption, the fitter was directed to join up in two months, and the other man in one month.

At Brighton, a local firm appealed for an electrician and fitter (30, C3), it being stated that the man was doing important work in electrically fitting up local military hospitals. Sir John Blaker (for the Military) urged that the man would be of even more use in the Army, where electrical fitters were badly needed. He would probably be very useful abroad for the Army, not, of course, in the fighting line, but on electrical work. Mr. A. F. Gasston (a member of the Tribunal) said that he believed that C3 men who had been sent into the Army were being turned out of it now, and Sir John Blaker replied that they must be men with no trade. Mrs. Ashton expressed surprise that C3 men would be sent abroad. Sir John Blaker: Not into the firing line, and it does not follow that he would go abroad. He could be used on electrical work at home, and if you visit military camps in this country you will be astonished at the big electrical plant they have for different purposes, including the generating of their own electric light. The appeal was allowed.

At Mansfield, there was a Military review of the cases of J. Tranter (29, Class A), inspector, and G. W. Marshall (35, Class A), driver, engaged with the Tramway Co., given conditional exemption in May, 1916. The Military Representative said that the review was made on account of the classification of the men, and Mr. Walker, manager of the company, stated that Tranter was formerly an inspector, but, being a skilled electrician, he was now doing much more important work in looking after the overhead cables. He was prepared to let Marshall go, as they could find a woman to take his place. Tranter's exemption was continued, but that of Marshall was cancelled.

BUSINESS NOTES.

Trade with Brazil: A Consul's Counsel.—The Acting British Consul at Bahia, who has recently visited a number of towns in Brazil has reported giving information respecting commercial conditions which is published in the *Board of Trade Journal* for September 27th. Among the points touched upon are: commercial travellers, openings for trade, and packing. In regard to the first, he finds that at Aracaju, German travellers, even at the present time, are numerous. Complaint is made that, as a rule, British travellers are not accommodating as regards the particular requirements of prospective customers, and the Consul is convinced that in many cases a little tactfulness and resource on the part of travellers would promote trade. One firm stated that prior to the war it received constant visits from German travellers, that it was buying every year more from Germany, and less from the United Kingdom, and that it is also buying largely from the United States at present. There is a great field for the initiation of business through the agency of travellers in Aracaju, but it is useless to send men who do not speak the language and who cannot, at any rate partially, understand the Brazilian character. With regard to the ironmongery stocked at Aracaju, much of this of British manufacture is superior to any others, but the cheap German goods are preferred, as buyers cannot afford to pay our high prices. He does not advocate that British manufacturers should imitate the inferior goods supplied by German firms, but, after comparing the goods, he states that British manufacturers could probably turn out very serviceable articles at but slightly higher cost than the cheap German goods, and that once British goods were introduced they would hold the market. Articles to last a life-time are not required, but cheap goods which can be readily replaced. With regard to the packing of German goods, the usual thoroughness is shown in ticketing. Tickets on German goods are the same as are used for sales in Germany, but printed in Portuguese, thus saving shopkeepers a great deal of trouble. British goods are ticketed in English, and the shopkeepers have to make Portuguese translations and gum them on. This extra trouble does not facilitate sales any more than conducting correspondence in Spanish. The language to use is Portuguese. In looking through the correspondence of one firm, however, he

was gratified to find how much of it from British houses was written in excellent Portuguese, though some was written in English, a matter which always creates difficulty, as English is not usually understood.

"Supertax" on British Trade with Australia.—The *Australian Statesman and Mining Standard* characteristically takes up the cudgels on behalf of British export trade against the Australian Customs Authorities, who are adding 10 per cent. to the amount stated in invoices on certain classes of machinery. We quote from our contemporary's leading article, entitled "Super-taxed British Trade," below:—

"Under a clause in the Tariff Act, originally designed to operate in pre-war conditions of trade, the duties on various engineering and other imports are based on the fair selling value in the country of origin at the time of shipment. In the present disorganised state of the markets in Great Britain, it is probably often difficult to arrive at a close approximation of 'fair selling value.' This consideration does not, however, appear to trouble the Australian Customs Authorities much. They have come to the conclusion that in many instances of late the declared value is understated, and they have accordingly adopted an arbitrary practice of adding 10 per cent. to the amount stated in the invoices on certain classes of machinery. No doubt they have a technical right to do this; but in instances where they show a rigid insistence upon their own judgment and powers, their action conveys, to reputable English firms, an appearance of harshness, and even of sharp practice. The 'loading' of invoices to the extent mentioned presses with considerable severity, and possibly serious injustice, in the case of important electrical contracts which were undertaken before the beginning of the war, and thus before the firms concerned could protect themselves by special arrangements to meet losses through delays, increased costs of production, and other causes. Apart, however, from the question of justice involved in this new rule of the Customs Department, what are we to think of it as an indication of policy—of a policy which not only tends (owing to the conditions of production in England at the present time) to favour foreign manufacturers, but is inconsistent with, if it does not actually stultify, the unqualified assurances given at intervals by our leading political representatives that the Commonwealth would do the utmost in its power to aid Great Britain during the war? Those assurances undoubtedly imply an obligation to assist the export trade of Great Britain, or at least to avoid discouraging and injuring it. By helping to maintain it we can do a service of real, if indirect, importance in the war. . . . To inflict, under an obsolete law, practically penal surcharges on British firms at the Commonwealth Customs Offices, while Australia is handling tens of millions of British money, is worse than ridiculous; it is stupid and humiliating. If the personnel of the Customs Department cannot bring themselves to interpret their discretionary authority in a more rational spirit, the matter should receive prompt attention from the Government or the Federal Parliament."

Spain.—There has been formed, at Barcelona, an industrial supplies company styled Sociedad Anonima Abastos Industriales, with a capital of 100,000 pesetas. The company will trade in industrial and agricultural machinery, motors, dynamos and accessory electrical material, manufacture complementary parts, import and export primary materials, and manufactures. The promoters are Messrs. Marimon & Jorda.—*La Energia Electrica*.

Scarcity of Lamps in S. Africa.—The *British and South African Export Gazette* says that electric lamps are so scarce in South Africa that those supplies presumed to be on the water are being disposed of on "to arrive" terms.

Our Commercial Intelligence Service.—At the last meeting of the Advisory Committee to the Board of Trade on Commercial Intelligence, the President of the Board of Trade and Sir A. H. Steel-Maitland made statements as to the reconstitution on an extended scale of the Department of Commercial Intelligence under the arrangements recently concluded between the Board of Trade and the Foreign Office. The Committee also considered questions relating to the promotion of British trade and shipping interests in Latin America, and a report of a special inquiry into the electrical trade in Spain and Portugal. A report to the Board of Trade on the work of the Committee since its appointment in 1913 was adopted; and this being the final meeting, the President expressed to the members his appreciation of the valuable assistance given by them to the Board of Trade during their period of office.—*Daily Telegraph*.

Italy.—Under the style of the Società per lo Sviluppo della Cianamide e di altri Prodotti Chimici, there has been formed at Rome, with commercial and administrative quarters at Turin, a company for the production of cyanamide and other chemical products. The company has interests in the most important foreign cyanamide concerns, and proposes greatly to develop this industry, as well as the chemical industry generally. An influential management committee has been nominated.—*Revista Tecnica d'Elettricità*.

Lighting Large Areas.—That the arc lamp is by no means out of the running is shown by a leaflet which Messrs. JOHNSON & PHILLIPS, LTD., recently issued, giving the comparative running costs of a 2,000-C.P. unit per year of 4,000 lighting hours, with an arc lamp and with half-watt lamps respectively. The 8-ampere "Metroflam" flame arc cost £11 9s. 8d. inclusive and the half-watt lamps (two of 1,000 C.P. each), with renewals, £28 0s. 10d., energy being reckoned at 1d. per unit. The flame arc, in fact, is unexcelled for the economical lighting of large shops and yards where powerful units are required.

Book Notices.—A small journal, called the *Smic Record*, has been issued by Messrs. Watson & Sons (Electromedical), Ltd., of 196, Great Portland Street, W. 1, dealing with the progress of the X-ray industry, which has been extraordinarily rapid during the war, owing to the universal use of X-ray apparatus at the military hospitals. The first issue contains short articles on X-ray plates, a new exposure meter, dental radiography, &c., and future issues will be supplied regularly to any reader who applies to the firm for them.

"Theory and Calculations of Electrical Apparatus." By C. P. Steinmetz. London: Hill Publishing Co. Price 17s. net.

"Minutes of Proceedings of the Engineering Association of New South Wales." Vol. XXXI. Sydney: The Association.

"Proceedings of the American Institute of Electrical Engineers." Vol. XXXVI, No. 9. September, 1917. New York: The Institute. Price \$1.

"Heat Drop Tables." Calculated by H. Moss from the formulae and steam tables of Prof. H. L. Callendar, F.R.S. Published for the Turbine Section of the B.E.A.M.A. London: Edward Arnold. Price 5s. net.

Liquidations.—**WORTHINGTON PUMP CO., LTD.**—This company is winding up voluntarily, with Mr. F. M. Whiting, Queen's House, Kingsway, London, as liquidator. The liquidation is for the purpose of amalgamation with a company with which the Worthington Pump Co. have been associated for many years. The business of the two companies will be carried on as hitherto at the same address, and creditors will be paid in full.

BRITISH CONTINENTAL ELECTRICITY CO., LTD.—A meeting of creditors is called for October 19th, at 21, Finsbury Pavement, E.C. Liquidator, Mr. C. E. Barker.

Trade Announcement.—The Jandus Arc Lamp and Electric Co., Ltd., has changed its name to ARC AND GENERAL EQUIPMENT, LTD. The alteration has been made because difficulty has arisen from time to time with reference to the name "Jandus," regarding which there was a suspicion that the company was of German origin. We understand that William Jandus was a native of Ohio, U.S.A., and that he no longer holds any interest in the company.

Trade with Switzerland.—Mr. J. B. Beak, the Acting British Consul-General at Zurich, who is visiting this country, will be prepared to interview by appointment representatives of British firms at the offices of the Department of Commercial Intelligence, commencing on Monday, October 22nd. British firms who may desire to have an interview with Mr. Beak are requested to make their applications as soon as possible, and in any case not later than Thursday, October 18th, to the Comptroller-General, Department of Commercial Intelligence, 73, Basinghall Street, London, E.C. 2. Reference number, 46,273/17.

Catalogues.—**MESSRS. MELDRUMS, LTD.,** Timperley, near Manchester. Two illustrated lists, one (No. 86) giving particulars and pictures of typical refuse-destructor installations for power production; the other (89) dealing with apparatus for chemical and explosives and other works.

A. Gallenkamp & Co., Ltd.—The Public Trustee is inviting tenders for 1,650 preference and 1,341 ordinary shares in this company of laboratory fitters and makers of scientific apparatus, under the Trading with the Enemy Acts.

LIGHTING AND POWER NOTES.

Basingstoke.—**PRICE INCREASE.**—The T.C. has decided to increase the charges for current by 15 per cent. as from September 29th.

Bradford.—The Corporation Electricity Committee has decided to apply to the B. of T. for power to disconnect classes of non-essential consumers in cases of urgent necessity, as suggested by the Coal Controller.

Braintree.—**PROV. ORDER.**—The U.D.C. has decided to apply for a prov. order for electric supply, and to oppose, solely to protect the interests of the town, any similar application by the Crittall Manufacturing Co., Ltd.

Coal Economy.—It is reported from Oldham that certain Corporation departments are short of coal, the stock being 10,000 tons under the normal amount, and the Coal Controller is to be interviewed. The question of coal consumption at the Middleton electricity works has been investigated by Mr. Robertson (for the Coal Control Department), and he is in agreement with the proposal to convert the station into a transforming and distributing centre, utilising a bulk supply from Manchester. At Wigan T.C. attention was drawn to the necessity of persuading small power users to convert to electrical driving in the interests of fuel economy.

Continental.—**SPAIN.**—Application has been made for a concession to establish a hydro-electric station on the River Hormazuela, in the Isar district, with a view to supplying Isar and Villa Nueva de Argano with electric light.—*La Energia Eléctrica.*

Consequent upon the result of trials carried out at the Maria Luisa colliery, at Langreo, underground electric traction has been introduced into the majority of the groups of the Sociedad Metallurgica Duro-Felguera. Twelve 26-H.P. locomotives have been installed, continuous current at 220 volts being employed.

Darlington.—Domestic consumers desiring to use electricity for heating, &c., are to be charged 4d. per unit up to the amount consumed for lighting in previous quarters, and 1½d. per unit for excess consumption, the amount to be paid by a consumer to be not less for any six months ending June or December than the amount fixed for lighting, plus 20s. for heating or cooking. This rate overcomes the present difficulty of installing two meters on a consumer's premises.

Derby.—The T.C. has contracted for the repair of the armature of a turbine set which has broken down after ten years' continual heavy work—at a cost of £725. The new plant which the Council contracted for in January has not yet been received, and an appeal has been made to the public to economise in the use of electricity over peak load periods. An extensive new works which it had been hoped to supply, intends to provide its own electricity, the Government finding the funds, and thus directly negating the policy of concentrating electric power production which it is supposed to be strongly supporting.

Halifax.—**WAGES.**—The Corporation employees, on Sunday night last, decided that their demand for increased wages, rejected by the T.C., be submitted to arbitration. They ask for a further 6s. per week, to bring their war bonus up to 15s. per week above pre-war wages. In August they asked for 12s. above pre-war rates, and the Committee on Production granted 9s., which was a 1s. higher than the Corporation had previously given. The men now hold that since then employees of other Corporations have obtained better awards.

NEW POWER STATION.—Sir John Snell has confirmed the advisability of purchasing the site at Copley for a possible new power station. Though such a station may not be required before 1920, it will be necessary to commence it almost immediately, and the present station in the town is not suited to extension.

Ipswich.—**YEAR'S WORKING.**—The annual report of Mr. Ayton, the manager, on the working of the Corporation electricity undertaking during the year ended March 31st last, shows that the units sold advanced from 3,734,158 in 1916 to 4,836,171 in the year under review, the increase being principally in power units, while public lighting supply decreased. The revenue totalled £39,575, while working expenses were £26,825, and, after meeting interest and sinking fund charges, and £370 war service allowances, there was a deficit on the year's working of £172, although the total revenue shows an increase of £5,606 on the previous year. Coal has cost £2,900 more, wages £540, and repairs were £500 higher than in the previous year; taking the whole of the working expenses, they are £5,470 more, or 30 per cent. increase. Mr. Ayton states that great benefit has been experienced from the new coal-handling plant which was put into operation in September last year, and again draws attention to the ash and clinker content, which has reached as high a figure as 30 per cent., while, generally, it has averaged a figure in the neighbourhood of 20 per cent., or nearly double what the same coal gave in pre-war days. He also points out that a lowering of the boiler-house costs would follow the fitting of mechanical stokers to the five marine-type dryback boilers, and considers that this work, as well as the installation of additional plant, must be undertaken as soon as normal conditions return.

Kingston-on-Thames.—The T.C. has appealed to consumers to use less electricity, owing to the demand for energy for power purposes, otherwise it will at times be necessary to cut off the supply from some portions of the borough.

Kirkburton.—**PROV. ORDER.**—The U.D.C. has given consent to the Huddersfield Corporation for a prov. order to supply electricity in the district.

Leeds.—**POLICE INDICATING LAMPS.**—The police authorities are about to commence the use, by special constables on point duty at night, of indicating lights. The equipment consists of a white light on the left hand, a red light on the right, and a red lamp on the constable's back; thus he is protected from accident in the rear, and can hold up or wave forward traffic with the hands. The lamps are supplied by a 10-volt accumulator strapped to the back by shoulder-straps and the belt, and the total weight is less than 5 lb.

Lewes.—**STREET LIGHTING.**—The T.C. has accepted the offer of the electricity company to provide 30 temporary lamps in the town at a cost of £74, and to light them for £10 a year; the use of gas would cost £30 more.

Liverpool.—The proposal to increase the salaries of Corporation officials has led to a considerable amount of feeling. Strong opposition was expressed, but an amendment that no advance be given to officials in receipt of salaries of £500 a year or more was defeated in Council by a large majority. The Municipal Employees' Association, at a mass meeting, passed resolutions protesting against "exorbitant increases of salary to already overpaid officials, while ordinary employees are practically ignored," and demanded an increase of 8s. per week on the war bonus (12s.) to include all employees over 18 years of age, the present bonus with the increase to be converted into wages.

London.—**STEPNEY.**—The Electricity Committee recommends that all charges made in respect of electricity supplied to consumers, including meter rentals (except special contracts) be increased by an additional 16½ per cent., making a total increase on pre-war rates of 50 per cent., to commence with and include the accounts rendered for the month of October, 1917. An

arrangement has been come to by which the Council will co-operate with the Bethnal Green E.C. in respect to wiring and supply of apparatus for consumers.

HAMPSTEAD.—The annual report of Mr. Wyld, the borough electrical engineer, shows that the total sales of energy, 5,202,454 units, though an increase on the previous year, were below pre-war figures. The net income, £76,628, was £9,109 up; the total expenditure, £78,728, showed an increase of £4,500, and a deficit of £2,100 resulted, as compared with a deficit of £6,710 in the previous year. The reduced deficit is due to increased charges in force. During the year a new 1,500-kw. turbo-alternator was burnt out, the makers accepting responsibility; new B.T.H. switchgear has been erected on the site of the Ferranti board while in commission, by the department's staff, and a new cooling tower has been added.

Marsden.—E.L. PROPOSAL.—At a special meeting of the U.D.C., held for the purpose of considering the advisability of applying for a prov. order, Mr. Ernest Schofield advised the Council not to apply for an order at the present time, and the Council decided to ask the Yorkshire Electric Power Co. how soon it would undertake to supply electricity to the district after the war.

Newcastle-under-Lyme.—LINKING-UP.—The Council has decided that the electrical engineer, in conjunction with the engineer of the Stoke-on-Trent undertaking, shall prepare a scheme for linking-up the two undertakings. A general conclusion in favour of this course was arrived at sometime since at an informal meeting between representatives of the two Corporations.

Oldham.—The restricted output of local cotton mills under the Control Board scheme is believed to be responsible for a decrease in the number of units supplied recently by the Electricity Committee, as compared with last year. The production cost per unit had risen from 0.462d. to 0.516d.

VEHICLE CHARGING.—The Corporation Electricity Department is now prepared with the necessary apparatus for charging electrical vehicle batteries. It is expected that this form of traction will become increasingly popular in Lancashire towns.

Peterborough.—Messrs. Barford & Perkins have voluntarily agreed to pay the T.C. a further increase of 10 per cent. in the price of current supplied to them under contract.

Sheffield.—According to the local papers, the city's electrical undertaking sold during the year ended March last, 48,600,000 units more than in the previous year, an increase of 62 per cent. The revenue increased from £277,580 to £450,088. The total connections increased by 30,000 kw. to 113,870 kw., and applications awaiting connection totalled 21,350 kw. The installation and motor department had a turnover of £55,473, an increase of 50 per cent., and installed over 8,000 H.P. of motors during the year. The electricity department now employs 106 females.

The renewal of the equipment in No. 1 sub-station at the Neepsend power house, at an estimated cost of £2,000, is to be proceeded with.

Stafford.—Land has been purchased by the T.C., at a cost of £1,125, for the extension of the electricity works.

Stoke-on-Trent.—LINKING-UP.—A preliminary discussion between representatives of the T.C. and Leek U.D.C. is to be held regarding the question of linking-up the electricity undertakings, as well as that of the Newcastle-under-Lyme Council.

Sunderland.—YEAR'S WORKING.—The annual report of the Corporation electricity undertaking shows that the total revenue for the year was £78,290, and the expenditure £48,821, leaving a gross profit of £29,469, to which there was added a contribution of £2,026 from district fund towards the sinking funds. The net revenue was applied as follows:—Payment of interest and income-tax, £12,911; repayment of loans, £17,421; contributions to capital, &c., £287; renewals, £870. The net revenue for 1915-16 was £30,636. The capital expenditure to March 31st, 1917, was £494,069, and the loan debt, including a debt of £8,305 remaining on superseded plant, was £263,356.

Swansea.—EXTENSIONS.—The borough electrical engineer has drawn attention to the necessity of extending the plant at the electricity station on account of increased load. Although he did not suggest that the whole scheme should be proceeded with at the present time, yet he thought the question of installing a new turbine of 3,000 kw. or 5,000 kw., with all auxiliaries, should have immediate attention. It was decided to have a report on the subject.

The Electricity Committee has received a report from the borough electrical engineer of a meeting of the Western District Joint Committee on Linking-up. Discussion ensued at the meeting over questions as to the best way of dealing with the intervening mains between adjacent supply authorities (which in this particular case would come specifically under the powers of the South Wales Power Co.), and Mr. Chamen observed that a power company might erect and maintain on such terms as either a rental paid or transmission charges. Mr. Burr said the links would cost the Swansea Corporation some £15,000. The proposed routes of the mains between Swansea and Llanelly and Swansea and Neath were also discussed at the meeting, and Mr. A. H. Thomson (engineer, Neath) estimated that the cost of the Neath link, so far as his Council was concerned, would be some £10,000. The matters were adjourned for further consideration, Mr. Chamen stating that he would be very pleased to commence

negotiations at once with the parties concerned. Mr. Burr's report was adopted.

The Electric Lighting Committee has approved of a recommendation of the Borough Technical College Sub-Committee that Mr. J. W. Burr, the borough electrical engineer, undertake, as a temporary measure, the teaching of the advanced class in electrical engineering at the Technical College.

Walsall.—The Electricity Committee has decided to reconsider the matter of electricity charges three months hence. A Committee on Production award involves the department in an additional wage expenditure of £400 a year.

The erection of the second turbo-alternator is completed, but, owing to trouble with a circulating pump, the alternator is not yet in commission. The Committee has approved a schedule of plant at the Wolverhampton Street generating station about to be advertised for sale.

Wednesbury.—ANNUAL ACCOUNTS.—The report of the year's working of the electricity undertaking shows receipts amounting £12,386, as compared with £10,860; working costs to £11,030, as compared with £8,331, leaving a gross profit of £1,356, as against £2,529 in the previous year. Loan and other charges totalled £3,818, leaving a deficit on the year's working of £2,462, which, with £1,681 debit balance brought forward, makes the total deficiency £4,143. The reduction of public lighting, and the increased costs of fuel and Mond gas, are the principal causes of the unsatisfactory result.

Wharfedale.—The Burley Council, in considering the Yorkshire Power Co.'s application for a prov. order, has asked the company to agree to various conditions, including a purchase clause: the Menston Council favours electric lighting.

Wolverhampton.—PRICE INCREASE.—The Electricity Committee has decided that, in addition to the 20 per cent. increase in the charges for electricity already sanctioned by the Council, a further 10 per cent. advance be made in the charges to consumers of electricity for power purposes who are paying the pre-war price of 1d. per unit and under (plus the 20 per cent. increase), such further increase to date as from October 30th.

Worcester.—PRICE INCREASE.—The City Council has decided to add a further 10 per cent. to its lighting, heating and power charges, making 20 per cent. on pre-war rates. The 10 per cent. increase will produce £16,000 towards a deficiency of £24,000.

The City Council has granted increased salaries to its assistant electrical engineers and a war bonus to each member of the staff; it has also revised the wages list, and the increases are estimated to cost £600 per annum.

TRAMWAY AND RAILWAY NOTES.

Accrington.—Mr. H. Pilling, Corporation tramway manager, in discussing the award just made by the Committee of Production to Lancashire tramway workers, states that previous to the latest grant the war bonuses paid to the local tramway workers exceeded £3,000 per annum, and the last award will mean an additional £900 a year. This is equivalent to a rate of 4d. or 5d. in the £. Some of the Accrington workers, who number 115, will receive as much as 14s. or 15s. per week for overtime. As an alternative to this advance in wages, the question of the increase in fares will have to be seriously considered. Before the outbreak of the war the cost of tramway tires, &c., was much less than now; material for which £1,000 was paid prior to the war is costing £3,000.

Bootle.—TRAMWAYS AGREEMENT.—A lengthy discussion took place at the T.C. on the new tramway agreement with Liverpool. Alderman Booth, explaining the reason for the agreement, said that before the war it was decided that the entire system needed reconstruction, but the war held up the matter. Liverpool claimed over £30,000 for loss of traffic, damage to cars, &c., to the end of 1916, and, after deciding to go to arbitration, it was arranged to settle the matter between the two Corporations. The new lease would run for 25 years from July 1st last, at a rental of £500 a year for the first six years and £1,000 a year after, Liverpool taking over the debt of £20,000, less the reserve fund of £700. In case of future extensions, Liverpool had agreed to pay £200 a mile. Liverpool would pay £13 per mile yearly for the upkeep of the overhead equipment. Councillor King said Bootle were selling their birthright to Liverpool, and they would be sorry for it, and Councillor Randall considered that they had been bluffed into the agreement. The Council, however, sealed the new agreement.

Continental.—SPAIN.—Application has been made for a concession to establish an electric tramway in Guadalajara, running from the railway station to the Plaza Mayor of the city.

The success which has attended the public subscription of capital, brings the realisation of the Oviedo electric tramways scheme into measurable distance. The work will be divided into six sections of 17 km. Later some 12 branches will be constructed to distant localities, thus completing the Asturias tramway network.

The concession granted to Pedro Garcia Faria, on June 3rd, 1892, for the construction of an underground electric railway in Madrid is declared to have lapsed, but an appeal may be lodged. The

above concession should not be confounded with that of the Central-Metropolitano, granted in September, 1916; the latter is a modest scheme of only 4 km. extent, out of an eventual aggregate of 14 km.

Doncaster.—CHEAP FARES. —At the T.C. meeting, last week, an attempt was made to upset the decision of the Council-in-Committee to support the Tramways Committee's recommendation for the withdrawal of all workmen's and other cheap return tickets, owing to the present high cost of working. Councillor Warren, who moved that the minutes be not confirmed, admitted that on September 17th he had himself voted in favour of the abolition of the tickets, but he now thought there was another way out. He said last summer, on considering the tramway estimates for the present year, the price put down for current was 1½d. per unit plus, 10 per cent. war charge, and that worked out at 4s. 7d. per 40 units. In May this year a sliding scale for large consumers had been brought forward, based on seven-tenths of a penny per unit, whilst the coal was 10s. per ton. Provision had also been made for a fluctuation of coal on the basis of 55ths of a penny for every 6d. increase per ton in the price of coal. Based on to-day's price, he worked that out to be 3s. 1d. for 40 units. He suggested that this margin was more than enough to make up the deficiency with which the tramways would be faced on account of increased expenditure, without taking such a drastic step as withdrawing the tickets. Councillor Marshall ably defended the Tramways Committee's reasons for urging the withdrawal, and the meeting decided, by 20 votes to 8, on the final adoption of the recommendation.

Ipswich.—YEAR'S WORKING. —The annual report of the Corporation's tramway undertaking shows a total revenue amounting to £25,566; working expenses amounted to £21,922 and war service allowances to £587, and, after meeting interest and loan repayments, there was a deficit on the year of £2,671, as compared with a profit of £2,757 in the previous year. The loss has been taken from the surplus brought forward of £3,700, leaving a credit balance of £1,028 to be carried forward. The passengers carried numbered 6,246,820 and the car-miles were 567,503, which compare with 6,798,589 passengers and 620,115 car-miles in 1916. The reserve or renewals fund now stands at £24,053.

London.—L.C.C. —The reduction in ticket transfer facilities, referred to in our last issue, is stated to have greatly increased the congestion at certain points on the tramway system, involving delay and overcrowding. According to the *Times*, it is being urged that the cost of reducing the loss by fraud under the old arrangement will exceed the possible saving.

Now that fares have been increased on the Council's tramways, the Stepney B.C. is inserting the tramways in a provisional valuation list with a view to increasing the rateable value.

Lytham.—The Council has decided to inform St. Anne's Council that it has been advised that the consent of the B. of T. to the supply of electrical energy to the Tramways Co. in the Urban District of Lytham should be applied for by St. Anne's, with the consent of Lytham Council, such consent to be effective only during the existence of the agreement between the two Councils.

Manchester.—INCREASED EXPENDITURE. —Some interesting figures were given at the City Council last week: Alderman Bowes, chairman of the Tramways Committee, said the recent award of the Committee on Production to the employes in that department would mean an increased cost of £78,780, which, with the war advance, amounted to £90,000. The award given on September 27th to the tramway and vehicle workers would cost £27,040, and, with the award given to the Workers' Union on the same date, the total was brought up to £119,086. The undertaking could not stand such a heavy burden without doing something to increase the fares, and the Tramways Committee would take the matter into consideration at the earliest opportunity. However much they disliked higher fares, they had reached a point at which it was absolutely impossible to go on paying their way on the present fares. It is not expected, however, that the increases will be of a very drastic character, a return to the scale obtaining before the stage extensions in 1913 being the scheme mostly favoured.

Mansfield.—The Mansfield and District Light Railway Co. has applied to the B. of T. for an extension of time until April 9th, 1921, for the completion of five lines of tramways in Sutton-in-Ashfield and Skegby.

Nelson.—SUGGESTED 'BUSES'. —The Corporation Tramways and Electricity Committee has had under consideration the provision of passenger-carrying vehicles, to be run in the higher portions of the town in conjunction with the existing light railways. The Sub-Committee inspected the electric omnibuses at Lancaster, but it was decided to defer the matter for the time being, the view being that the type of vehicle was unsuitable for gradients, and that there was prospect of an improvement after the war.

Newcastle-on-Tyne.—ASSESSMENT. —At the Quarter Sessions, on October 6th, Mr. Maynell, representing the Corporation, asked for a consent order regarding the tramway assessment for 1915, 1916, and 1917, and this was granted. The total figures had been agreed between the parties, and the order would reduce the assessment in accordance with the figures. The matter was referred to in our last issue.

New Zealand.—ELECTRIC VEHICLES. —Mr. W. E. Stark, the Christchurch city electrical engineer, recently declared himself convinced of the future of the electric vehicle, predicting that within five years' time after the war Christchurch will have a fleet of 500 cars. At present there are nine representative "electricies" in use in the city, which have given every satisfaction.

Sunderland.—YEAR'S WORKING. —The report of the year's working of the Corporation electric tramways undertaking shows that the total revenue was £85,513, and the expenditure on traffic, power and management expenses £49,970, leaving a gross profit of £35,543, as compared with £34,669 in 1915-16. The gross profit was applied as follows: —Interest and income-tax, £10,650; repayment of loans, £13,368; contributions to capital, &c., £127; borough fund in aid of rate, £5,000; and the balance of £6,098 was transferred to the renewals fund. The capital expenditure to March 31st, 1917, was £307,120, and the loan debt £115,311; the amount to the credit of renewals and reserve funds was £56,711.

Swansea.—NEW LEASE. —The Committee has agreed to proposals in regard to a new tramway lease. The reason for the new lease is because of the peculiar state of the law governing the Swansea tramways and light railways. These are held under various leases, and as each lease expires it has to be renewed, with the result that it is not until 1980 that the Corporation is able to exercise its powers of purchase of the whole system. In 1911, however, negotiations were opened, and it was agreed to equate the varying periods, so that the Corporation can exercise its powers in about 20 years' time. An agreement was also come to by which there should be one lease only of the existing system, and certain new sections of tramways and light railways then under construction. It is in pursuance of that agreement that the new lease is about to be completed. The fixed rental comes to about £6,000 per annum.

Walsall.—The Tramways Committee has accepted an offer of the services of boy scouts to assist conductors during busy hours.

CONTRACTS OPEN AND CLOSED.

OPEN.

Dublin.—November 1st. G.N. Railway Co. (Ireland). Six or twelve months' supply of general stores (including several electrical items). See "Official Notices" October 5th.

Grimsby.—October 29th. Corporation. House service boxes and house fuse-boxes and fittings. See "Official Notices" to-day.

London.—OFFICE OF WORKS. —October 12th. Steam tubes and fittings for twelve or six months. Secretary, H.M. Office of Works, Storey's Gate, S.W. 1.

Morecambe.—October 15th. Electric Traction Committee. Supply of electrically-driven omnibus. See "Official Notices" October 5th.

CLOSED.

Bradford.—Having received a report as to difficulty in obtaining delivery of pinion wheels from the present contractor, the Tramways Committee has decided, without interfering with the existing contract, to accept the offer of the British Hele-Shaw Patent Clutch Co., Ltd., for 162 steel pinions, at £212.

Derby.—T.C. Repairs to turbine armature: Parsons, Ltd., £725.

London.—MARYLEBONE. —Electricity Committee. Grab for the electricity works travelling crane, £500; Goodaeres and Sons, Ltd.

STEPNEY.—The Electricity Committee has accepted the following offers for coal:—

Bradbury, Son & Co.—5,000 tons Clifton peas, &c., at 24s. 6d. per ton.
Foster & Co.—5,200 tons Bolsover nutty slack, at 21s. 7d. per ton; 1,000 tons Arley D.S. nuts, at 25s. 4d. per ton; 600 tons Stribston slack, at 21s. 8d. per ton; and up to 100 tons per week of Coombs Wood beans, at 22s. 10d. per ton.

Sheffield.—City Council:—

Ferguson, Pailin & Co., Ltd.—One 500-amp., 2,000-v. switch panel.
W. T. Glover & Co., Ltd.—Cable (revised price schedule).

Stafford.—Gas and Electricity Committee. J. Dallow and Sons, Blackheath, at £1,987, new boiler-house and pump-room for the electricity department.

Stretford.—U.D.C. Accepted tenders:—

Underwood (Manchester), Ltd.—One 25-h.p., 500-volt D.C., shunt-wound, totally-enclosed motor, £175.
James Hodgkinson (Salford), Ltd.—One 66-in. diameter special induced-draught fan, £204.

Transformer Contracts.—The following orders for transformers have been received by Messrs. Ferranti, Ltd.:

Glasgow Corporation.—Sixteen 1,875-k.v.a. single-phase transformers.
Birmingham Corporation.—Seven 1,250-k.v.a. single-phase transformers.
Barrow-in-Furness Corporation.—One 400-k.v.a. three-phase transformer.
Manchester Corporation.—One 125-k.v.a. three-phase transformer.
British Thomson-Houston Co., for Shoreditch Borough Council.—One 1,650-k.v.a. three-phase transformer for use with a rotary converter.

Wolverhampton.—Corporation. Accepted tenders:—

Strachan & Henshaw.—Coal-conveyor plant for the electricity works, £1,542.
Gibbons Bros.—Steel structure for additional coal-conveyor plant, £926.
Reynolds & Co.—One 5,000-kw. generator panel and two 2,000-kw. feeder panels, £1,950.
Stirling Boiler Co.—Boiler equipment complete with stokers, fans, chimney, &c., £19,822.
British Thomson-Houston Co.—5,000-kw. turbo-alternator, £17,803.
Allen & Co.—Condenser body, £6,083.
Willans & Robinson.—Condenser plant auxiliaries, £3,729.

FORTHCOMING EVENTS.

Electro-Harmonic Society.—Friday, October 12th. At 8 p.m. At the Holborn Restaurant (Venetian Chamber). First smoking concert of the season.

Junior Institution of Engineers.—Friday, October 12th. At 7.30 p.m. At 39, Victoria Street, S.W. 1. Paper on "Scale Prevention in Water-cooling Systems" (illustrated by experiments), by Mr. H. Sampson Wills.
Monday, October 15th. At 7.30 p.m. At 39, Victoria Street, S.W. 1. Paper on "Mechanical Arms," by Mr. E. W. Hobbs.

Birmingham and District Electric Club.—Saturday, October 13th. At 6.30 p.m. At the Swan Hotel, New Street. Ladies' night.

North of England Institute of Mining and Mechanical Engineers.—Saturday, October 13th. At 2 p.m. At the Wood Memorial Hall, Newcastle-on-Tyne. General meeting.

Institution of Mechanical Engineers.—Friday, October 19th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. "A Comparison of the Working Costs of the Principal Prime Movers," by Mr. Oswald Wans.

NOTES.

Organisation of Power Station Engineers.—The meeting of the Midland Electric Power Supply Engineers' Association, announced in our issue of September 28th, was held at Birmingham, on October 5th. Representatives were present from other large Midland towns, and the temporary Committee was strengthened by their inclusion. Detailed information can be obtained from the hon. secretary, Mr. P. J. Burgess, 21, Geraldine Road, South Yardley, Birmingham.

Association of Electrical Station Engineers.—On Friday last a meeting was held at St. Bride's Institute of central-station staff engineers, at which representatives of 16 central stations in the London area agreed to support the A.E.S.E.

A similar meeting was held in Manchester on October 3rd of the central-station staff engineers of Manchester and district. The following resolution was carried unanimously:—"That this meeting of staff engineers in the Manchester district being convinced that collective organisation is an urgent necessity, expresses its entire agreement with the objects of the A.E.S.E., and resolves to hold a further meeting to discuss the various details in connection with the Association as soon as possible." During the last few days a form has been extensively signed by London central-station staff engineers protesting against the Electrical Trades Union negotiating with regard to rates of pay, &c., for central-station staff engineers. The number of signatures received to date gives the A.E.S.E. a very strong position in the matter. Any engineers interested can obtain full particulars from the Hon. Secretary, A.E.S.E., 26, Little Park Gardens, Enfield.

London Power Station Employees.—The Stepney B.C. Electricity Committee has appointed two representatives to serve, together with the borough electrical engineer, on a body, the formation of which is recommended by the Associated Municipal Electrical Engineers to consider working conditions, rates of pay, &c., of employment in the power stations of London.

Marylebone Electricity Committee having considered a communication from the Chief Industrial Commissioner, Ministry of Labour, concerning war wage grants in municipal power stations in the metropolis, and the possibility of uniformity, has informed the Commissioner that it has from time to time, and as late as August last, been in negotiation, and has come to satisfactory arrangements, with employees of the Electricity Department, through a representative of the National Amalgamated Union of Engineemen, Firemen, Mechanics, Motormen and Electrical Workers, and that it sees no reason to re-open the question at the present time. The Committee entirely agrees with the suggestion as to establishing uniform payments and conditions for employees in London power stations.

Instruction in Technical Optics.—At the last meeting of the Governing Body of the Northampton Polytechnic Institute, Prof. Frederic J. Cheshire, Director of the Department of Technical Optics in the Imperial College of Science and Technology, South Kensington, was appointed Honorary Head of the Technical Optics Department of the Northampton Polytechnic, in accordance with the schemes of the Board of Education and of the London County Council for the provision of instruction in technical optics.

Tyneside Power Supply Data.—At a meeting of Newcastle-upon-Tyne Chamber of Commerce, on the 3rd inst., Mr. Turnbull, of North Shields, representing the Electrical Section of the Chamber, said that Section had been requested by the Board of Trade to supply evidence in regard to the use of electric power in the district, and the Section asked for the appointment of a Sub-Committee from the Council to assist. Among the information required was as to the saving in the cost of power by the use of electricity, and the effect upon industrial development, convenience of electricity when adding new machinery, and its adaptability to awkward situations, and the possibility of the use of waste heat from coke ovens and blast furnaces. Messrs. E. L. Beckingham, H. Pyle, and B. C. Browne were appointed to act.

A New Electrical Furnace.—A new type of electric furnace has recently been constructed in Sweden, which is especially useful as an economical small unit for crucible works and steel foundries. In addition, it may be made suitable for copper smelting, glass melting, and for melting various alloys. The furnace is of the arc type, but differs from existing ones: it is cylindrical, with closed ends. Two of the electrodes enter the furnace horizontally, one in the centre of each end; the third electrode is vertical, entering at the top in the centre.

Heating is by radiation from the arcs, but their deflection upon the bath is also of material assistance. The furnace is built with a horizontal cylindrical steel shell, rolling in cradles or tilting round a horizontal diametric axle. It is lined with acid, basic, or neutral material, according to the work for which it is intended. The currents entering at each end through the horizontal electrodes neutralise each other, but the returning current into the central electrode generates a field of force which deflects the arcs downward towards the bath. This is the essential feature of the new furnace, which differentiates it from those hitherto used. The points of the electrodes are usually kept 6 to 12 inches above the surface, but they can be adjusted as required. The furnace is adapted for work on cold or liquid metal, and the electrodes can be drawn back while the furnace is being charged. The circular form of the furnace is one of its greatest advantages. The radiant heat from the free-burning arcs is reflected on to the bath from the entire mirror-like incandescent inner surface of the vault. Yet the arcs are at such a distance from this roof that the danger of melting is minimised. A sound point in construction is that there is no break between the roof, the side walls, and the bottom, all being built together in one curve. To enable the furnace to be relined, the shell is in halves, bolted together. The electrodes, of graphite, are held together in a loose fit in water-cooled, insulated phosphor-bronze boxes, those for the horizontal electrodes being adjustable also in the vertical plane. Once the arcs are adjusted, it suffices to advance the side electrodes by about 1 in. per hour.—*Scientific American*.

U.S. Eight Hours' Law Suspended.—According to the *Labour Gazette*, the Orders for suspending the Eight Hours' Law were effective from date of the promulgations in March and April last, and they are operative "during the pending emergency and until further orders." In addition to applying to Government contracts, they apply to mechanics and labourers employed on work which, in the judgment of the Secretary for War, is important for purposes of national defence.

Coal Shortage Effects in Switzerland.—In order to effect greater economies in coal and electrical energy Swiss shops are to be closed at 7 p.m. Kinematograph and variety theatres are to be closed 12 days a month. Hotels and boarding houses will be allowed to heat only 25 per cent. of their rooms, or in exceptional cases, 50 per cent. Mountain hotels will be exempt from this rule.—*Times*.

The Electrolytic Production of Zinc.—Among the important metallurgical developments in British Columbia during last year was the completion and commencement of operation of the electrolytic zinc-producing plant, dealing with raw ore, at the works, at Trail, of the Consolidated Mining and Smelting Co., towards the beginning of 1916. The plant was in continuous work during the remainder of the 12 months, and is now turning out from 25 to 30 tons of spelter per day, which means that from 150 to 200 tons of ore are being treated daily. The total production of spelter by the new plant during last year is returned at approximately 6,810 tons. The installation was designed primarily to treat the complex zinc-lead ore, of which large reserves have been proved. The ore is roasted, and then leached with a solution of weak sulphuric acid; this dissolves out the zinc, which is then precipitated in electrolytic tanks. The lead and low silver contents of the ore remain as an insoluble residue from the leaching process, and are sent to the lead furnaces for smelting. This process enables the zinc contents of the ore to be saved—at least, in a large part—and also makes a much better product for the lead-stacks than the crude ore. The cost of producing zinc by this method is stated to be about the same, or possibly a little higher, than by fire smelting, but the latter process could not be used with the particular ore in question. At the beginning a number of difficulties were met, but they were eventually successfully overcome, these being, perhaps, necessarily incidental to the standardisation of the production in a large way of electrolytic zinc, and it is expected that, as the staff becomes more familiar with the operations, further improvements will be effected. Before the plant was completed further contracts, at the request of the Imperial Munitions Board, were entered into for an increased supply of zinc, which rendered necessary very large additions to the installation as originally designed, but the completion of which has been delayed owing to the difficulty experienced in obtaining deliveries of electrical machinery.

Industrial Reconstruction.—A scheme has been elaborated for a Council for the Study of Industrial Reconstruction, and a meeting is shortly to be held at which the proposals advanced by those prominently associated with the movement will be explained. A manifesto signed by a large number of well-known professors, editors of trade journals, and officers of trade associations sets forth in fair detail what the scheme is. We give some extracts below, and would refer readers who may be sufficiently interested in the matter to desire further information to the Secretary, Mr. F. W. Galton, care of Messrs. Benn Bros., Ltd., 8, Bouverie Street, E.C.4. It is considered that to meet the urgent needs of the times, increased efforts to develop our industries will be necessary on the following lines:—

1. The mobilisation of each industry for common action.
2. A greater degree of co-operation between manufacturers.
3. Co-operation between labour and capital, and the avoidance of industrial strife.
4. A more complete association between scientific institutions and traders.
5. Education better adapted to our commercial needs.
6. Each industry to be studied as a whole, and freed from unnecessary internal competition.
7. Every trade to present a united front to foreign competition.
8. Output regarded as a duty by both capital and labour.
9. Encouragement by the Government of the activities of traders with a minimum of interference.

The necessity for greatly increasing the national output is so imperative that some national scheme which shall ensure the securing of these objects is considered necessary.

It is suggested that a national organisation, along the lines of the Whitley Report, should be established, which will retain all the sterling qualities of our individualistic system, and add ordered force to ensure greater activity; also that such an organisation will need to provide for the representation of all classes of persons engaged in a given industry; that industry should, therefore, be enfranchised, and every man and woman, employer and employed, given a vocational or trade vote, by means of which this representation would be effectively realised; that every citizen should have the right to register with some approved Trade Association or Trade Union, and thus an Industrial or Vocational Register properly classified would be produced; that Trade Councils should be elected in each industry from the Trade Associations and the Trade Unions, upon a truly representative basis, so as to be able to speak in the names of the whole of their respective industries; that all questions between the Government and a given trade should be delegated to the Council of that trade to deal with; and that questions of output, education, trade schools, scientific research, export, wages, profits, markets, tariffs, &c., &c., should be settled in each trade by the Council of that trade, and national funds spent upon these matters dispensed through the Trade Councils.

Feeling that the time has come when the discussion of these matters should take a more detailed and practical form, those responsible for the manifesto have put forward various heads as a basis for further study.

These heads are concerned with the organisation of separate trades; a Government Department to promote or encourage trade; Trade Unions and Associations; Trade Councils (consisting of representatives of Trade Associations, Trade Unions, and aldermen elected by the Council on the nomination of Government Departments; and, lastly, work. "A very large proportion of the work now badly done by various Government Departments could be delegated to these Trade Councils, and would be more effectively performed. Reconstruction work, which largely depends upon industrial prosperity, could be undertaken by these Councils with a better prospect of success than it would have in any other way."

Generally, the scheme involves the establishment of a complete, new system of trade government comparable to our existing system of local government, with a Ministry at the head with powers similar to those of the Local Government Board, controlling numerous Trade Councils with powers comparable to those of existing County Councils. It recognises the essential principle that industrial interests should be grouped by trades, and not by localities.

National Insurance (Unemployment) Acts, 1911-1916.—

The following are further decisions of the Umpire:—Contributions are payable in respect of:—

2,388 X. All workmen engaged in making, including welding, stamping and machining, fernules for water-tube boilers.

This decision amplifies decision A 1,263 (*Board of Trade Journal* of January 30th, 1913).

2,389 X. Workmen described as painters employed by a firm of manufacturers, and engaged wholly or mainly in painting street lanterns or steel book-stacks at the works.

The Production of Nitrates in the United States.—

The U.S. War Department has announced that the Nitrate Supply Committee recommends the Government to use the synthetic ammonia process of the General Chemical Co., and to allocate out of the £4,000,000 nitrate supply appropriation a sum of £600,000 for this purpose, to build a plant having an output of 60,000 lb. of ammonia per 24-hour day, as well as a sum of £120,000 for a plant to oxidise ammonia to nitric acid and concentrate the acid, the output being equivalent to 24,000 lb. of 100 per cent. nitric acid per day.

A further sum of £40,000 is asked for, to experiment with a view to the industrial development of the Bucher process for the production of ammonia, which is owned by the Nitrogen Products Co. in the States. The installation of by-product coke ovens is also to be accelerated. The decision as to the more extensive installation of nitrogen fixation processes and water-power development in con-

nection therewith is to be postponed until the plants above mentioned are in operation. A reserve of half a million tons of Chile saltpetre is to be accumulated as a matter of urgency.

Volunteer Notes.—COUNTY OF LONDON VOLUNTEER ENGINEERS (FIELD COMPANIES).—Headquarters, Balderton Street, Oxford Street, W. 1.

Orders for the week, by Lieut.-Colonel C. B. Clay, V.D., commanding:—

Officer for the Week.—Second Lieut. E. A. Ullmann.

Monday, October 15th.—Drill and Elementary Bridge Construction for No. 3 Company, Left Half Company, 6.30. Signalling Section, 6.30. Recruits' Drill, 6.30.

Tuesday, October 16th.—Physical Drill and Bayonet Fighting, 7.30.

Wednesday, October 17th.—Drill and Elementary Bridge Construction for No. 1 Company, 6.30.

Thursday, October 18th.—Drill and Elementary Bridge Construction for No. 2 Company, 6. Signalling Section, 6.30. Ambulance Section, 6.30.

Friday, October 19th.—Drill and Elementary Bridge Construction for No. 3 Company, Right Half Company, 6.30.

Saturday, October 20th.—Commandant's Parade for Route March and Drill, Parade at Headquarters, 2.45 p.m. Uniform. A and B N.C.O.'s and Men are reminded that one Route March per month is compulsory.

Musketry.—The Range at Belvedere Road will be open every Tuesday, Wednesday, and Thursday evening from 5.30 to 7.

Medical Examination.—The Medical Officer will attend at Headquarters for this purpose every Thursday at 6.

(By order) MACLEOD YEARSLEY, Capt. and Adjutant.

Institution and Lecture Notes.—The Faraday Society.—

A general discussion on "Pyrometers and Pyrometry" will be held on Wednesday, November 7th, at 8 p.m., in the rooms of the Royal Society of Arts, John Street, Adelphi, London, W.C. 2.

Sir Robert Hadfield, Bart., F.R.S., President of the Society, will preside over the discussion and deliver an introductory address.

Dr. E. F. Northrup (Trenton, N.J.) will send in a communication entitled "High Temperature Production and its Measurement."

Dr. Ezer Griffiths and Mr. F. H. Schofield, B.A., B.Sc. (National Physical Laboratory) will read a paper on "Pyrometer Standardisation."

Mr. R. S. Whipple (Cambridge) will read a paper on "The Advantage of Burying the Cold Junction of a Thermo-couple as a means of Maintaining it at a Constant Temperature."

Mr. Richard P. Brown (Philadelphia) will read a paper and give a demonstration on "The Automatic Control Measurement of High Temperatures."

Prof. J. O. Arnold, F.R.S. (Sheffield) will speak on "Pyrometry Applied to the Hardening of High-Speed Steel."

Mr. Cosmo Johns (Sheffield) will speak on "Determining the Temperature of Liquid Metals by Means of Optical Pyrometers."

Dr. W. H. Hatfield (Sheffield) will read a paper on "Pyrometry from the Standpoint of Ferrous Metallurgy."

Mr. H. Watkin (Stoke-on-Trent) will read a paper on "The Measurement of High Temperature by Means of Pottery Materials."

Mr. C. R. Darling will read a paper on "Base-Metal Thermo-Electric Pyrometers."

Dr. J. W. Mellor, Mr. F. Twyman, and Mr. G. E. M. Stone will also contribute to the discussion.

Instruments will be exhibited by Mr. Richard P. Brown, the Cambridge Scientific Instrument Co., Messrs. Hadfields, Ltd., Mr. H. L. Heathcote, Mr. Robert W. Paul, and Messrs. Siemens Bros. & Co., Ltd.

Wages of Foremen Engineers.—

A deputation from the London Association of Foremen Engineers waited upon the Ministry of Munitions, on Tuesday, to call attention to the rate of wages paid to foremen in the engineering trades, which was stated to be in many cases lower than those received by even unskilled hands. It was said that in many cases they had the sympathy of their employers, but such employers were helpless without the sanction of the Ministry. The deputation was informed that although any increase in wages in a controlled establishment of any members of the staff must be approved, it was recognised that the foremen did important work. The merits of different cases varied largely, but the Ministry of Munitions was in sympathy with those foremen who did special work, and would not raise any objection in such cases to any advance of salary which might be agreed upon between employer and employé. In asking for such approval, the nature and extent of the extra work should be clearly stated. If the foreman could not agree with his employer as to the amount of increase, he could apply to the Minister of Labour, Industrial Department, and an arbitrator would be appointed.—*Morning Post*.

Appointments Vacant.—The Chief Engineer, War Department, Salisbury, is advertising in our pages to-day for competent men, who are required immediately to fill the following positions:—Electrician, mains engineer, shift engineer, engine driver, fitter, fitter driver, joiner, wireman, and wireman's mate. Electrical fitter (50s.), for Chester Corporation tramways; oil engine and dynamo attendants (35s. to 40s.), for the power stations in the Northern Command; Londonderry Corporation wants a charge engineer for its generating station. See our advertisement pages to-day.

The Ventilation of the Tube Railways.—In an interesting communication to the *Times*, General Sir Desmond O'Callaghan refers to the crowding of the tube railway stations by aliens during air raids, and suggests that if a bomb deranged the ventilating arrangements these people might be suffocated. There is, however, little danger on this score: the tubes are not all supplied with power from the same source, and it would have to be a very lucky shot indeed that would cut off the supply from even a portion of the system for a long period. Moreover, there is an immense volume of air in the tunnels, which is always more or less in movement, and the stairways are open to the atmosphere at the surface.

Inquiries.—Makers of "Crosby" clamps and wood separators for storage battery plates are asked for.

The Australian Strike.—Additional restrictions on coal and power for industrial purposes have thrown 13,000 more hands out of work in Victoria. Oil engines, and even motor-car engines, are being used to run machinery.—*Times*.

London Electrical Contractors' Dinner.—We read in the *Electrical Contractor* that the London Section of the Electrical Contractors' Association will hold a dinner on November 7th at Tricity House, Oxford Street. A paper by Mr. A. F. Berry on "Electric Cooking" will follow.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station Officials.—Mr. W. H. SHORTER, superintendent in the sales department of the Marylebone electricity works, has obtained a commission in the R.F.C.

Mr. T. ROLES, city electrical engineer, Bradford, who has been "lent" to the Coal Controller's Department for the purpose of explaining to Yorkshire local authorities the Controller's scheme of coal economy, has now got to work on his new task, and has commenced operations on his own city and Leeds and Halifax.

West Bromwich T.C. has increased the salary of the borough electrical engineer, Mr. W. A. JACKSON, from £400 to £500 a year.

Canterbury T.C. has increased the salary of the electrical engineer, Mr. BLASCHECK, from £350 to £400 per annum.

Mr. M. BELL has been appointed superintendent of the generating station at the West Bromwich Corporation electricity works at a salary of £300 a year.

The Bath Corporation has increased the salary of Mr. A. R. SHAWLEY, the deputy city electrical engineer, by £25 per annum.

Mr. E. P. AUSTIN, chief assistant engineer at the Chesterfield electricity works, has been appointed chief electrical engineer at the Sheepbridge works. He has held the position at Chesterfield since 1906, and the Electricity Committee, in accepting his resignation, have placed on record their appreciation of his energy and ability. A successor will be appointed at £230 per annum.

The Chester Electricity Committee has granted leave of absence to Mr. PERCY HEARD, who has been called up. It is recommended that, as a temporary measure, Mr. G. E. SWIFT, the mains superintendent, perform the duties of station superintendent at £75 per annum, in addition to his existing salary of £200.

Marylebone Electricity Committee recommends that the salary of Mr. E. J. JENNINGS, secretary and accountant to the electricity department, be increased from £500 to £525 per annum, and afterwards by £25 per annum to £600; also that the salary of Mr. C. H. SMYTH, mains engineer, now £500, be advanced on exactly the same scale.

Mr. H. S. ELLIS, electrical engineer to the South Shields Corporation, has been invited by the Controller of Coal Mines to act as an honorary representative of the Coal Control Department, and the Corporation has given leave for him to devote part of his time to the work. The district in which Mr. Ellis will work includes the counties of Northumberland and Durham, in which area he will have to interview the Corporation officials, and the engineers of electricity, gas, and water undertakings to discuss questions of coal economies. The installation of electric or gas cooking and heating appliances will also be dealt with, with the object of saving coal.

General.—Mr. T. A. ST. JOHNSTON has just resigned his position as assistant electrical engineer at the Associated Equipment Co.'s Works, at Walthamstow, to take up a new appointment as works superintendent with the Micanite and Insulator Co., Ltd., whose works are in the same district. He was presented with a cigarette case from the employees in the electrical department on leaving.

Mr. H. N. HICKLEY, managing director of Messrs. Newtons, Ltd., electrical engineers, of Taunton, on his marriage to Miss Meade-King, of Walford, has been presented by the employees with a silver kettle with spirit lamp and stand, a silver cigarette box, and an illuminated album.

The marriage has taken place of Mr. G. BIRKLEY ROLL, B.Sc., A.M.I.E.E., and Miss Violet McKenzie Scott, of Redford Park, W.

Mr. NORMAN ROGERS, formerly with the B.I.H. Co., Rugby, has relinquished his appointment in the Industrial Arts Department of the Cincinnati Public Schools in order to prepare for active service with the United States Officers' Reserve.

Roll of Honour.—Captain R. S. ROONEY, R.E., who has died of wounds, was an electrical engineer with the British Electric Plant Co., Ltd., Alloa.

Private H. WEST, Durham L.I., who has died from wounds received in action, was employed at the Bradford Corporation electricity works.

Gunner J. HARRISON, Australian F.A., who is in a London hospital wounded, was formerly employed in the Leeds Corporation electricity department.

Sergeant F. C. LUSCOMBE, Seaforth Highlanders, who has died from the effects of gas poisoning, was prior to the war an electrician with Rolls-Royce, Ltd.

Lieutenant ERIC SLEIGHT, who has been wounded, and has had his foot amputated, enlisted whilst manager of the tramways at Carlisle.

Lance-Corporal A. BROWN, R.E., aged 23, who has been awarded the Military Medal, was employed as an electrician with Messrs. Dick, Kerr & Co., at Preston. He gained the distinction for laying a cable across "No Man's Land" on the day the infantry went over, and under heavy fire.

Bombardier W. D. THOMPSON, West Lancashire Field Artillery, who has been awarded the Military Medal, was employed by Blackpool, Lytham and St. Annes Tramway Co.

Lance-Corporal H. PARKER, South Lancashire Regiment, who has been killed in action, aged 22, was employed at the B.I. & Helsby Cable Works.

Flight Sub-Lieutenant J. D. GRANT, R.N., drowned at sea as the result of a seaplane accident, was in the service of the General Electric Co., Ltd., at Manchester.

Captain R. H. UTHOFF, R.E., who was mentioned in this column last week, was the head of the engineering department at one of the works of Messrs. Pilkington Bros., Ltd., not their chief electrical engineer. Mr. P. M. Hogg is the company's chief electrical engineer.

Lieutenant A. J. ADAMSON, R.G.A., who has been killed in action, was a clerk with the Oxford Electric Light Co., Ltd.

Temporary Lieutenant F. H. WEBB, R.F.A., who has been awarded the Military Cross for conspicuous gallantry and devotion to duty, is a son of Mr. S. H. Webb, president of the National Federated Electrical Association, with whom he was associated in his business at Leicester up to his joining the Army in the early days of the war.

Obituary.—Mr. B. G. ARKWRIGHT.—The death is announced, at the age of 55, of Mr. Bernard G. Arkwright, a director of Sir W. G. Armstrong, Whitworth & Co., Ltd., who was also manager of the company's engine works.

Will.—The late Mr. F. A. HOPKINSON, chairman of Messrs. J. Hopkinson & Co., Ltd., Huddersfield, left £56,101 gross.

NEW COMPANIES REGISTERED.

Corona Lampworks (Ireland), Ltd. (4,498).—Private company. Registered in Dublin, October 3rd. Capital, £6,000 in £1 shares. Manufacturers of and dealers in all kinds of electric bulbs, lamp fittings, &c. Agreement with the Corona Lampworks, Ltd. The subscribers (each with one share) are:—W. Hepworth-Collins, 10, Ascham Street, Kentish Town, London, N.W.; C. Shields, 93, Foulden Road, Stoke Newington, London, N.; cashier. The first directors are:—Geo. N. Ogilvie, W. Hepworth-Collins, and C. Shields. Solicitor: Chas. M. Worsley, 2, Walbrook, London. Secretary: C. Shields.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Harold Wood Electrical & Engineering Supplies Co., Ltd.—Memorandum of satisfaction in full on August 31st, 1917, of debentures dated October 17th, 1913, securing £600, has been filed.

Rural Electricity Supply Co., Ltd.—Particulars of £1,700 debentures created August 10th, 1917, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Suffolk Electricity Supply Co., Ltd.—Particulars of £2,000 debentures created August 22nd, 1917, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. The above debentures are in addition to the previous issue not exceeding half the amount of the paid-up capital by consent of the holders of the previous issue.

CITY NOTES.

Marconi Wireless Telegraph Co. of Canada, Ltd.

The report for an 11-month period states that for the third successive season the company has had to contend with the abnormal conditions created by the war, and, despite the difficulties imposed by various restrictions, an increased volume of Transatlantic traffic was handled between the company's Glace Bay station and Great Britain, as was anticipated. This improved volume is since being well maintained. The value of the company's organisation, both to shipowners and to the Naval authorities, has again been demonstrated. The school of instruction conducted by the company has been a

factor in contributing to maintain the company's staff in replacing operators assigned for duty in all parts of the globe. Schools in affiliation with the company are also conducted on the Pacific Coast at Vancouver and Victoria, B.C. The output of the company's plant in Montreal was somewhat less than during the previous year, due to the fact that a smaller number of installations was required for Naval purposes. Advantage was taken of this opportunity to develop an improved type of ship apparatus, combining the best practice in design with reliability of operation in unskilled hands. Compact and self-contained, the new cabinet set, either of medium or large size, can be installed on shipboard in short order, thus meeting the frequent demand under present conditions for emergent installations. This new design has received favourable comment both in Naval and mercantile quarters, and its success has been followed up by the development of a smaller set on similar lines, which should open up a large field for service on cargo and smaller vessels, where the cost of wireless equipment hitherto has been regarded as prohibitive. The company has subsequently been awarded further important orders for the purchase of a considerable number of wireless sets of various types. As a further step in the company's policy for increasing the facilities of its service to shipowners, a divisional office for the Maritime Provinces has been established at Halifax, thus completing the plan of maintaining stores and offices at the important divisional points of Vancouver, Toronto, Montreal, Halifax, and St. John's, Newfoundland. The number of wireless telegraph stations operated by the company on shipboard has shown an increase during the year, notwithstanding the fact that several installations had been lost or transferred to other routes. The same difficult conditions had prevailed with regard to message traffic to and from ships, due not only to general dislocation of sailing schedules, but also to strict censorship and other limitations imposed on commercial messages, nor can any improvement in these adverse conditions be looked for during the period of the war. The directors have not yet been able to obtain from the Government a basis of settlement in respect of remuneration for the use of certain coast stations taken over by the Naval Department since the commencement of the war, or compensation for other services rendered to the Admiralty and elsewhere.—*Financier*.

Escher, Wyss & Co.—The report of Escher, Wyss & Co., of Zurich, which deals with the year ended March 31st, 1917, states that the production in most departments was again approximately on the level of an ordinary peace year. The great difficulties experienced in obtaining raw and other materials, the forwarding of goods, and in connection with the enhanced cost of living for the workmen, considerably increased as compared with the previous year. It was necessary to pay unprecedentedly high prices for some materials, and frequently to pay before delivery. The arrival of orders continued very satisfactory, especially the extensive contracts for hydraulic turbines, whilst a very favourable turnover was also obtained in steam turbines. Special apparatus was made for the native chemical industry, and large orders have recently been received for compressors. After allocating £41,000 to depreciation, as against £32,000 in 1915-16, the accounts exhibit net profits of £20,000, as compared with £17,000, and the dividend is 5 per cent., as contrasted with 4 per cent. in the preceding year.

Companies to be Struck Off the Register.—The following companies will be struck off the register unless cause is shown to the contrary within three months:—

Acton Battery Co., Ltd.
Electrical Sales Promotion, Ltd.
London Battery & Manufacturing Co., Ltd.
Mies' Electrical & Chemical Culture, Ltd.
Photo-Telegraph & Cable Co., Ltd.
Scandinavian Water Power & Paper Mills, Ltd.
Trade Journals, Ltd.
United Cablegram Co. of France, Ltd.
United Kingdom Manufacturers' Representative Association, Ltd.

Shanghai Electric Construction Co., Ltd.—Interim dividend at the rate of 5 per cent. actual (10s. per share), less tax.

Rio de Janeiro Tramway, Light & Power Co., Ltd.—Dividend, 1½ per cent. on the capital stock.

Sao Paulo Tramway, Light & Power Co., Ltd.—Dividend, 2½ per cent. on the common stock.

Cuba Submarine Telegraph Co., Ltd.—Interim dividend 5 per cent. per annum, free of tax, on ordinary shares.

Oriental Telephone & Electric Co., Ltd.—Interim dividends of 3 per cent. on the 6 per cent. cumulative preference shares for the current year, less income-tax, and 4 per cent. on the ordinary shares, free of income-tax.

Indo-European Telegraph Co., Ltd.—Interim dividend for the half-year ended June 30th last at the rate of 5 per cent. per annum, free of tax.

Direct United States Cable Co., Ltd.—Interim dividend of 2s. per share, less income-tax at 5s. in the £, making with the interim dividend already paid a total distribution of 4 per cent. for the half-year ended September 30th.

Royce, Ltd.—Dividend, 5 per cent.; £5,000 is written off goodwill, and £224 is carried forward.

Glenboig Union Fireclay Co., Ltd.—The directors have placed £12,000 to reserve, and out of surplus of £62,000 they recommend an ordinary dividend of 35 per cent., less tax, and carry forward £22,579.

Calcutta Tramways Co., Ltd.—Interim dividend on the ordinary shares at the rate of 2½ per cent., free of tax.

STOCKS AND SHARES.

TUESDAY EVENING.

THE outstanding feature in the markets at the present time is the strength of all the gilt-edged stocks. The rise in the prices of the 5 per cent. War Loan and Consols has stimulated subscriptions to the new War Bonds, applications for which are now flowing in freely. There is no lack of money available for investment. The fine news from the Western Front plays a prominent part in helping prices; and there are few markets in the Stock Exchange which have not responded to the latest advance in Flanders.

To give some idea of the scarcity of good investments which prevails, we may observe that it lay within our province the other day to make some inquiries for what shares were on offer in the list of home electricity companies. The principal dealers in the market ran through the whole catalogue of shares, and out of the list of the best concerns there were scarcely a couple of hundred shares on offer altogether. This is as good an illustration as can be cited of the difficulty which meets the intending investor in such companies. Of course, if he likes to bid fancy prices—that is to say, prices well above the market figures—he might possibly be able to lay in a few hundred pounds' worth of stock. But unless he is prepared to do this, his choice is limited in the extreme. The only change on the week is a rise of ¼ in Westminster ordinary, which has advanced the price to 6½, so that the yield at the present time is barely 5½ per cent. on the money.

The Home Railway market is better, reflecting the strength of Consols; and the improvement has been shared by the Undergrounds, as well as by the stocks in the heavier list. The rise in Undergrounds has naturally been the subject of quiet jesting, although it follows events which were very far from humorous. Underground Electric incomes gained a point to 83½, and the ordinary shares at 1½ are ½ higher. The shares just lately have received some attention from the speculative investor in the country, and the shilling shares at 6s. 3d. are a few pence better on the week. Metropolitan regained the ¼ which they lost the other day, and the various Central London stocks maintain the rises which they recently put on.

Mexican affairs are still rather hopeless, but the latest news is to the effect that there is a chance of a change in the Mexican Ministry, which, if it came about, would make the attitude of Mexico much more definite towards Germany, bringing her conspicuously into line with the Allies. The dramatic rise in the price of silver, the metal, has been followed by a sharp fall. But silver, in spite of the reaction, still commands a big price; and, of course, the value of the white metal makes a considerable difference to Mexican issues of all kinds. Mexican Light and Power preferred has risen to 35, a jump of 3½ points, and Mexico Tramways Firsts are 2 up at 46½.

No improvement has occurred in the British Columbia group, and Brazilian Tractions continue weak at 46. The Anglo-Argentine Tramways market is very steady, there being noticeable inquiry for the first preference shares. Labour troubles are still agitating the Argentine Republic; and it is only within the past few days that a partial resumption of railway traffic, under the protection of the military, has got under way.

The telegraph list is quiet, with small improvements in Anglo-American Telegraph deferred stock and in West India and Panama shares, the latter recovering the slight decline which occurred last week. Great Northerns are £1 up at 31, but Indo-Europeans at 53½ show a fall of the same amount. There is a good deal of activity in American Marconi shares, and the price has risen to 22s., though the parents keep about 32, and Canadians seem unable to get away from the price of 10s. 6d., at which they have stuck for some weeks.

In the manufacturing group, British Insulated have dropped back to 14, but Telegraph Constructions have reached the level 40. Small falls have occurred in British Westinghouse preference and in Babcock & Wilcox shares. The recent animation in Edison Swan has given place to quietude; and although the price of the shares keeps steady about a guinea, speculation has died out for the time being. The fully-paid remain at 35s. Henleys have risen to 15½.

Business is good amongst rubber shares, where prices are well held, and the reaction in the price of rubber to 2s. 8d. had little effect. Movements, however, are narrow, and of little consequence from day to day. Base-metal shares are generally better, a good dividend from the Rio Tinto Copper Co. putting up the prices in their market, while the conclusion of the strike on the Broken Hill field has brought about improvement in the Barrier shares. There is not much doing amongst armaments, though several of the explosives are again mounting.

Good wishes have poured in upon Mr. H. B. Renwick, the managing director of the County of London Electric Supply Co., upon his recent appointment in the Ministry of Food. Considering the wide experience which Mr. Renwick has had in the way of organisation in business matters, the appointment should prove a valuable one to the country, and everyone will wish him success in his new office.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.					
	Dividend	Price	Rise or fall	Yield	
	1915. 1916.	Oct. 9, 1917.	this week.	p.c.	
Brompton Ordinary ..	10	6½	—	26 18	6
Charing Cross Ordinary ..	6	8½	—	6 9	0
do. do. do. 4½ Pref. ..	4½	8½	—	6 18	4
Chelsea ..	4	23	—	5 9	1
City of London ..	8	12½	—	6 4	3
do. do. 6 per cent. Pref. ..	6	10½	—	6 18	5
County of London ..	7	11½	—	6 5	10
do. do. 6 per cent. Pref. ..	6	10	—	6 0	0
Kensington Ordinary ..	7	6½	—	5 11	8
London Electric ..	8	1	—	Nil	
do. do. 6 per cent. Pref. ..	6	8½	—	5 6	8
Metropolitan ..	8	8½	—	4 12	4
do. do. 4½ per cent. Pref. ..	4½	8½	—	7 4	0
St. James' and Pall Mall ..	8	7	—	5 14	6
South London ..	5	2½	—	7 5	6
South Metropolitan Pref. ..	7	21/6	—	6 10	9
Westminster Ordinary ..	7	6½	+ ½	6 8	8
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref. ..	6	99	—	6 1	0
do. Def. ..	88/8	1½	+ ½	6 9	5
Obile Telephone ..	8	7½	—	6 11	4
Cuba Sub. Ord. ..	9	5½	—	6 14	3
Eastern Extension ..	8	14½	—	6 8	4
Eastern Tel. Ord. ..	8	14½	—	6 7	9
Globe Tel. and T. Ord. ..	7	18	—	6 7	8
do. Pref. ..	6	10½	—	6 15	8
Great Northern Tel. ..	22	99	+ 1	6 3	1
Indo-European ..	18	65½	- 1	6 1	6
Marconi ..	10	35	—	4 9	0
Oriental Telephone Ord. ..	10	10	+ 1½	2 19	8
United R. Plate Tel. ..	8	6½	—	5 16	4
West India and Pan. ..	6d.	6d.	+ ½	3 4	1
Western Telegraph ..	8	14½	—	6 10	4
HOME RAILWAYS.					
Central London, Ord. Assented	4	60½	—	6 12	8
Metropolitan ..	1	38½	+ ½	4 4	3
do. District ..	Nil	16½	—	Nil	
Underground Electric Ordinary	Nil	17	+ ½	Nil	
do. do. "A" ..	Nil	6/8	+ 3d.	Nil	
do. do. Income ..	4	85½	+ 1	4 15	10
FOREIGN TRAMS, &C.					
	Dividend	Price	Rise or fall	Yield	
	1915. 1916.	Oct. 9, 1917.	this week.	p.c.	
Adelaide Snp. 6 per cent. Pref. ..	6	4½	—	6 3	1
Anglo-Arg. Trams, First Pref. ..	6½	6½	—	8 14	0
do. do. 2nd Pref. ..	6½	2½	—	—	—
do. do. 6 Deb. ..	5	67½	—	7 8	9
Brazil Traction ..	5	46	—	—	—
Bombay Electric Pref. ..	6	95	—	6 4	8
British Columbia Elec. Rly. Pref. ..	6	40½	—	12 4	10
do. do. Preferred Nil	Nil	30	—	Nil	
do. do. Deferred Nil	Nil	27½	—	Nil	
do. do. Deb. 4½	4½	60	—	8 10	0
Mexico Trams 5 per cent. Bonds	Nil	46½	+ 2	Nil	
do. do. 6 per cent. Bonds	Nil	40	—	Nil	
Mexican Light Common ..	Nil	22½	—	Nil	
do. Pref. ..	Nil	85	+ 8½	Nil	
do. do. 1st Bonds ..	Nil	46½	- 1	—	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox ..	16	16	— ½	4 14	4
British Aluminium Ord. ..	7	10	— ½	6 3	1
British Insulated Ord. ..	17½	14	— ½	7 2	10
British Westinghouse Pref. ..	7½	14½	— ½	4 18	0
Callenders ..	20	20	—	6 18	0
do. 6 Pref. ..	5	6	—	6 1	4
Casner-Kellner ..	22	22	—	6 8	0
Edison Swan, fully paid	—	—	—	Nil	
do. do. 4 per cent. Deb. ..	4	72½	—	5 10	4
Electric Construction ..	7½	7½	—	7 10	0
Gen. Elec. Pref. ..	8	103	—	5 15	8
do. Ord. ..	10	17½	—	5 14	8
Henley ..	25	25	+ ½	7 18	8
do. 4½ Pref. ..	4½	15½	—	5 12	6
India-Rubber ..	10	19½	—	47	6
Telegraph Con. ..	20	40	+ 1	46	0

* Dividends paid free of income-tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, October 10th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic ..	per lb.	1/6	..
a Ammoniac Sal ..	per ton	£76	..
a Ammonia, Murate (large crystal) ..	..	£64	..
a Bisulphide of Carbon ..	..	£28	..
a Borax ..	..	£288	..
a Copper Sulphate ..	..	£61	..
a Potash, Chlorate ..	per lb.	2/6	..
a " Perchlorate ..	..	2/-	..
a Shellac ..	per owt.	£12 10	..
a Sulphate of Magnesia ..	per ton	£16	..
a Sulphur, Sublimed Flowers ..	..	£35	..
a " Lump ..	..	£25	..
a Soda, Chlorate ..	per lb.	10½d.	..
a " Crystals ..	per ton	120/-	..
a Sodium Bicarbonate, casks ..	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2" to 12" basis) ..	per lb.	..	..
c " Tubes (solid drawn) ..	..	..	..
c " Wire, basis ..	..	..	..
c Copper Tubes (solid drawn) ..	..	1,6½ to 1/7	Ad. dec.
g " Bars (best selected) ..	per ton	£151	£4 dec.
g " Sheet ..	..	£151	£4 dec.
g " Rod ..	..	£151	£4 dec.
d " (Electrolytic) Bars ..	..	£125	£5 dec.
d " " Sheets ..	..	£152	£5 dec.
d " " Wire Rods ..	..	£133	£5 dec.
d " " H.C. Wire ..	per lb.	1/3½	Ad. dec.
f Ebonite Rod ..	..	8/-	..
f " Sheet ..	..	2/6	..
n German Silver Wire ..	..	2/3	..
h Gutta-percha, fine ..	..	6/10	..
h India-rubber, Para fine ..	..	8/6	2½d. inc.
i Iron Pig (Cleveland warrants) ..	per ton	Nom.	..
l " Wire, galv. No. 8, P.O. qual. ..	..	£42	..
g Lead, English Pig ..	..	..	..
g Mercury ..	per bot.	Nom.	..
e Mica (in original cases) small ..	per lb.	6d. to 8/-	..
e " " " medium ..	..	3/6 to 6/-	..
e " " " large ..	..	7/6 to 14/- & up.	Ad. dec.
d Silicon Bronze Wire ..	per lb.	1/8½	..
r Steel, Magnet, in bars ..	per ton	..	..
g Tin, Block (English) ..	..	..	..
n " Wire, Nos. 1 to 16 ..	per lb.	8/6	..

Quotations supplied by—

a G. Bonr & Co.	g James & Shakespeare.
c Thos. Bolton & Sons, Ltd.	h Edward Till & Co.
d Frederick Smith & Co.	i Bolling & Lowe.
e F. Wiggins & Sons.	l Richard Johnson & Nephew, Ltd.
f India-Rubber, Gutta-Percha and	n P. Ormiston & Sons.
Telegraph Works Co., Ltd.	r W. F. Dennis & Co.

Science and Industry in South Africa.—In his presidential address to the S.A. Association for the Advancement of Science, reported in *Nature*, Prof. John Orr stated that the Government had not always fully realised in the past the powerful aid of science and scientific research in general and industrial development, and had paid totally inadequate salaries to the personnel of its scientific departments. But all this was going to be changed; science had gained immensely in prestige since the war began, and perhaps the greatest lesson of the war had been the realisation of the necessity for more scientific methods in relation to industry. They must realise that the whole fabric of industry was based on science, and Governments were now recognising it as their duty to promote scientific research on a national scale.

The land abounded with examples of neglected opportunities. The absence of a "primary" iron and steel industry in South Africa was most keenly felt; they had the raw materials in coal and ore. A successful experimental plant, constituting the first electric furnace in South Africa, was erected by the Chamber of Mines during the past year for making steel castings (shoes and dies) from scrap metal, and the manufacture of bar iron, &c., from scrap metal had been carried on for some years in the Transvaal. Such industries had been referred to as "bastard" industries; primary industries utilising the raw materials were essential. A start was made in June in electrochemical industries, when a factory for the manufacture of carbide was inaugurated on the Rand; but electrochemical industries in other parts of the world relied mainly upon cheap electricity derived from water-power, and it was of the utmost importance in the industrial development of the country that the Government should spare no expense in having the water-power resources of South Africa immediately investigated.

Portable Electric Lighting Plants.—It is stated that in both the French and Italian armies portable electric lighting plants are being largely made use of for the illumination of officers' quarters. The sets consist of a water-cooled petrol engine, direct-coupled to a generator, both being mounted on a wooden platform capable of being carried by a couple of soldiers. Wiring and lamp sockets are packed separately, and are in charge of an electrician. The entire outfit is brought up on a motor wagon, and with the aid of three or four men, staff quarters can be fitted up with an electric lighting installation in about an hour's time.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.
		£	£		£	£	
Bristol (Trams) ..	Sept. 28	24,804	+3,446	39	192,936	+16,962	80.6
Cork ..	" 27	2,662	+ 147	39	21,862	+ 1,377	9.89
Dublin ..	" 23	25,008	+2,575	39	260,811	+25,529	54.25
Hastings ..	" 30	6,985	+1,053	39	49,702	+ 7,387	19.8
Lancashire United	" 26	11,058	+2,746	47	90,910	+20,075	42
Llandodno-Col. Bay	" 21	2,432	- 157	42½	15,153	- 991	6.6
Anglo-Argentine ..	" 30	213,492	+8,048	39	2,002,800	+24,827	26.63
Auckland ..	" 21	22,154	+1,270	12	64,876	+ 2,018	51
Calcutta ..	Aug. 29	19,114	+ 204	4	—	+ 1,491	..
Kaigorlie, W.A. ..	June	2,644	—	28	15,441	—	20.5
Madras ..	Sept. 30	4,695	+ 272	52	41,623	+ 8,691	..
Montevideo ..	Sept.	29,426	+2,716	48	84,679	+10,636	..

Town.	Population. W = white, C = coloured.	Date of start.	Manager.	Bulk supply from or owners.	Distribution system. v = volts; c = cycles; w = wires.	Units sold.	Plant or s/s. cap. kw.	Capital expen- diture. £	No. of consumers.		Street lamps.		Revenue last year. £	Tariff of charges. L = light; P = power.	Purchase price of energy. Pence.	Remarks.
									Light.	Power.	No.	C.R.				
Boksburg	W 11,582 C 38,077	1905	F. R. Clark (Town Engineer)	Victoria Falls Co.	A.C. 230 v, 50 c, 3 w	546,000	400	24,826	1,000	20	600	50	3,991	6d. L, 1½d. P	1½	Tramways also.
Benoni	W 15,000 C 65,000	1912	P. J. Gold	Kleinfontein Co.	A.C. 3-phase, 25 c, 4 w, 200 v. light, 346 v. power	473,000	520	19,680	1,510	29	270	50	12,800	7d. to 4d. L, 2½d. P	2½ L, 1½ P	Motor-buses also.
Germiston	W 15,317 C 38,244	—	—	Victoria Falls Co.	A.C. 3-phase, 50 c, 3 w, 120 v. light, 200 v. power	—	—	—	—	—	—	—	—	5d. L, 4d. P, 1½d. cooking	—	Tramways also.
Kimberley	W 18,000 C 35,500	1904	R. W. H. Smith	De Beers Co.	A.C. 50 c, 220 v, 2 & 3 w	830,217	1,260	38,904	1,220	133	35	Incl. arcs.	11,377	6d. L, 2½d. P	2	Supply Co. controls distribution.
Rooderpoort	W 7,192 C 25,550	1912	R. Hortimer	Victoria Falls Co.	A.C. 3-phase, 50 c, 3 w, & 4 w, 230 v. light, 400 v. power	225,984	225	14,015	750	4	248	50	5,540	8d. to 6d. L, 4½d. P	2½	—
Standerton	W 1,740 C 1,559	1908	W. Leonard	S.A. Railway.	D.C. 230 v, 2 w	38,661	75	3,825	165	—	150	—	2,030	9d. less 70 per cent. over 300 units	4½	Portion of area 3 p, 3 w.
Springs	W 2,000 C 7,000	1912	G. M. McComb (Town Engineer)	Victoria Falls Co.	A.C. 200 v, 50 c, 3 w	82,677	200	5,500	242	6	114	Series lamps	1,804	7d. L, 2½d. to 4d. P, 4½d. cooking	1½	—
Dundee	W 1,140 C 1,862	1902	E. H. Gellender	E. H. Gellender and Co.	D.C. 220 v, 3 w (2250 v lamps in series)	—	175	15,000	220	4	85	—	—	8d. to 4d., 3d., and 2d.	—	Steam plant.
Indwe	W 600 C 500	1908	G. Muller	Indwe Coal Co.	D.C. 500 v, 2 w	30,500	300	—	60	2	66	16	597	6d. L, 2d. and 3d. P	—	In liquidation.
Volksrust	W 1,626 C 891	1912	G. Strong	E. H. Gellender and Co.	D.C. 220/440 v, 3 w	—	100	8,500	150	—	123	—	—	11d. L, 4d. and 3d. P	—	Steam plant.
Vryheid	W 1,150 C 1,100	1908	B. Sargent	L.R. & G.P. Co., Ltd.	D.C. 200 v, 2 w	21,560	27	3,500	140	1	60	—	1,078	12d. L and P	—	Suction gas plant.

Private Company Supply.

Municipal Supply.

TRAMWAYS.

Town.	Date of start.	Manager.	System: v.c.	Miles track.		No. and type passenger cars.	Other rolling stock.	Capital expenditure. £	Units used.	Price per unit.	Car-miles.	Passengers carried.	Total revenue. £	Operating expenses per car-mile.	Remarks.
				Single.	Double.										
Bloemfontein	1915	G. A. Stewart (City Engineer)	Span wire and bracket construction. 550/600. Tramless.	—	—	10 "R.E.T."	—	44,227	192,381	1d.	180,861	934,177	7,834	11-64d.	Year ending March, 1917.
Durban	1902	H. N. Thomas	Centre, side, and span construction. 550/600. Tramless.	9-25	11-15	90 d/d 4-wheel, 1 d/d 8-wheel	1 funeral car, 3 sprin- klers, 12 freight-cars	591,714	3,701,851	1d.	1,726,687	17,589,375	115,265	12-41d.	Purchased from Durban T. Co. for £111,350.
East London	1899	J. M. Lamb	Centre and span con- struction. 550/600. Tramless.	2	2	15	—	57,343	411,385	1-5d.	250,936	3,022,870	17,028	15-84d.	—
Johannesburg	1906	J. H. Dobson	Centre, side, and span construction. 550/600. Tramless.	(track) 65-131	—	5 motor road buses, 114 d/d 4-wheel, 24 3-d 8-wheel	8 freight, 3 water, 2 motor tower wagons (elec. and petrol)	880,456	7,855,151	1-379d.	3,377,014	(1915) 30,825,558	382,221	18-04d.	Purchased from Johan- nesburg T. Co. in 1904.
Pietermaritzburg	1901	P. Finlayson	Centre and side con- struction. 500 v. Tramless.	6	2-25	1 Pulling-Stevens bus, d/d Brush, 6 bogie, 4 radial, 6 ordinary	3 freight, 1 water.	113,796	243,542	1-5d.	245,700	2,152,751	11,712	10-26d.	—
Pretoria	1910	T. Wolley-Ibbot	Centre pole construc- tion. 500 v. Tramless.	3-67	6	3 motor buses, 25 s/d, 4 and 8 wheel	3 freight, 2 water.	242,179	1,022,000	1-5d.	565,720	—	48,065	11-2d.	Purchased from Pre- toria T. Co. for £40,000.
Boksburg	1911	F. R. Clark	Mostly span construction. 500 v. Tramless.	route. 5-25	—	6 "R.E.T." (28 pas- sengers)	—	23,000	154,000	1-33d.	110,000	630,000	7,391	19-0d.	—
Germiston	1914	—	Side-pole construction. 500 v. Tramless.	9-5	—	10 Codes Stoll	—	55,000	222,700	Av. 1d.	192,707	—	7,329	13-63d.	—
Cape Town	1896	W. F. Long	Span wire and side con- struction. 550 v. trolley	16-45	5-96	62 d/d, 15 s/d.	2 freight, 3 water, 1 tower wagon	—	4,302,874	—	1,493,393 (Camps Bay cars) 81,884	18,134,842	172,168	11-98d.	Owned by City, Cape Town, and Green Point T. Co., Ltd.
Camps Bay	1901	W. F. Long	Span wire and side con- struction. 550 v. trolley	6-87	—	7 open, 7 composite	3 freight	250,983 including gene- rating plant	598,806	2-02d.	—	707,875	17,487	17-24d.	Owned by Camps Bay T. Co., Ltd.
Kimberley	1905	—	Span wire and side con- struction. 500 v. trolley	(Track) 16	—	20 open	1 freight, 1 water	—	311,229	—	—	2,089,863	—	—	Owned by De Beers Co., Ltd.
Port Elizabeth	1897	W. H. Free- mantle	Side and span construc- tion. 550 v. trolley	3-42	5-61	13 d/d, 21 s/d.	1 trailer, 1 water, 1 prison van.	175,400	1,016,410	1-208d.	550,000	4,012,524	40,000	11-23d.	Owned by Port Eliza- beth T. Co., Ltd.

Municipal Bulk Supply.

Private Company Supply.

1916.—Union of South Africa: Municipal Electrical Undertakings.

COMPLETE PLANTS: LIGHT AND POWER.

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(Compiled by E. POOLE, A.M.I.E.E., Durban.)

General Table.

Town.	Pop- ulation. W = white, C = col'd.	Date of start.	Manager.	Source of power. C = con- densing, N.C. = non- condensing.	Generation system. v = volts; c = cycles; p = phase.	Distribution system. O.H.M. = overhead mains. U.G.M. = underground mains. v = volts; c = cycles; w = wires.	Units sold.	Max. load. kW.	Plant capa- ty. kW.	Load factor (year).	Capital expendi- ture. £	Cost per kw. in- stalled. £	No. of consumers. Light. Pow.	Street lamps. No. and c.p.	Remarks.	
Alval North ..	W 2,400 C 5,000	1905	E. Taylor	Water and oil	D.C. 500 v	D.C. 3 w, 220/460 v, U.G.M. only	62,556	—	170	—	752,000	326	226	5	87 (50 and 100)	Expenditure includes water scheme.
Bloemfontein ..	W 13,500 C 11,500	1900	G. A. Stewart (City Engineer)	Steam C	A.C. 2-phase, 2,100 v, 50 c	D.C. 500 v, A.C. 200 v & 347 v, 3 & 4 w, U.G. and O.H.M.	2,019,653 (to Mar., 17)	860	1,650	26.8	184,252	112	1,840	—	690 (2) (50 & 2,000)	Tramways also.
Bethlehem ..	W 1,850 C 1,350	1905	M. McDonough (Town Engineer)	Gas	D.C. 500 v	D.C. 480/240 v, 3 w, O.H.M.	—	—	125	—	—	—	130	—	—	Year 1915.
Cape Town and suburbs ..	W 82,156 C 75,038	1905	G. H. Swiegler (Acting)	Steam C	D.C. 440 v, A.C. 2-phase, 2,200 v, 50 c	D.C. and A.C. various v, 2, 3, 4 & 5 w, U.G. & O.H.M.	13,424,594	4,545	8,900	33.8	665,000 (1915)	74	7,586	2,500	(50 to 1,500)	Purchased from C. P. Co. in 1912; supplying Sea Point, Kalk Bay, Maitland, Woodstock, Mowbray, Claremont, Rondebosch, and Wynburg (semi-bulb).
Ceres ..	W 906 C 1,650	1910	P. J. C. Spies	Water	D.C. 145 v	D.C. 145 v to 110 v, 2 wire, O.H.M.	est. 9,000	23	23	4.4	2,900	126	78	76	25	Tramways also.
Crabcock ..	W 3,000 C 3,100	1914	H. Brittle	Oil	D.C. 450 v	D.C. 220/440 v, 3 wire, O.H.M.	38,809	44	100	10.3	10,326	—	340	5	107 (60 and 100)	Tramways also.
Durban ..	W 35,848 C 38,312	1907	J. Roberts	Steam C	D.C. 550 v, A.C. 3-phase, 6,600 v, 50 c, 1-phase, 2,750 v, 62 c	D.C. 550/500 v, A.C. 3-phase, 6,600 v and 500 v, 1-phase, 100, 200 & 400 v, 2 & 3 wire, O.H. & U.G.M.	20,025,906	5,049	10,000	44.8 (70 max.)	550,172	55	7,336	881	2,258 (32, 307 (400), 19 (600), 26 (100)	Purchased from C. P. Co. in 1912; supplying Sea Point, Kalk Bay, Maitland, Woodstock, Mowbray, Claremont, Rondebosch, and Wynburg (semi-bulb).
Ernest ..	W 2,400 C 1,003	1914	A. Douglas	Steam N.C	D.C. 500 v	D.C. 550/500 v	47,846	—	50	—	8,711	174	180	3	61 (100, 200 and 400)	Tramways also.
East London ..	W 14,000 C 7,000	1909	J. M. Lambie	Steam C	D.C. 550 v, A.C. 1-phase, 2,200 v, 50 c	A.C. 110 v, 2 w, U.G. and O.H.M.	1,474,736	1,010	933	16.7 (20 max.)	56,318	60	1,711	89	571	Purchased from Colliers and Kessler, in 1904, for £2,050.
Greytown ..	W 1,210 C 1,250	1904	W. H. Blatchford	Steam N.C	D.C. 220 v	D.C. 200 v, 2 w, O.H.M.	55,680	44	74	14.4 (25 max.)	6,533	88	192	6	85 3	Year 1915.
Heilbron ..	W 2,000	1901	—	Steam N.C and gas	D.C. 250 v	D.C. 220 v, 2 w, O.H.M.	44,100	—	65	—	6,236	96	121	—	44	Tramways also.
Heidelberg ..	W 1,527 C 1,076	1915	T. H. A. Brown	Gas	D.C. 480 v	D.C. 440/220 v, 3 w, O.H.M.	25,401	45	45	6.4	8,071	172	152	1	92 (60 and 80)	Purchased from Colliers and Kessler, in 1904, for £2,050.
Harrismith ..	W 2,145 C 3,352	1904	T. Millar	Steam	A.C. 1-phase, 2,000 v, 50 c	A.C. 200 v, 3 w, U.G.M. only	115,628	60	185	22	21,000	113	312	6	162 (100, 50 and 32)	Tramways also.
Johannesburg ..	W 134,000 C 119,274	1901	A. H. Dobson	Steam C	D.C. 600 v	D.C. (inner area) 460/230 v (3 w, U.G. A.C. (outer area) 400/200 v, 1-p (O.H.M.)	25,057,534	11,043	13,750	25.9	1,101,254	80	16,091	—	6,681 (50), 1,300 (100), 278 (16), 33 (1,000 and 2,000)	Purchased from Johannes- burg Lighting Co. in 1835 for £165,000. Tramways also.
Krugsdorp and Randfontein ..	W 13,114 C 41,145	1908	R. W. Fletcher	Steam C	D.C. 180 v	D.C. 220/460 v, 3 w, O.H. and U.G.M.	752,878	500	700	17.2	43,476	62	1,111	59	322	Two stations in Krugers- dorp Municipality.
King Williams Town ..	W 3,571 C 3,571	1903	J. Vovle	Steam C	A.C. 1-phase, 2,200 v, 50 c	A.C. 220 v, 2 w, U.G. and O.H.M.	82,802	50	120	18.3	10,351	86	177	6	75	Purchased from King Elec. Light Co. in 1905 for £23,251.
Kroonstad ..	W 3,530 C 2,782	1904	R. A. Stoker (Town Engineer)	Steam N.C	D.C. 250 v	D.C. 220 v, 2 w, U.G. and O.H.M.	297,360	138	200	24.6	27,800	139	755	30	300	Tramways also.
Klerksdorp ..	W 3,071 C 2,932	1911	J. R. English	Gas	D.C. 480 v	D.C. 220 v, 2 w, U.G. and O.H.M.	516,376	153	190	38.5 (63.5 max.)	12,500	69	411	17	113 (50 and 100)	Tramways also.
Ladysmith ..	W 2,037 C 2,712	1903	T. Jagger	Steam N.C	D.C. 220/440 v	D.C. 220/460 v, 3 w, O.H.M.	118,000	75	70	17.9	10,525	150	210	3	120	Purchased from Gellender and Co. in 1912 for £6,250. No day supply.
Newcastle ..	W 1,300 C 1,700	1902	G. N. Dawson	Steam N.C	D.C. 250/500 v	D.C. 220/460 v, 3 w, O.H.M.	360,567	156	475	26.4	23,097	48	866	9	212	Purchased from Gellender and Co. in 1912 for £6,250. No day supply.

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Oudstroom	W 5,849 C 5,851	1911	F. Castle	Oil	D.C. 440 v	D.C. 220/440 v, 3 w, U.G. and O.H.M.	133,602	195	805	11'8	41,000	134	528	14	286
Port Elizabeth	W 13,824 C 13,252	1906	B. Sankey	Steam C	D.C. 550 v A.C. 3-phase, 6,500 v, 50 c	D.C. 250/500 v, U.G. & O.H.M., 2 & 3 w A.C. 1-phase, 250 v, 3-phase, 6,500 and 500 v	2,065,706	930	3,500	25'4	197,198	56	2,432	164	10 flame arcs; 44 3 watt, 1,000; 184 211 watt, 100-600; 511 watt, 50
Potchefstroom	W 8,102 C 4,955	1912	W. D. Ross	Steam C	D.C. 250/500 v	D.C. 240/480 v, 3 w, O.H.M.	137,611	125	120	12'6	20,000	166	440	100-300	Tramways also.
Pietermaritzburg	W 16,000 C 16,000	1896	A. S. Munro	Steam C	D.C. 550 v A.C. 3-phase, 2,300 v, 60 c 1-phase, 2,100 v, 100 c	D.C. 550/500 v A.C. 3-phase, 2,300 v 1-phase, 200 v, 3 w, U.G. and O.H.M. D.C. 250/500 v, 3 w, U.G. and O.H.M.	2,103,277	720	2,200	33'3 (61'5 max)	215,489	98	1,979	77	182 100-300 418 50
Pretoria	W 29,440 C 18,560	1892	T. C. Wolley-Dod	Steam C	D.C. 550 v	D.C. 230/460 v, 3 w, O.H.M.	4,975,299	2,400	3,200	23'1	217,745	68	4,100	155	1,378 50-144 (100), 29 30-2,000 215 100 and 60
Paris	W 2,000 C 300	1913	W. McKenzie	Water	D.C. 460 v	D.C. 220/380 v, 4 w, U.G. and O.H.M.	33,911	—	30	—	5,500	183	170	—	Purchased from Pretoria Elec. Co. in 1904 for £115,000. Tramways also.
Paarl	W 4,806 C 6,224	1917	H. Wragg	Water	A.C. 3-phase, 3,900 v, 50 c	A.C. 220/440 v, 3 w, U.G. and O.H.M.	—	—	150	—	—	—	265 appli- cation.	—	Plant not completed.
Queenstown	W 3,725 C 3,286	1912	W. Bellad-Ellis	Oil	D.C. 460 v	D.C. 220/440 v, 3 w, U.G. and O.H.M.	152,000	140	200	12'4 (35 max.)	18,000	90	700	32	270 (50 and 400) 178 48 100 80
Somersset, E.	W 1,700 C 3,314	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Senekal	W 1,700 C 2,700	1915	R. Rascher (Town Engineer)	Gas	D.C. 500 v	D.C. 230/460 v, 3 w, O.H.M.	24,480 (16 months)	30	45	10'8	5,426	120	96	4	43 50
Stellenbosch	W 9,700 C 3,155	1914	E. J. Hamlin (Town Engineer)	Oil	D.C. 480 v	D.C. 220/440 v, 3 w, U.G. and O.H.M.	78,649	82	80	10'9	11,524	144	328	21	167 (50 and 100)
Uitenhage	W 6,291 C 3,619	1911	—	Oil	D.C. 440 v	D.C. 220/440 v, 3 w, O.H.M.	—	—	270	—	30,259	112	180	—	— Year 1915.
Winburg	W 3,148 C 1,516	—	W. H. Hodge (Town Engineer)	Gas	D.C. 240 v	D.C. 230 v, 2 w, O.H.M.	32,937	25	36	1'5	4,084	113	131	1	88 32
Wellington	W 2,120 C 2,178	1914	E. G. Mould	Gas	D.C. 440 v	D.C. 220/440, 3 w, O.H.M.	98,000 (generated)	—	96	—	11,268	117	258	6	120 40
Worcester	W 4,000 C 4,500	1916	C. Duncan (Acting)	Water and oil	D.C. 440/500 v	D.C. 220/440, 3 w, O.H.M.	61,919	64	127	11'0	14,065	110	251	32	240 600 and 100

UNION OF SOUTH AFRICA MUNICIPAL ELECTRICAL UNDERTAKINGS.

By E. POOLIE, A.M.I.E.E., Assistant Borough Electrical Engineer, Durban.

(Abstract of paper read before the Engineering Section of the NATAL SOCIETY FOR THE ADVANCEMENT OF SCIENCE AND ART, at Durban, on August 28th, 1917.)
(Concluded from page 321.)

Tramways.—Private companies were first in the field in nearly all the towns in South Africa with both horse and electric tramways, and even to-day the electric tramways at Cape Town, Camps Bay, Port Elizabeth, and Kimberley are in the hands of such. Other towns have acquired companies' undertakings operated by horses, which have been electrified by power obtained from the lighting station. Boksburg and Germiston, however, purchase their current for tramways as they also do for lighting, and have adopted the railless system, as has also Bloemfontein, the system adopted by all the other towns being the overhead trolley. Motor vehicles serve as feeders to the main tramway routes at Johannesburg, Pretoria, and Pietermaritzburg, while in the case of Benoni the municipality has lately inaugurated a system of electric buses, five in number. Durban has a parcels collection and delivery system, which alone brought in a revenue of £700 last year. A universal gauge of 4 ft. 8½ in. is adopted for the track. The steepest grade and sharpest curve are at Cape Town, being 1 in 8 and 28 ft. radius respectively, while in miles of track Johannesburg has just over 65 miles, or 42 route miles.

In charges for current for tramways, Durban and Bloemfontein are the only two instances where one penny per unit is charged. In road maintenance, some towns charge the tramway department half cost, while others pay in full. A wayleave is charged in the case of Camps Bay Tramway Co. of £50 per mile.

In fares, the penny cash fare does not yet apply to all towns. Pietermaritzburg, Cape Town, Bloemfontein, and East London, however, have adopted it.

Street Lighting.—Many changes have taken place in street lighting in the last few years, and whereas at one time all large towns used arc lamps for their principal thoroughfares, the introduction of the high-candle-power metal-filament and half-watt lamp has practically forced the arc lamp on the scrap heap.

The location of lamps is a point which requires careful consideration; and in my opinion centre lighting from span wires is difficult to improve on. Some few towns are even now adopting this style of construction, which permits of the pavements under the verandahs being lighted as well as the roads, and where trees line the footpaths, as they so frequently do in South Africa, there is far less obstruction to the light than there is with side poles.

The switching of street lamps is in many cases carried out by time switches, though one or two towns have distant solenoid control.

The maintenance of street lighting is an important matter as well as costly, but thanks to the introduction of the modern vehicle (which rightly is an electric one), Durban, by way of example, is able to carry out all its repairs and replacements (and there are over 2,500 lamps to look after) with one man and two natives, whereas at one time it required three men, six Indians, and four natives.

House Services, &c.—Connections to houses are made by overhead as well as underground mains, and in the case of the former the class of wire used, though not highly insulated, offers some sort of protection to those who might come in contact with it. It is a double or triple-braided wire, sometimes compounded, and withstands the weather conditions very well. The application fee covers the cost of the service up to a certain distance, beyond which charges are made, in some cases half the cost, and in others the full cost of the extra material required.

There is a vast variety of meters in use. There are few towns which do not charge meter rent, varying from 6d. to 2s. 6d. per month, which, in the case of Pietermaritzburg, brought in a revenue of over £1,000 last year.

Generally the wiring rules are all based on the Rules of the Institution of Electrical Engineers and Fire Office Rules, though several towns publish their own, which embody special rules to suit the local conditions. Some will not allow casing or bobbin work, one other prefers it, some again carry out consumers' wiring; the majority are against municipal trading in this line, but roughly 50 per cent. of them have adopted assisted wiring, while a few hire out apparatus.

We find all sorts of tariffs from as low as 375d. for a restricted-hour supply at Durban to as high as 1s. per unit at several of the smaller towns, and by going beyond the Union we find a charge of from 1s. 6d. to 2s. at Bulawayo. Durban is cheapest all round, the lighting rate having been lowered to 5d. per unit since August, 1917.

The total European staff of all our municipal stations is about 800 in number, exclusive of tramway staffs.

Finance.—In practically every town the control is vested in the hands of the financial head of the Corporation—the

town treasurer. In favour of this system may be held the fact that the town treasurer is a specialist on finance, but against it is often held out the loss of expediency and economy caused by the unnecessary duplication.

With the recently introduced Government audit, as well as the inter-municipal audit, I fail to see why a proper control could not be kept if the electrical engineer did the accountancy, and there would be no continual overlapping as is now the case. Before, however, such a state of affairs can come about it is necessary to have some universal form for financial statements, as is the case at home.

Though the electrical engineer is generally in control of his own stores, in the few larger towns the control is in the hands of the general storekeeper, who when he buys has to consult the electrical engineer as to details, and when the goods arrive has again to consult the electrical engineer as to whether the goods are up to sample.

On account of the various ways of costing adopted, it is practically an impossibility to make comparisons of working costs with any degree of accuracy.

In regard to the disposal of net profits, most of the larger towns appropriate a large portion to the relief of rates under a providing Act, the amounts set aside last year in the various towns being as follows:—

	Light.	Tramways.
Johannesburg	£49,003	£59,281
Durban	17,936	19,159
East London	1,500	—
Pretoria (1915)	10,000	—

The total amount that has been set aside in Durban since the inauguration of the electric light amounts to no less than £198,527. Other appropriations are in the use of net profits for capital expenditure, special sinking funds or reserve accounts.

The paper is accompanied by the tables printed on pp. 357-359.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

NEW ZEALAND.—Lamps, of patterns approved by the Minister of Trade and Customs, including "Incandescent Mazda" and "New Miniature" electric lamps, specially fitted and peculiarly adapted for microscope work, are now admitted free of duty into the Dominion in accordance with a revised decision by the Customs Department. [A "primage duty" of 1 per cent. *ad valorem* is payable on importation in accordance with the Finance Act of 1915.]

SOUTH AFRICA.—Among recent decisions issued by the Commissioner of Customs as to the classification of various articles under the Customs Tariff, the following are noted:—

	Rate of Import duty.	Rebate on goods manufactured in the U.K. and reciprocating British Colonies.
Insulating tape (sleeving) when imported by importers of electrical material, and on a declaration that it is to be used for insulating purposes ...	3 p.c. <i>ad val.</i>	Whole duty.
Patent quazare electrodes ...	3 p.c. <i>ad val.</i>	Whole duty.

SOUTHERN RHODESIA.—A Customs decision has been issued recently classifying parts of electric starters for motor cars for Customs duty, as follows:—

Chains are dutiable under Tariff heading 51c at the rate of 20 per cent. *ad val.* under the General Tariff, and at 17 per cent. *ad val.* under the Preferential Tariff on British goods.

Adjusters and parts are dutiable under 114b at the rate of 3 per cent. *ad val.* under the General Tariff, British goods being admitted free of duty.

TERRITORY KNOWN AS GERMAN EAST AFRICA.—Regulations have been made by the Senior Customs Officer at Nairobi setting out the conditions under which goods may be conveyed through the occupied territory of "German East Africa" to a foreign port. The text of these regulations, which are at some length, was given in the official *Board of Trade Journal* for July 26th.

CEYLON.—The Customs Tariff has been revised by an Ordinance, dated June 8th, which provides a new schedule of import duties. The general rate of duty leviable upon goods unspecified in the schedule has been increased from 5½ per cent. *ad val.* to 7½ per cent. *ad val.* Among the list of goods specified is copper—blocks, bars, plates, rods, wire, tubes, sheets, ingots, and scraps, on which the duty is Rs. 3 per cwt. The table of exemptions from import duty includes electrical machinery (and component parts) for electric traction and electric lighting, or for certain specified industries; electric accumulators, and lead, pig, and sheet.

BRITISH HONDURAS.—An Ordinance promulgated on June 23rd provides that the export duty on chicle be increased from ¼ cent (¼d.) per lb. to 1½ cents (¼d.) per lb. as from June 20th.

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

- 13,692. "Self-locking electric lampholder or attachment." L. BAGGULEY AND C. W. LACEY. September 24th.
 13,697. "Electrically producing a gas for use in internal-combustion engines, &c." T. McCLELLAND. September 24th.
 13,699. "Operating and carrying electric flashlamps on or about the person." E. NUTTALL. September 24th.
 13,713. "Contact rings for dynamos and electric motors." COMPAGNIE UNIVERSELLE ELECTRIQUE (Roulland Frères et Cie). September 24th. (France, October 11th, 1916.)
 13,725. "Electrical systems of power transmission and regenerative braking." BRITISH THOMSON-HOUSTON Co. (General Electric Co., U.S.A.) September 24th.
 13,726. "Supporting device for overhead electric trolley wires." P. DAWSON, F. W. FAWCAY & H. W. H. RICHARDS. September 24th.
 13,728. "Cooling electric apparatus." R. CZEPEK & R. DOCKERAL. September 24th.
 13,737. "Self-exciting dynamo-electric machines." N. BEGG & A. SCHAANNING. September 24th.
 13,738. "Electrically-heated gloves, caps, socks, boots, clothing, carpets, &c." A. A. LEMERCIER. September 24th. (France, October 26th, 1916.)
 13,741. "Electrical transmission arrangements for motor vehicles, &c." J. SANKOV & SONS AND W. A. STEVENS. September 24th.
 13,746. "Ignition devices for internal-combustion engines." W. G. IKIN. September 24th.
 13,772. "Self-exciting dynamo-electric machines." N. BEGG. September 24th.
 13,780. "Electrically reducing refractory substances." J. G. WEBB. September 25th. (U.S.A., March 16th.)
 13,786. "Separators for storage-battery plates." W. MORRISON. September 25th. (U.S.A., April 2nd.)
 13,788. "Spark plug for internal-combustion engines." M. FERRARIS. September 25th.
 13,796. "Electric lifts." C. M. LEWIN. September 25th.
 13,848. "Electrical system for indicating alarm of fire, &c., simultaneously at number of stations." A. W. BROWN. September 26th.
 13,853. "Accumulators or secondary batteries." F. LA ROCHE. September 26th.
 13,857. "Connections for electric furnaces." C. BINGHAM. September 26th.
 13,858. "Electric furnaces." C. BINGHAM. September 26th.
 13,859. "Heavy electric conductors." C. BINGHAM. September 26th.
 13,873. "Wood separator for storage-battery plates." E. C. R. MARKS (W. Morrison). September 26th.
 13,883. "Electrolytic cells for electrolysis of salt, &c." N. STATHAM. September 26th.
 13,884. "Electrolytic cells for manufacture of caustic alkali from sodium chloride." N. STATHAM. September 26th.
 13,885. "Metal electrodes used in depositing and soldering by electric arc." E. H. JONES. September 26th.
 13,891. "Spark plugs for internal-combustion engines." L. S. CLARKE. September 26th.
 13,918. "Electrode holder for electric furnaces." G. MARRIOTT. September 27th.
 13,950. "Transmission of power by alternating currents." J. KRUYSWIJK. September 27th.
 13,951. "Combined interrupter and distributor for battery ignition systems." G. F. COOKE. September 27th.
 13,952. "Starting motors and lighting dynamos for motor vehicles." A. G. BENSTAD & ROTAX MOTOR ACCESSORIES Co. September 27th.
 13,956. "Electric furnaces." BOOTH-HALL Co. & H. WADDE. September 27th.
 13,977. "Electric furnaces." C. BINGHAM. September 28th.
 13,978. "Watertight and weatherproof cases for electrical apparatus, &c." R. L. STANBROOK. September 28th.
 13,986. "Electric signal lantern." R. J. HART. September 28th.
 13,990. "Lanterns for incandescent electric lamps." H. T. WILKINSON AND WARDLE ENGINEERING Co. September 28th.
 14,002. "Electric flashlamps." A. F. BROWN. September 28th.
 14,021. "Manufacture of copper, &c., tubes and articles by electrolysis." T. F. NEWMAN. September 28th.
 14,025. "Telephone exchange systems." WESTERN ELECTRIC Co. September 28th. (U.S.A., October 11th, 1916.)
 14,033. "Electric couplings." H. DE LA VALETTE. September 28th. (France, November 3rd, 1916.)
 14,035. "Dynamo-electric machines." ENCLOSED MOTOR Co. & H. C. E. JACOB. September 28th.
 14,049. "Valve receivers for wireless telegraphy." E. R. CLARKE. September 28th.
 14,054. "Watertight glands for electric cables." CALLENDER'S CABLE AND CONSTRUCTION Co. AND L. NEWITT. September 28th.
 14,071. "Electric illuminating device for telescope, &c., sights of machine guns." J. GERBER. September 29th.
 14,078. "Tilting trunnion combined with roller chain for electric tilting furnaces, tilting kettles, &c." J. H. TWIDELL. September 29th.
 14,092. "Electrical gyroscopes." A. H. NIDGLEY AND C. A. VANDERVELL AND Co. September 29th.
 14,097. "Spark plugs." M. J. WILCOCKS. September 29th.

PUBLISHED SPECIFICATIONS.

1916.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

- 10,731 FIELD MAGNETS FOR ELECTRIC DYNAMOS AND MOTORS. L. MURPHY, LYON & WRENCH. July 29th, 1916. (109,277.)
 10,985. METHODS AND APPARATUS FOR TRANSMITTING AND RECEIVING SOUND WAVES THROUGH THE GROUND. R. A. FESSENDEN. October 7th, 1915. (101,698.)
 12,446. METHOD OF COOLING COMMUTATORS OF ELECTRICAL MACHINES. THOMAS TRANSMISSION, Ltd., & J. G. P. THOMAS. September 2nd, 1916. (109,289.)
 12,528. ELECTRIC GENERATORS AND MOTORS. J. SHEPHERD. September 5th, 1916. (Cognate application, 3,155/17.) (109,294.)
 12,580. PROCESS OF ELECTRICAL PRECIPITATION OF SUSPENDED PARTICLES FROM GASES. A. MOND (W. A. SCHMIDT). September 5th, 1916. (109,297.)
 12,583. METALLIC BODIES AND PROCESS AND APPARATUS FOR OBTAINING THE SAME. J. PINISCH AKT. GES. September 5th, 1916. (Addition to 16,620/14.) (109,298.)
 12,584. VARIABLE-SPEED TRANSMISSION GEAR. T. VON ZWEIFBERGK. September 5th, 1916. (109,293.)
 12,689. HAMMERS. G. L. KOLLOCK & R. P. MARTIN. September 7th, 1915. (101,321.)
 12,690. PORTABLE ELECTRIC GENERATOR LAMPS. H. R. VAN DEVENTER. July 31st, 1915. (101,322.)
 13,342. METHOD OF AND MEANS FOR DEPOSITING METAL BY AN ELECTRIC ARC. E. H. JONES. September 20th, 1916. (Cognate application, 3,864/17.) (109,321.)

THE ELECTRICAL REVIEW.

VOL. LXXXI.

OCTOBER 19, 1917.

No. 2,082.

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TWO IMPORTANT QUESTIONS.

Two events have occurred during the past few days which are of considerable importance to the electrical and other engineering trades. Both are concerned with the preparations which the nation must make in connection with the work of reconstruction. The closer one gets to the inevitable problems of demobilisation and reconstruction the more serious do they appear to be. Neither the nation nor our national industries dare adopt an apathetic attitude in regard to such matters. The work of the Ministry of Reconstruction promises to become more important than that of any other section of Government, for its operations will necessarily cover practically all departments of activity, and upon the wisdom of its decisions and their timely adoption and execution must depend consequences fraught with immense possibilities for good or for evil. From the many things that we have written here already the reader is aware that this is no newly-arrived-at conviction so far as we are concerned. But no excuse is needed for returning to the subject now; indeed, our desire is to do so with greater emphasis than ever before, so that the industries which we represent may be prevented from falling into the lamentable error of delaying action which is imperatively necessary. The two events which lead us to refer to the matter now are: (1) the appointment by the Minister of Reconstruction of a special committee to report upon questions connected with the supplies of raw material that will be required by British industries in order to restore and develop trade after the war, and the best means of securing and distributing supplies, due regard being had to the interests of the Allies; (2) the approval by the War Cabinet of the report of the Whitley Committee on the relations between employers and employed, and the authorising of the Ministry of Labour to proceed with the setting-up of Joint Standing Industrial Councils. The first of these decisions is designed to ensure that our own industry in its different sections and that of the Allied countries shall have their proper share of the raw materials that may be available or reasonably in sight, so that there may be the least possible delay in finding employment for millions of workers, so that distress from unemployment shall be at a minimum, and so that we may as speedily as possible ensure industrial prosperity to help pay for the war. We in England recognise quite as well as the enemy does how vital is this matter of raw materials, and we cannot afford to let the grass grow under our feet. The second decision mentioned is closely related to the first, for while work for Labour is impossible without supplies of raw material, the latter will not yield the required results unless everything in enlightened reason is done to secure that there shall be what we

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Telegraphic Address: "AOEERAY, LONDON." Code, A B C.

Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 6d.; Canada, £1 3s. 10d. (\$5.80). To all other countries, £1 10s.

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Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

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have come to call Industrial Harmony produced by the promotion of a sincere spirit of co-operation between employers and employed.

If we all consider the matter one of great urgency—there is absolutely no question in regard to merit or policy—we may feel that the time for talking has gone by, and that the period for definite action is already upon us. That being taken as agreed, what are the courses that we ought to pursue, and pursue at once?

During war time, in order that essential industries may have the wherewithal to produce what the Forces have required, the Ministry of Munitions has exercised what to all intents and purposes has amounted to rationing of essential materials. We know how great have been the difficulties and grievances of some manufacturers in consequence; it is more than probable that those difficulties and grievances might have been lessened had the organisation of our industries been more perfect. This leads us to suggest, and we desire to do so very pointedly, that when the whole of the industrial world is clamouring for raw materials for much the same purposes as we ourselves shall require them for, the difficulties and grievances will not disappear. It will be most unwise of us to expect Governments to permit a wild scramble for supplies on the part of the industrial representatives of all the nations. That would make neither for equity among the industries nor for efficiency, and we all know the harmful possibilities if prices of essential raw materials, perhaps somewhat limited in volume, were to be subject to private manipulation. Is it unreasonable, then, to anticipate that in respect of some materials which the engineering industries will require there may be a special duty devolving upon the organisations which represent those industries? In season and out of season we have tried to impress upon the electrical trade the pressing necessity for complete organisation, and to-day, looking ahead regarding the conditions under which we may have to operate for some time after the cessation of hostilities, we are compelled, in the real interests of the electrical and other engineering trades, to urge every manufacturer who so far has been content to whistle along his solitary course as an unassociated trader, to consider his ways. With absolute candour, and with sufficient reason, we may say that it is in his own immediate interests, and in the interests of the workers in his employ, that he become connected with a trade organisation, for it is through trade organisations that governments can most effectively deal when such matters as raw materials are concerned.

So much for the need for organisation. Now let us turn to the question of the Whitley report on industrial co-operation. We ought to be able to assume that every responsible head of a manufacturing firm has made himself acquainted with the recommendations of the Whitley Committee, which were put before the trade organisations some months ago, and which were editorially referred to in the *ELECTRICAL REVIEW* for July 6th and August 24th, 1917. If we are not right in making that assumption, we can only regret it and urge that every such representative, whether his be an associated or an unassociated business, secure a copy from the Government publishers at once. There has been so much general talking about industrial harmony during the past two years that no more of it is needed in manufacturing circles, for surely every manufacturer sees by now that there will not be anything approaching industrial peace unless appropriate, sympathetic, and far-seeing measures are taken to ensure it. What, then, is the next step? The Government has made it clear that in many of its future industrial negotiations it will give preferential consideration to industrial organisations in the councils of which Labour has its representa-

tives. Accepting this decision as irrevocable and as correct, it seems to us that the right course for the organisations which represent electrical and engineering industries is to call in suitable representatives of Labour to consider with them the whole question of these Standing Industrial Councils which are about to be set up, and prepare the way for smooth development along the lines of the adopted recommendations. We shall thus leave the period of general talk on co-operation and get down to something definite out of which what we all aim at may be carefully and amicably evolved. We trust that such conferences will soon be arranged on this particular matter in the electrical and engineering circles. The scheme can be more easily applied if the necessary measures be initiated through the medium of strong and representative organisations. Therefore, we arrive at the conclusion that what is called for by these two problems—raw material supply and industrial unity—is more complete organisation of manufacturers and their co-operation with Labour. We have scattered our efforts far too long—the reasons matter little to-day—this is the time for concentration, and for serious constructive operations based on the Whitley proposals now endorsed by the Government.

Government Shareholding in Germany. ONE of the first instances of great importance in which the German Imperial authorities have taken up a considerable financial interest in an electricity supply undertaking

has just arisen. It concerns the Elektron Works Co., which is utilising extensive lignite deposits in the vicinity of Bitterfeld as fuel in connection with the production of electrical energy, particularly, if not exclusively, for one or two of the Government works in that district for the fixation of nitrogen. The shares in question were formerly owned by the Berlin Electricity Works Co., and were part of the directors' scheme for participating in electrical undertakings for the purpose of possessing other electrical interests in the event, which in the meantime has taken place, of the Berlin works and plant being acquired by the Berlin Municipal Council. During the course of the present year, however, the A.E.G. relieved its subsidy of these shares, partly by a cash payment and partly by an exchange of shares, and in its turn the A.E.G. has been constrained to transfer the shares to the Imperial authorities. At the July meeting of the A.E.G. it was mentioned that negotiations were proceeding in regard to a change in the situation respecting the shareholding in the Elektron Works, and it is now stated that the entire interests have been sold to the State for the reason, as given, that the Empire needs the production of energy at the works in question for war purposes. The A.E.G. is said to have been compelled to make moderate sacrifices on the transfer, which have already been provided for in the accounts, and to have renounced the right of repurchasing the shares which the company possessed.

According to later information the State has acquired all the shares issued by, and the credits advanced to, the Elektrowerke by the Berlin Electricity Works Co. and the A.E.G. It is stated that the purchase price is understood to range from £2,000,000 to £2,500,000, although the form in which the payment has been or is to be made has not yet been disclosed. The expropriation of the undertaking will permit of the closest co-operation between this lignite power station and the Imperial nitrate works, to which power has been delivered at contract prices which, owing to the growth in working expenses during the war, left no profit to the company.

C. H. WORDINGHAM, President of the Institution of Electrical Engineers.

THE new President, Mr. C. H. Wordingham, is one of the veterans of the electric supply industry in this country, having begun his professional career under particularly auspicious conditions as the only pupil of that great pioneer, Dr. John Hopkinson, and returning, after a spell of experience with the early supply of electricity in London, and in the construction of telephone exchanges, to become his chief assistant.

Educated at King's College School, followed by some years at King's College in the Department of Applied Sciences, Mr. Wordingham earned his A.K.C., and throughout his career has shown a practical interest in his old college. The college authorities have no less shown their appreciation of their old pupil by electing him to a Fellowship and to a seat on the Council.

Receiving his baptism of fire at an early age when the Grosvenor Gallery power station was burnt down, Mr. Wordingham went through the experience of the change-over to Deptford, and he was thus intimately connected with the first large-scale extra-high-tension system in this country. After removal to Deptford, he took charge of the standardising department—an early indication of the important assistance to the cause of standardisation which the President later on was so largely to contribute. Returning to Dr. Hopkinson, the supervision of the contracts for the Manchester and Whitehaven power stations fell to him, and in 1894, at the invitation of the Corporation, he became chief at Manchester, the original power station being then a mere 2,000 kw. or so. In the years that followed, the developments at Manchester ran up to 50,000 kw., and included the practical working-out of a three-phase system for lighting, traction and power over a district of some 45 sq. miles. In a report to the Corporation as long ago as 1896, Mr. Wordingham advised the adoption of a three-phase, 10,000-volt system—subsequently reduced to 6,600 volts—and he laid down the essential economical principle of concentration of plant in one large power station; he thus sowed the seed which has produced the present harvest in Manchester, where, under the control of Mr. S. L. Pearce, one of the finest and most successful municipal undertakings in the world has been established. The President's advice became then in much demand, and he determined to set up a consultative practice; a busy

and useful two years followed—then the "Destiny that shapes our ends" brought about the unexpected in the shape of an invitation from the Board of Admiralty to become their first civilian electrical engineer-in-chief, which Mr. Wordingham felt compelled to accept. Those who know of the great work he has done there in the years that have followed can testify to the successful result of the President's labours. An entirely new department had first to be organised, at a time when the application of electric power in the Navy was only just beginning—of fire control and similar telegraphs on board ship there was then no

trace. The new chief at once introduced parallel running of generators, raised the pressure from 100 volts to 220 volts, introduced paper-insulated cables, developed an entirely new system of distribution, and radically re-designed old fittings, besides introducing many new fittings of a very special design, and he also succeeded in getting the Admiralty contracts submitted to competitive tenders on definite specifications. His was the great responsibility of the design and supervision of contracts for the electrical equipment of all His Majesty's ships, and he has had the unique experience of having seen his designs and arrangements satisfactorily withstand the supreme test of action with the enemy. Not only has this responsibility covered the electrical equipment for all kinds of purposes of the greatest Navy in the history of the world, but since the first installations at the Admiralty Dockyards



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C. H. WORDINGHAM.

[London.]

carried out by Messrs. Preere & Cardew before the appointment of the Electrical Engineer-in-Chief, the President has been adviser to the Admiralty on all matters of power supply and lighting in all their land establishments, including the whole of the work for the great Dockyard at Rosyth and the numerous naval air stations established throughout the country. It is an appropriate year for the Institution of Electrical Engineers to place in the chair one who has done so great a work for that "sure shield"—our incomparable Navy—on which civilisation itself depends.

The President has ever been a hard worker in the interests of the Institution—the only touch of sadness being that his mother, who was such a constant and devoted companion to her son at the conversazioni and other public functions, is not here now to welcome his new dignity. He is one of the oldest members of the famous Wiring Rules

Committee, and has laboured for the Institution in many other ways. If he has served the Institution well, it may also be said he has served the industry even better. Very few people perhaps realise the enormous energy which Mr. Wordingham has put into the work of standardisation; so long ago as 1898 he read a paper on "The Necessity for Uniformity of Plant and Apparatus," and in 1902 he was invited by the late Sir William Preece to join the Engineering Standards Committee. For 15 years the President has given his best to this cause, and many British standard specifications are the visible result of the labours of the many Sub-Committees over which Mr. Wordingham presides.

The second President of the Municipal Electrical Association, now grown into the Incorporated Municipal Electrical Association, the esteem in which Mr. Wordingham is held by municipal engineers was shown by his election as one of the five Honorary Members of that Association. Chairman, also, of the Electrical Research Committee, founded under the auspices of the Advisory Council of Scientific and Industrial Research, he has embarked on a work of national importance, which will be of practical assistance to the electrical industry. Whether from his general courtesy, his invariable kindness, his wide experience in engineering, his great interest in research, and unceasing labours in the cause of British standardisation and the advance of the British electrical industry, the members will feel that they have done wisely in electing Mr. Wordingham to the highest distinction they can offer him.

THE FIXATION OF ATMOSPHERIC NITROGEN.

(Continued from page 342.)

The Schönher-Hessberger Process.—This process utilises a linear arc, the furnace containing a central iron tube, water-cooled at the top, and a movable bottom electrode, also of iron. The arc plays between the bottom electrode and the upper, water-cooled part of the top electrode. Air entering the furnace is heated to 500° C. by a jacket of hot gases; inside the central tube the temperature is 3,000° C., and that of the gases leaving the cooler and passing into the pre-heating jacket, is about 1,200° C.

This furnace is more robust than the Birkeland furnace, and does not require a magnetic field (which consumes 10 per cent. of the energy supplied to a Birkeland furnace). Nevertheless, Eyde states that the net efficiency of the Schönher-Hessberger furnace is practically equal to that of the Norwegian furnace.

In the Christiansand works, making only sodium nitrite by the action of gases at 300° C. on caustic soda, there are 12 150-kw. Schönher-Hessberger furnaces utilising A.C. at 1,200 volts, 50 cycles, and working with an arc 16 ft. in length. At Saarheim there are 96-kw. furnaces with 20-ft. arcs, the total length of the furnaces being nearly 10 ft.

The Panling Process.—Water-cooled iron electrodes, resembling a horn-type lightning arrester are mounted inside an oval chamber, through which air is blown from bottom to top. Alternating current at 6,000 volts, 50 cycles, is used, and the arc assumes a fan-shape. Furnaces ranging from 100 to 1,000-kw. rating are used at Gelsenkirchen (Westphalia). The French "Le Nitrogène" Co. uses furnaces of 600 and 1,000 kw. at Roche de Rame. Three 1,100-kw. and one 2,000-kw. furnaces are used at Nitrolée (U.S.A.); other furnaces of the same type are used at Innsbruck, Milan, Chippis, and in South Carolina; and a 15,000-kw. plant capable of producing 6,000 tons of nitric acid per annum has recently been installed at Muldenstein (Saxony).

The Naville-Guye furnace is of the same type as the Panling furnace, and yields 1,200 to 1,230 lb. of nitrogen per kw.-year. An inverted V-shaped arc is produced between horn electrodes, through which the gas stream is constricted. The Moscieki furnace, with a magnetically rotated arc, is not used extensively, but is employed in the Bodio Works of the Neubausen Co.

The Haussner Process.—Although this process has not been used on an industrially important scale, it is worth mentioning, because the high temperature requisite for direct oxidation of nitrogen in a mixture of nitrogen and oxygen is not obtained by the electric arc, but by explosion of a combustible mixture of gas and air. A mixture of town gas, air, and oxygen compressed to 45 lb. per sq. in. develops a maximum pressure of 325 lb. when exploded. The burnt gases are at once cooled by expansion to prevent decomposition of the oxidised nitrogen. The yield is equivalent to about 15 gm. of nitric acid per cubic metre of gas at the outlet of the apparatus. For the sake of cheapness, Haussner proposed to use coke oven gas instead of coal gas, but the yield per cubic metre of gas of 4,100 calories thermal value is only 170 gm., which corresponds to a much lower efficiency than is obtained in the arc processes. One wonders, however, whether there is a possible application for the Haussner process in conjunction with explosion turbines.

Direct Synthesis of Ammonia: Haber's Process.—Prof. Le Chatelier took out a patent concerning the synthetic manufacture of ammonia in 1901, but owing to a serious laboratory accident he abandoned his researches before bringing his results to an industrial basis. As subsequent events have shown, this was particularly unfortunate. The problem was again attacked by Haber in 1908, and, with the immense resources of the Badische Anilin and Soda Fabrik at his disposal, this investigator achieved a success so complete that the Germans are now producing at Oppau (near Ludwigshafen) at least 60,000 tons per annum of combined nitrogen, corresponding to 300,000 tons of ammonium sulphate. The latter is now produced at £6 per ton, where it formerly cost £16 per ton, and it is largely owing to the Haber process that Germany has been able to make fertilisers and explosives in spite of the Allies' blockade. The total cost of £6 per metric ton is due principally to the cost of materials employed; thus 476 lb. of nitrogen = 6s. 6d.; 102 lb. of hydrogen = 46s. 6d.; 1,662 lb. of sulphuric acid = 37s.; manufacturing cost = 32s.; total, £6 2s. per ton of ammonium sulphate.

The direct synthesis of ammonia from nitrogen and hydrogen, bristles with technical difficulties, both of materials and of processes, but all the difficulties have been overcome and the vital secrets are guarded effectually by the Badische works. Both hydrogen and nitrogen are now available cheaply on an industrial scale, and the Haber process, though it demands close and highly-skilled supervision, does not necessitate high temperature or very cheap electrical energy, yet it produces combined nitrogen at very low cost, and is a correspondingly serious rival to all other processes. The direct combination of nitrogen and hydrogen under stable conditions is made possible by aid of a catalyst, osmium, uranium, and various iron compounds having successively been found effective. Power required to compress the gases may be obtained cheaply from water-gas or from gas producers operating on lignite. Incidentally, it may be mentioned that electrical energy thus produced has been used extensively in Germany to make calcium cyanamide, the output of which has been increased considerably during the war.

Fixation of Nitrogen in Metallic Compounds.—Within the last quarter of a century the electric furnace has shown that the apparent inertness of nitrogen is simply a question of temperature, and that, at suitable temperatures, nitrogen is comparatively active. Even at normal temperatures, certain micro-organisms are able to fix atmospheric nitrogen, but the means whereby they do so is not yet known. The only metallic compounds of nitrogen which have yet found industrial applications are those with the carbides of alkaline earths and with aluminium.

Calcium Cyanamide, frequently (but erroneously) called simply cyanamide, is produced by the action of nitrogen on calcium carbide. Cyanamide itself, or its calcium salt, is transformed easily into urea, and so into ammonium carbonate. Cyanamide manufacture thus constitutes an indirect synthesis of ammonium carbonate. The special electric furnace used for cyanamide manufacture at the Odda works comprises a large iron cylinder with a double bottom and a detachable cover. The false bottom is perforated with holes, through which the nitrogen enters. Axially in the

furnace there is placed a long carbon pencil connected to the terminals of an alternator, and surrounded by a paper sheath. The charge of carbide, amounting possibly to 1,000 lb., is in successive layers separated by sheets of paper. When the central rod is heated by the passage of current, a temperature of 800 to 1,000° C. is attained along the axis, and nitrogen is then passed into the furnace. The action is completed in 25 to 30 hours.

In determining the electrical energy needed to fix nitrogen by the above method, it is necessary to allow for that consumed in producing calcium carbide. About 1 lb. of carbide is needed to fix 1 lb. of nitrogen, and 1 h.p.-year yields 3,300 lb. of carbide, hence 1 lb. of nitrogen requires 4/3,300 h.p.-year in respect of carbide. The energy requirements of the calcium cyanamide furnace are very low, and 1 h.p.-year is sufficient to fix at least 5,500 lb. of nitrogen, so that the total energy consumption is $(4/3,300) + (1/5,500) = 0.0014$ h.p.-year per lb. of nitrogen—i.e., 1 kw.-year fixes about 970 lb. of nitrogen. This corresponds to nearly four times the efficiency realised in arc furnaces: but the cyanamide process requires carbon (coke, anthracite, or wood charcoal), which is a compensating disadvantage in some countries.

As it leaves the furnace, the cyanamide contains barely 60 per cent. of CaCN_2 , the principal impurities being 18 per cent. of free lime and 12 per cent. of carbon. The nitrogen content is 20.5 to 21 per cent. Before the war, the principal, if not the only, use of cyanamide was as a manure, and its use will doubtless extend, although nitrates seem to be of higher manurial value. The latter varies with the conditions of test, but Gerlach gives the following figures:—

	Nitrogen content.		Relative value
	Gerlach.	Scott.	as manure.
	Per cent.	Per cent.	Gerlach.
	Per cent.	Per cent.	Per cent.
Sodium nitrate (Chile) ...	15	15½	100
Ammonium sulphate ...	21	18	89
Calcium cyanamide... ..	20–21	13	76
Calcium nitrate	13	18	99
Ammonium nitrate... ..	—	35	—
Farmyard liquid manure ...	—	—	64

When heated with water under pressure, cyanamide yields calcium carbonate and ammonia.* The yield of ammonia is 96 per cent. or more of the theoretical value, and the ammonia may be converted to sulphate (in a purer state than obtainable by distilling coal); or it may be combined with acid to yield ammonium nitrate, which, as shown by the above table, has a very high nitrogen content, and is therefore an economical form in which to transport combined nitrogen. If desired, the ammonia may be converted to nitric acid by the Ostwald catalytic process. The Haber process yields ammonia of higher purity at yet lower cost, and high purity is an important consideration in the catalytic oxidation of ammonia to nitric acid: but the Haber process is not likely entirely to supplant the cyanamide process, because the latter yields a number of nitrogenous compounds of growing importance.

The first cyanamide works date from 1909, but the world's production was 140,000 tons in 1911, 266,000 tons in 1913, and about 1 million tons at present (corresponding to 1,250,000 tons of Chile nitrate). German production (60,000 tons in 1913) is now about 400,000 tons per annum, and it is due to cyanamide and the Haber process that Germany has been able to dispense with 800,000 tons per annum of Chile nitrate, one quarter of which was used by industry and the remainder for agriculture. Early in the war the German Government placed £7,500,000 at the disposal of cyanamide works† and of the B.A.S.F.: as a result of this munificent grant, the supply of nitrates for explosives and agriculture has been assured.

The Serpek Process.—The B.A.S.F. has patented the manufacture of such compounds as TiN_3 , Si_3N_4 , but has derived no practical application therefrom. The Société des Nitrures (Paris), however, has developed the Serpek process whereby Al_2N_3 is made by heating bauxite and carbon in the presence of nitrogen. Under the action of high-pressure steam, Al_2N_3 yields pure alumina (useful in aluminium manufacture) and ammonia, which may be

regarded as a valuable by-product. The first industrial plant utilising this process consisted of two rotary-tube furnaces, in the first of which bauxite was dried, whilst in the second the dried bauxite mixed with carbon formed a resistance element between two carbon rings, and was thus heated electrically, in the presence of nitrogen. The first furnaces were of 3,000 to 5,000 kw. rating, but 500-kw. furnaces are now considered preferable. It is estimated that 1 kw.-year yields 2 tons of pure alumina and 1,100 lb. of nitrogen in the form of ammonia. The Serpek process seems to be capable of great development, and further details concerning it are given in *Génie Civil* (*loc. cit.*).

Oxidisation of Ammonia.—This is a chemical process dictated by the commercial consideration that nitrogen is worth more as nitric acid than as ammonia. Also nitric acid is a primary material in the manufacture of explosives. Ammonia and atmospheric oxygen interact to yield nitric acid when they are passed over spongy platinum. The true action is complicated, but the apparatus is simple. Various refinements have been introduced, but essentially Ostwald's apparatus is retained. Nearly 100 per cent. efficiency of conversion is obtained, the principal requirements being pure ammonia, such as is yielded by the Haber process.

(To be continued.)

MAGNETIC TESTING FOR STEEL PRODUCTS.

A NEW method of testing steel and steel articles without damaging them in any way was described recently before the American Society for Testing Materials, and is, we understand, to form the subject of a forthcoming bulletin of the Bureau of Standards. The method in question consists of simple magnetic tests, and is based upon the fact that the magnetic and mechanical properties of a certain grade of steel are definitely co-related, so that one may be taken as a criterion of the other. Mechanical tests, chemical analyses, and microscopic examinations of steel are all useful, but none of them can be applied to the actual piece or part which is to be used in service. Mechanical, chemical and microscopic tests are vicarious: they relate only to a small part (sometimes a *very* small part) of a specimen which is assumed to be representative of the service piece or pieces, and the results of such tests are frequently no more than comparative. Magnetic tests, on the other hand, can be applied to the actual pieces to be used in service, they can be applied to the whole length of a steel rail or to the working tip of a tool, and their results can be interpreted definitely, after establishing the magnetic characteristics of what is known to be a satisfactory sample, by a preliminary series of tests.

The first step in evolving magnetic tests to be applied to steel or steel products on an industrial scale is to determine magnetic data for good, bad, and indifferent samples, and thence to derive a scale of equivalence between magnetic data and whatever qualities it is desired to assess in the material under examination. The best magnetic criteria to be adopted in individual cases must be determined by trial, and apparatus must be designed to suit the work pieces handled and the tests made thereon. An important point is to arrange the tests and apparatus so that a minimum of skilled attention is required. The tests can and should be reduced to routine.

As typical of the kind of relation which it is desired to establish (naturally on a definite numerical basis in individual cases), it may be mentioned that the greater hardness and tensile strength and the reduced toughness following upon increased carbon content in steel are accompanied by increased coercive force and hysteresis and decreased permeability. Similarly, cold-drawing of carbon steel increases its tensile strength and simultaneously increases the coercivity and hysteresis, whilst reducing permeability. Heat treatment, the lapse of time ("ageing"), and previous mechanical treatment, all produce corresponding changes in the mechanical and magnetic properties of steels, and it is possible to determine, once for all, the numerical relation between these changes for each particular steel.

* Details of the process are given in *Génie Civil*, pp. 370-371.

† Bayerische Stickstoffwerke, Trostberg (Frank-Caro process); A.G. für Stickstoffdunger, Knapsack und Mitteldeutschen Stickstoffwerke, Gross Kayna (Polzenius process).

The great advantage of magnetic testing in the present connection is that it can be applied quickly (where suitable apparatus is designed for repetition tests) to actual pieces which it is intended to use—even to pieces in service (*e.g.*, bridge members, mine-shaft cables, &c.). Another advantage of magnetic testing is that it indicates variations in mechanical state, chemical composition, heat treatment, &c., whether purely local or whether in the piece as a whole. Of course, the number of variables capable of affecting the magnetic properties necessitates systematic and well-devised interpretation of the latter, but there are no serious difficulties. A simple variation-in-leakage test permits a steel rail to be tested for uniformity in one minute or so. An induction test, using some form of permeameter, then discloses unsuitable chemical composition and bad heat treatment (such as unsuitable finishing temperature or too rapid cooling). Measurements of coercive force reveal differences in quenching temperature as accurately as pyrometer readings.

Raw materials may be tested rapidly and with certainty by magnetic means. The quality of finished products may be checked in the same way, and it may be ensured that samples, whether of material or of products, are really representative. The consequences of not detecting a faulty sample until a destruction or service test is reached may be far-reaching. The possibility of testing actual service pieces without injuring them in any way permits of more economical design with a lower initial factor of safety, and the possibility of testing parts whilst in service permits them to be used until the lowest permissible factor of safety is reached. To cite only a single example, steel ropes for hoisting or winding may be kept much longer in service when a reliable means is available for observing continuously their deterioration. Individual testing of all parts or pieces permits of grading, and, by eliminating uncertainty as to quality, prevents wasteful expenditure of material and quality, and attaches higher value to the latter where really required, since it can now be guaranteed with greater certainty.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Disconnectors and Gate-End Boxes.

MESSES. GEORGE ELLISON, of Wellhead Lane Works, Perry Barr, Birmingham, have recently introduced a line of "disconnectors" for A.C. and D.C. circuits up to 720 volts. These are intended for isolating sub-sections of works installations, branch cables and motors, during alterations or repairs, and being "isolators" only are not intended to be operated when currents are flowing. They can be bolted to walls or installed in cable trenches and manholes. Two sizes, triple-pole, for cables of 125 and 24 sq. in. section, are made; by omitting one pole a double-pole pattern is obtained.

The contacts of the two sizes will carry 125 amp. and 210 amp. with 35° F. temperature rise.

Fig. 1 shows a disconnector with the case closed; fig. 2 shows



FIG. 1. ELLISON DISCONNECTOR, CLOSED.

the switch interior removed. The arrangement consists of a circular cast-iron box built up in three sections, and provided with four flanges for radial cable fittings.

The mechanism and contacts are supported on the base casting only; the fixed contacts are round copper rods with tapered ends, while the moving contacts are brass blocks with circular recesses or chambers containing rings made of phosphor-bronze spiral springs, which the plugs force against the sides of the recesses, giving an

intimate elastic self-cleaning contact between plug and block. A cast-iron partition under the handle entirely encloses all live parts, and the whole moving system can be withdrawn from the box without the risk of accidental contact with live parts.

Fig. 3 shows another of Messrs Ellison's specialities, viz. an oil break gate-end box with trailing cable socket and plug inserted, the breaker being closed. The makers point out that instead of using long and heavy trailing cables to remote positions it is better to install plug sockets, with a protecting switch or circuit breaker at suitable intervals.

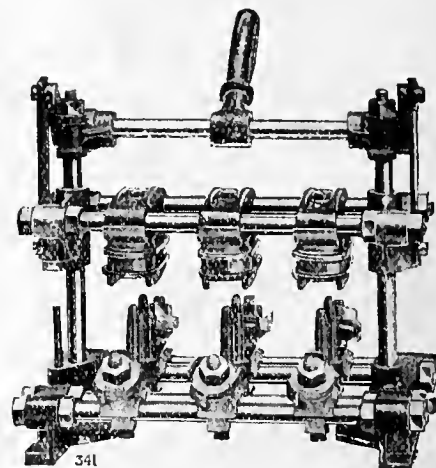


FIG. 2.—SWITCH INTERIOR REMOVED FROM BOX.

The fittings have been designed to combine an oil circuit-breaker, interlock and socket and plug in one unit, with special application as gate-end boxes for the trailing cables of coal cutters. One size of 100-amp. capacity is made in double and triple-pole patterns for use with standard oil circuit-breakers.

For the double-pole pattern, a three point socket and a plug are mounted on a dividing box bolted to a D.P. breaker, and the plug cannot be removed until the breaker is off. In the triple-pole

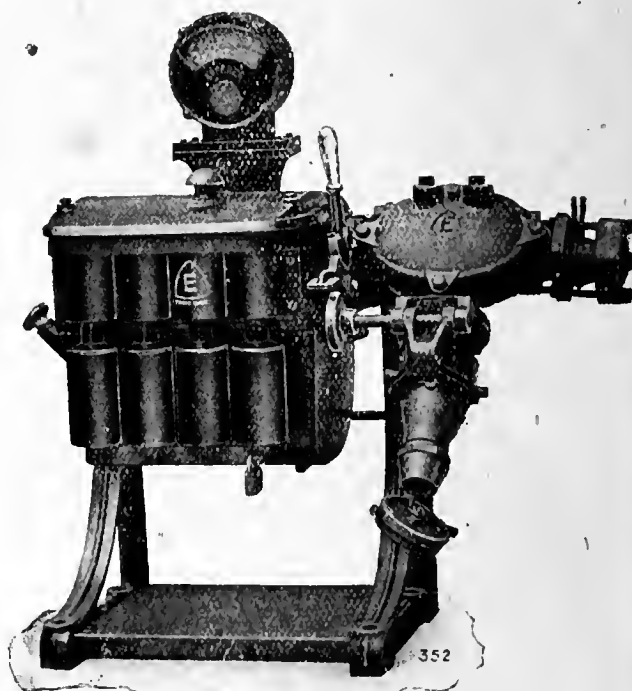


FIG. 3.—ELLISON OIL-BREAK GATE-END BOX.

pattern a four-point plug is used. The socket and plug cases are made in cast brass, with interiors of ebonite and gunmetal terminals; the plug is fitted with a grip to take the usual types of cable.

The cable cone clamps have substantial earthing lugs, and a terminal with shell clamp is fitted in an accessible position on the breaker. An ammeter or voltmeter, and pilot lamps, can be fitted, and the complete unit can be wall mounted or mounted on a stand as shown.

The apparatus is suitable for A.C. or D.C. circuits up to 750 volts pressure.

Stell's Cable Fault-finding Apparatus.

Finding faults in cable core at the earliest possible stage of manufacture will be admitted by makers to be a most desirable achievement. From the boy holding a wet cloth on the cable and receiving a shock when a faulty portion passed through it, to the more humane if less exciting use of a galvanometer, battery, and water bath, was not a long step, nor was the result all that could

be desired, for high-resistance faults still escaped detection, and the process could not be applied to cables at all stages of manufacture. The development of a successful "spark" method of testing, therefore, by MESSRS. NORMAN, STELL & CO., of 23, Spring Gardens Road, Heaton, Bradford, will be welcomed by the trade. We understand that the apparatus has been at work successfully for some 12 months, 10 hours or more daily, and has proved its worth; it is illustrated in fig. 4 herewith. In the makers' words, the method consists of using a high-potential and high-frequency discharge or spark to indicate a fault, the conductor of the cable being connected to one terminal or earth, while the cable itself runs through the hand-clip provided, which is connected to the H.T. terminal by means of flexible leads.

The apparatus comprises an induction coil controlled by specially arranged instruments, the energy being derived from any commercial D.C. or A.C. lighting supply, and the makers have arranged, for general work, a "Standard" apparatus fitted for four sets of fault-finding, each separately controlled; 20 ranges of regulation are provided. It is arranged for connecting to any B.C. lampholder or wall plug (two-pin), and being fitted (excepting leads and clips)

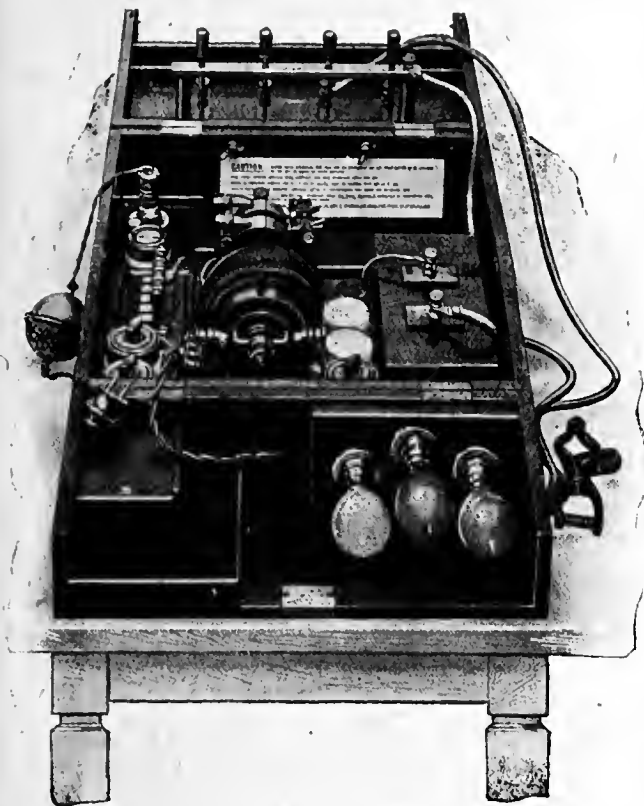


FIG. 4.—STELL'S FAULT-FINDING APPARATUS.

in a polished wood case, it is easily portable and can be used in any convenient position.

The makers claim the following advantages for their method and apparatus:—

The cables may be kept perfectly dry, so that repairs can be better and more easily made.

Cores can be examined before vulcanisation, thus obviating the separate curing of repairs.

Finished wires or cables which would be damaged by water or dampness can be easily "fault-found."

No batteries or tremblers are used, and consequently the detecting spark remains constant, thus eliminating expensive renewals.

Faults of comparatively high resistance (say, 200 megohms) are easily detected, hence the customary "breaking down" of faults—which is often damaging to the cable—is avoided.

There is no danger to the operators, provided the simple caution given with sets is observed.

The current consumption is exceedingly small, and a "short" on the primary or secondary of the coil will not cause any damage.

The wear and tear is exceedingly small.

No special skill is required to use the apparatus or keep it in working order, there being no intricate or delicate parts.

The spark, being static, does not damage the insulation as an ordinary A.C. high-tension current sometimes does.

The spark can be both seen and heard.

Finished flexibles and P.R. insulated cables can be examined for faults.

Cables and cores can be easily fault-found wet if proper precautions are taken—viz., the usual insulation of the conductor from the drum spindle and the outside of cable or core.

MESSRS. THOMPSON & CO., 48, Watling Street, E.C. 4, are the London agents for the makers.

The New C.A.V. Electric Starter.

The accompanying illustrations, fig. 5, show the initial and final positions of the pinion of the C.A.V. starter, which we described on

page 305 of our issue of September 28th. In the first position the screw thread is visible, which, when the motor is set in slow motion, with the pinion drawn into contact with the gear on the flywheel, brings the pinion fully into gear as in the second view. By using a two-position plunger, which allows the pinion to mesh with the gear wheel at a low speed, before the full power of the motor is

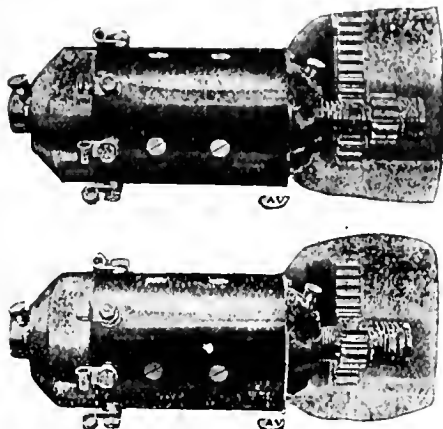


FIG. 5.—THE C.A.V. STARTER, DISENGAGED AND FULLY MESHED.

exerted, the sudden impulse which is applied to the flywheel by some American types of starter is avoided, and there is no danger of breaking the engine shaft. The screw also ensures with certainty the disengagement of the pinion without damage to any part of the mechanism in the case of a backfire.

We are informed that owing to the great public interest taken in the new starter and the wide publicity it has received, the firm have found it impossible to cope with all the demands for booklets, drawings &c., but inquiries are being dealt with as rapidly as possible.

THE ENGINEERING PLANT IN LARGE HOTELS.

SPEAKING on this subject at UNIVERSITY COLLEGE, LONDON, last week, at a public introductory lecture in association with the Sub-Department of Heating and Ventilating Engineering, Mr. A. H. BAKER, B.A., B.Sc., Whit.Sch., said the organisation of a large modern hotel was an affair of considerable complication. It must be prepared not only to supply the requirements of a thousand persons at all times, but at any moment for the unexpected arrival of a hundred new visitors at a time. Such an event should hardly cause any stir or confusion, but merely somewhat harder work on the part of the staff. Things were done for the individual guest to all appearance so automatically, that he never even thought of the organisation and engineering plant involved. It was the labour-saving devices which constituted the engineering equipment which enabled it to be done; it could not be done without these apparatus. The application of such apparatus on a small scale to a private house would greatly reduce the labour necessary. It must also be remembered that no part of this great mass of machinery was visible to the guests in an ordinary hotel except the lift cages and the taps. The bulky parts of the plant were all disposed of either in the sub-basement, which was one mass of machinery over almost the whole area, or at the top of the building. A large hotel was not constructed until a very great amount of thought had been expended upon it; its construction was so complicated that it would be inviting disaster to commence operations before the whole of the details had been exhaustively thought out. In the case of some large hotels in which he had been interested, every motor, fan, and other piece of machinery, every pipe and flue, had been on the plans, and the whole of the calculations had been completed even before the buildings, which were to be destroyed in order to make room for the future hotel, had been demolished. A particular example of this kind was very complicated. The hotel was practically cut in two by a railway which passed right through it; only one set of boilers was admissible, so that the supply of steam had to be carried across the railway to all parts of the building. Similarly, fresh air for ventilation could only be taken from one portion of the site, and distributed from this to every part of the building, and the same was true also of other services.

In the boiler-house and heater-room all the heat required for every service except the direct fire cooking was generated. The cost of the fuel in an hotel was a very serious item, amounting in some cases to tens of thousands of pounds per annum. It was easy to see that facility of control was one of the most important features in the design. It was necessary that it should be perfectly easy not only to know what the requirements at any given time were, but to adjust them according to requirements with very little trouble. It was, therefore, in the first place desirable to provide that all such operations could be carried out from one point in the hotel.

In the buildings for which he had been responsible this had been arranged to be done from one centre which he had termed the "control room," in which were concentrated electrical and mechanical appliances for enabling the control to be exercised at distant points without the engineer-in-charge leaving the control room. One of the principal difficulties in arranging all the mass of machinery in an hotel was to provide against noise, particularly in a modern hotel constructed of steel girders and concrete, which transmitted noises from the basement to the upper floors with great ease. The noisier machines had to be placed outside the buildings. It was necessary in all cases to bed the motors on sound-absorbing foundations, such as cork, or felt, or hair mattresses. Many of the operations necessary in a modern hotel continued throughout the night, and in one of the big areas or courtyards of an hotel, surrounded on all sides by bedroom windows, most of which were open, the least noise was apt to be magnified in the stillness of the night, and to become a ground for complaint.

WAR ITEMS.

Exports to China.—The "London Gazette" for October 16th contains further names of persons in China and Siam to whom exports may be consigned.

Belgian Reconstruction.—It is stated that M. Paul Hymans, the Belgian Minister, has been called upon by his Government to take up the direction of a new Ministerial Department specially entrusted with all questions concerning the economic reconstruction and the commercial policy of Belgium.

Trading with the Enemy.—The "London Gazette" for October 12th contains further lists of persons and bodies with whom trading is prohibited in the following countries:—Argentina, Paraguay, Uruguay, Bolivia, Chile, Netherlands, Netherlands East Indies, Norway, Peru, Spain, Sweden, and Venezuela. Variations in and removals from previous lists are also given.

Raw Materials After the War.—Dr. Addison, the Minister of Reconstruction, after consultation with the other Government Departments concerned, has appointed a Committee to consider and report upon questions connected with the supplies of raw materials which will be required by British industries for the purpose of restoring and developing trade after the termination of the war, and the best means of securing and distributing supplies, due regard being had to the interests of the Allies. The Committee is requested, in regard to any commodities which might not be available in sufficient quantities and at reasonable prices through the ordinary commercial channels, to consult members of the trades concerned with regard to any steps that may be necessary to safeguard the needs of industry, and to secure convenient and equitable distribution. The Committee, which will be known as the Central Committee on Supplies of Materials, consists of the following:—Sir Clarendon Hyde (chairman), Sir Henry Birchenough, K.C.M.G., Mr. Cecil Budd, Sir Charles W. Fielding, K.B.E., Sir H. Babington Smith, K.C.B., Mr. Wallace Thornycroft, and Mr. Andrew Weir. The Secretary is Mr. J. F. Ronea (Board of Trade), communications to whom should be addressed at the Ministry of Reconstruction, 2, Queen Anne's Gate Buildings, Westminster, S.W. 1.

Commerce and Demobilisation.—According to the *Financier*, the Council of the London Chamber of Commerce has referred the question of reconstruction affecting industry and trade to the trade sections concerned, with a view to the formulation of a definite policy in the interests of manufacturers and merchants. It has referred to a special committee to report as to the desirability of the early release from military service, after the war, of men in commercial occupations, including principals, partners, clerks, and technical experts, whose places have been kept open for them or whose services will be urgently required after the war. Arrangements were also agreed upon for a public meeting of merchants and others on the question of Government control of trade.

Recruiting in Munitions Areas.—Defence of the Realm Regulation 11AA, which came into effect on August 8th, 1917, requires employers to whom it applies to notify the Munitions Area Recruiting Officer within 48 hours when a man enters or leaves their employment who holds a certificate issued by any Munitions Area Recruiting Officer. This Regulation has been made in order to secure that the records in the Recruiting Register of men who hold certificates protecting them from recruitment because they are engaged on Admiralty, War Office, or munitions work, are kept up to date. The Scheduled Occupation Certificates and the Protection Certificates issued under the Schedule of Protected Occupations are only valid so long as the holder is engaged on Admiralty, War Office, or munitions work, though, as explained below, men will not forfeit protection from recruitment merely because they are moving from one firm engaged on such work to another. It is necessary in the interests of all concerned in the output of ships and munitions of war,

and in recruitment for the Army that the value of these certificates should not be impaired through their retention by men who have ceased to be entitled to hold them. It is not intended that this Regulation should in any way interfere with the individual workmen's freedom to change his employment, which is restored now that the abolition of leaving certificates under the Munitions of War Amendment Act, 1917, takes effect. On the other hand, it is not reasonable that protection from recruitment, which is given solely on the ground that a man is more usefully employed on necessary war work than he would be in the Army, should be abused by protracted absence from work. Accordingly instructions have been given to Munitions Area Recruiting Officers that after 14 days from the date of leaving they should call up any man who has left his employment, if by that date no notification has been received of his re-employment on work which entitles him to continued protection. In view of the urgent demand for labour of the kind protected under the Schedule, it is considered that a fortnight is ample time to allow for workmen to obtain fresh employment. If by the end of 14 days a man is still not employed on work entitling him to protection, he becomes liable to recruitment, unless he can prove to the Enlistment Complaints Committee that his failure to obtain work was due to sickness or to a definite cause entirely beyond his control, such as the temporary closing of a shop where he has secured employment. The period of 14 days runs from the date when the workman actually leaves his employment, whether he leaves on the week's notice or termination of employment provided for under the Munitions of War Amendment Act, 1917, Section 3 (1), or otherwise. It is the duty of any man holding a Scheduled Occupation Certificate, Army Form W.3476A, who changes his employment or his address, to take or send his certificate to the nearest Recruiting Office, in order that the change may be duly recorded in the Military Register.

Exemption Applications.—At Rochdale, temporary exemption to February 28th was given to F. Walton, 29, married, an overhead linesman in the Corporation tramways department. He was now C.2, formerly Class A, and Mr. G. Webster, the manager, said the man had been discharged from the Army.

At St. Annes-on-Sea, when two motormen, each C.2, were exempted to the end of March, it was stated by Mr. H. W. Laing, manager of the Blackpool, St. Annes & Lytham Tramway Co., that some 160 men in the company's service had joined the Forces, and there were now only eight of the original staff left.

At the West Riding Appeal Tribunal, a Leeds tramdriver, aged 42, Class A, who pleaded domestic hardship owing to the illness of his wife, said he was also in a certified occupation. He had been a driver continuously for 14 years, but it was said the Corporation were prepared to release him. Discharged soldiers were being substituted. The appeal was dismissed, applicant to report in a month.

At the same Tribunal, the storekeeper of a Leeds cable company, aged 39 and Class C.1, said that his firm were doing Government work, and he was better employed than in the Army. The case was dismissed.

At Farsley, Norman Hill (29), C.3, secretary of the Morley Electrical Engineering Co., had his exemption extended till December 31st.

At the same Tribunal, C. W. Broadbent (32, C.1), fitter; E. B. Wheatley (36), tool fitter; and F. Strickland, ripping machinist, all employed by the Phoenix Dynamo Co., Ltd., Bradford, were informed that, being in possession of trade cards, there was no further need for them to appeal, but should the cards be withdrawn they must lodge appeals within seven days, or otherwise they would be soldiers.

Before the Herts. Appeal Court, exemption was sought by M. J. Connari (38, B.2), electrician, Watford. The Military Representative said that it had been decided twice by the Local Tribunal and once by the County Appeal Court that appellant had no claim on business grounds. The Court heard the claim on the one-man business plea, but dismissed it, with grace until November 15th.

At Reading, an appeal was made by J. H. Ferguson (36, C.3), director and secretary of the Whitechurch and Pangbourne Electric Supply Co., Ltd., and said to be practically the only person now running the concern. Sir Cameron Gill, for the Military, claimed appellant as being useful for the Army Pay Corps. Three months were conceded.

Before the Horsham Rural Tribunal, exemption was claimed for the man in charge of the electric lighting plant on the Lower Beeding Estate (30, B.2). The man desires to join up, and time in which to find a substitute was asked for. The Tribunal suspended the calling up for five weeks.

Maidstone Tribunal has granted six months' conditional exemption to H. Clement (37, C.3), electrical engineer at the Allington pumping station.

Dover Tribunal has granted a further three months' exemption to A. E. Overs (33, C.1), electrician at the King's Hall.

On the appeal of Messrs. J. Walsh Ltd., exemption until April 11th has been granted at Sheffield to L. Fryer (B.1), electrical engineer.

A month's exemption has been allowed to T. W. Johnson, electrical engineer at the Stansted (Essex) sewage works.

On the appeal of the City Council, the Chester Tribunal has granted four months' exemption to the tramways super-

intendent, and conditional exemption to a driver (C 2) and a coachbuilder (41, B 1).

An electrical engineer and contractor (31, B 1), who appealed at Newcastle-under-Lyme, has been given exemption until the end of the year.

At Rochdale, exemption was claimed by W. Pickard (30, B 2), electrical engineer, previously rejected, and now engaged in making experiments. He was given until January 31st.

At Swinton and Pendlebury, Messrs. Ermin & Roby appealed for their electrical engineer (38), and temporary exemption until December 31st was granted.

Brighton Tribunal has granted three months' exemption to an electrical contractor (29, C 3).

At Leicester, appeals were made by two partners in a firm of electrical engineers, one in C 1 and the other in C 3. It was stated that the firm's turnover was £4,000 per annum, and that they were doing a great amount of work for local engineering firms. The C 3 appellant was allowed four months' exemption, and the other appeal was adjourned.

The East Kent Appeal Tribunal has allowed a Military appeal against the refusal of the Broadstairs Tribunal to withdraw conditional exemption held by the chief store-keeper of electrical plant in the employ of the Isle of Thanet Tramway Co. The man is not to be called up before January 8th.

An appeal was made at Maidstone for J. H. Baxter (31, passed for general service), electrician at the mills of Messrs. Reed, Tovil. The firm was willing to accept a substitute, and exemption was granted until a suitable one is found.

On the appeal of the Electric Tramways Co., the Oxford Tribunal has granted three months' temporary exemption to A. W. Oakley (37, C 3), blacksmith's fitter.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Curiosities of Early Mains Work.

In your issue of September 28th I read with considerable interest the article by Mr. G. W. Stubbings under the above heading. In it, he refers to "a system of distribution recently proposed in which the live main is looped into each consumer's premises in order that one distributor may be sectionised." I presume that the system he mentions is Patent No. 12,664/15, by Messrs. Callenders & Frampton. If this is the case, I think he cannot have given the system very careful consideration. His sole objection to it seems to be on the score of expense, and he quotes, as an example, the cost of a service 20 yards long. In the first place, in most provincial towns where distributors are laid on both sides of the streets, a consumer's cut-outs are very rarely 20, or even 10, yards from the main. Then, it is not proposed, I believe, to install a sectionising device in every consumer's premises; it would obviously be absurd to install one in a main street where practically every shop is connected; but to have two or three in each street would simplify fault localisation considerably, and what is of greater importance, would admit of the majority of the consumers' supplies being got on almost immediately (I am referring, of course, to a street being fed from both ends). These sectionising devices, moreover, would act as disconnecting boxes, thereby saving the cost of boxes, bush chambers, path frames, and covers, &c. The only expense entailed is in the cable, and this can be ordinary three-core with a small middle wire (in a three-wire D.C. supply), and two cores the same size as the main. The cut-out need only be a very simple affair, and can be made by anybody from odds and ends which are always lying about in the works. The extra labour is almost negligible. The system is quite capable of obviating a tremendous lot of mains trouble, and if Mr. Stubbings goes carefully into it I think he will admit that any slight extra cost is very easily balanced by the ease and simplicity of localising the fault and re-establishing the supply.

A. E. Baker.

R.F.C., B.E.F., France.

October 7th, 1917.

The Prospects of the Central-Station Engineer.

In your footnote to the letter of "Staff Electrician," in your copy of September 28th, you say:—"Under existing circumstances we cannot recommend young men of ability and ambition to join the staffs of power stations, unless it be for the purpose of acquiring a first-hand knowledge of the organisation and working conditions of such stations as part of their technical training, and not as a career."

Now, Sirs, if your advice is to be taken at its face value, it discloses a most serious and lamentable state of affairs—or, should I say, state of mind?

The generation, distribution, and utilisation of electricity, you will admit, is of some importance in the national life,

even at this date, and yet it is but on the threshold of its fuller development and possibilities.

"Existing circumstances," admittedly, are not all that are desirable. They are the result of lack of foresight and imagination in the early days, of the English genius for muddle, and of selfishness. That is in the past.

Are existing circumstances to become permanent? They can't. They must improve or deteriorate. Surely there must be something better to look forward to and to work for?

But a way to help forward is not to advise young men of ability and other desirable characteristics to shun us. It appears to me that this advice savours of rank disloyalty to those of ability and ambition already in the profession, whose ambition is not alone of the personal variety, but who have the fuller development of their chosen work in life ever before them; and there are such men, I beg to inform you.

Young men of ability and ambition are sorely wanted; never so much before as at this time—would you assert that an influx of "duds" is desirable, or is calculated to fit the profession to face the immense possibilities opening out before it?

Come, Sirs! Not a small percentage of your readers are numbered amongst us in the central-station side of the profession, and we look for an exhibition of truer logic on your part than is revealed in your advice as above set out. Admit that your criminal pessimism was an after-effect of some Hunnish raid!

John A. Vice.

Manchester, October 11th, 1917.

[Our correspondent writes an able and interesting letter, with much of which we agree. The subject is one on which a volume could be written, and, therefore, it is difficult in the space available to discuss it adequately; but it is necessary to make our position clear, and to disabuse the minds of Mr. Vice and his central-station colleagues with regard to our loyalty to their profession—though, in view of the efforts we have made during many years to improve their salaries and status, this should be a superfluous task! We fully realise the increasing importance of electricity supply, and are doing all that we can to accelerate its reorganisation on more efficient and economical lines; there will in the future be some very desirable appointments to be filled in this branch of the industry, and many more that can be described as comfortable. It is true in this calling, as in others, that there is always room at the top. But there is vastly more room in the lower grades of employment, in which the salaries are low, the work is monotonous and unvarying, the duties involve attendance seven days a week, and the prospects of advancement are poor. For proof of these facts, though he must be aware of them, we refer our correspondent to the articles on "Wages and Holidays in Central Stations" in our issue of February 28th, 1913; "Salaries in Municipal Undertakings," April 11th, 1913; "The Position of the Shift Engineer after the War," January 12th, 1917, and the letter of "Ex-Shift" in the following issue; and "Staff Organisation in Electricity Supply Undertakings," July 13th, 1917. These articles represent the "existing circumstances" to which we explicitly referred, and which our correspondent admits are "not all that is desirable"—a mild expression. He says: "That is in the past." Unfortunately, it is also in the present, and that is the reason why we cannot recommend any young man of ability and ambition to enter a power station with the intention of remaining in the business.

We fervently hope that the conditions will be changed in the future. We do not find fault with the able men who are engaged in electricity supply, nor do we reflect upon them in any way; but we sympathise with them as, in the main, a class of men who render valuable services to the community under conditions of work and remuneration which are a disgrace to the country.—EDS. ELEC. REV.]

The E.T.U. and the A.E.S.E.

I observe in Friday's, October 13th, issue that your correspondent, signing himself "Shift Engineer," states that there is no organisation in the provinces for dealing with shift engineers. I would point out that this Society has over 160 branches throughout Great Britain and Ireland, and seven special station engineers' branches, all of which cater for this and all station electrical grades. I shall be glad to supply him with full particulars, or he can obtain them direct by writing to our general office at 137, Great Clowes Street, Manchester.

H. H. Morton,

Secretary, Electrical Trades Union,

London Station Engineers, No. 1 Branch.

London, October 13th, 1917.

Anonymous advocacy carries no conviction, and adds no weight to discussions; we may therefore direct ourselves to the only signed letter on this topic in the columns of the last issue of your journal.

Ruling out the advertising matter in that letter, the remainder stands as an indictment of A.E.S.E. inactivity. This entirely misses the mark, and it would be well if your interested readers realised the following facts:—

This movement amongst station engineers does not arise

out of "A.E.S.E. tactics," but out of "E.T.U. tactics," and has been independent of any organisation.

The pioneers of the A.E.S.E. were central-station engineers, and its present constitution is that of central-station engineers.

Logical sequence: Individual aims merged in the common desire for a body representative of central-station engineers, which is now the A.E.S.E.

That is the only fact that matters, and all discussion surrounding A.E.S.E. inactivity and its past, or E.T.U. activity and its future, is superficial and futile.

The term "democratic" creeps into Mr. Barnes's letter. As a trade unionist he should be amongst the first to recognise that democracy clearly defines the right of every section to voice its own opinions. To assert that "an effective organisation will not tolerate interference" is hardly a democratic utterance!

W. Arthur Jones, *Hon. Sec.*

H. W. Healey, *Chairman.*

London Division, A.E.S.E.

Leytonstone, October 15th, 1917.

Instructions to Meter Readers.

I have been much interested in your article on "Meter Reading"; throughout, one could see it was from the pen of a practical man. I should like, however, to take exception to the statement of Mr. G. W. Stubbings, who thinks the average man would advise a consumer that his meter was 200 per cent. fast. I should like to ask G.W.S. if he has ever considered it worth while to spend a few minutes with his meter-readers, and give them advice, as these men need training just as much as the men in any other department.

I have known a chief to meet the meter-readers in at night, inquire as to the number read, and talk about the difficulties in a practical way, and advise them generally. The result was that the men saw the importance of the job, it led to a better understanding, and afterwards they tried to carry out as far as possible the engineer's wishes. I can only recall one such interview, but everybody benefited by it. I agree with G.W.S. that meter reading has to be done quickly, and any inspection of apparatus, to be of any value, would be better left to an inspector proper.

A.B., *Meter Inspector.*

October 15th, 1917.

The Association Movement.

Your leading article of the 5th inst. and Mr. Berry's contribution of the 12th serve to focus attention on a subject which is destined to receive even more consideration in the near future.

I hope you will prevail upon Mr. Berry to develop in a later article the plans to which he refers in his concluding paragraphs.

We are all in his debt for his earlier efforts, of which he has given such an interesting account, and his further advice cannot fail to interest many of your readers.

Has he despaired of the Federation of British Industries ever becoming a true federation of associations of the type his instinct rightly leads him to desire?

O. N. Looker.

LEGAL.

A DUNDALK PROSECUTION.

AT Dundalk Quarter Sessions, before Judge Green, Dominico Mezza, an ice-cream merchant, was found "not guilty" on a charge of fraudulent abstraction of electricity belonging to Dundalk Urban Council. Mr. P. A. SPALDING, the Council's electricity engineer, gave evidence in support of the contention that current was being used without going through the meter. To the Judge, witness said he could not state the method used to prevent the current being registered; he could only give the results. He was sure, however, that "a man in the street" could not adopt this method. His Honour told the jury that there was no evidence that Mezza had tampered with the meter or the wires, adding that it was often difficult to trace electrical defects. The verdict mentioned above was returned on the Judge's advice.

WORKMEN'S COMPENSATION CASES.

AT Preston County Court, William Greer, a skilled labourer, claimed compensation under the Workmen's Compensation Act from Messrs. Dick, Kerr & Co., Ltd., Preston. The applicant's case was that as the result of an accident whilst starting an electrical machine he developed facial paralysis, which affected his right eye and the right side of his face. The respondents' contention was that the man was suffering from an hysterical affection, and that work, instead of being harmful, might help him. His Honour Judge STURGES, K.C., found for the respondents, but gave no costs.

At Preston County Court on October 9th, James Berry, electrical engineer, of Woodcock's Court, Preston, asked for a review of the compensation agreement, with Thomas Cross, electrician, Ferny-

haigh, Preston. The respondent, it was stated, was injured on June 23rd, 1914, by his hand coming into contact with a live wire, charged with a current at 220 volts. As a result of the shock neurasthenia was brought on, and by agreement a sum of £1 a week was paid to him.

The medical evidence given by Dr. Collinson, and Dr. House, Liverpool, was that the respondent was in fair physical condition, and that light outdoor work would be of benefit to him, whilst brooding over his condition was likely to make it worse.

On respondent's behalf, Dr. Mooney and Dr. Warrington, Liverpool, said the man's condition was still so serious that he was unfit for any kind of work.

Respondent, describing the accident, said the amperage was very great as his body was "dead earthed." He was held until the wires melted, probably for a couple of minutes, and was unconscious for four hours afterwards. He still suffered from dizziness, falling in the street, confusion in traffic, and, occasionally, loss of memory. Gardening caused pains in the head, and when he tried to cycle he fell off through dizziness.

Judge HUGH STURGES, K.C., with whom sat Dr. Irvin Sellers as medical referee, remarked that the respondent was what might be termed an "odd lot" in the labour market, and he was not satisfied that the man was capable of doing light work, or that he could obtain such work in the open market. He gave an award for respondent, with costs.

In the Bow County Court, before his Honour Judge Graham, K.C., sitting with Dr. Bate as medical referee, Rosetta Ellen Cooper, of Plaistow, asked for an award, under the Workmen's Compensation Act, against the Western Electric Co., Ltd., of North Woolwich. It appeared that the applicant was employed on a fuse screwing machine, and in the course of using it she had to work a clutch which threw a band on to a wheel to start the machine. This clutch was very stiff, and one day in June of last year, as she went to "strike on," she felt a pain in her inside, and felt sure she must have hurt herself. She became so ill that finally she had to be operated upon in the hospital. In June of this year the respondents offered her light work and declined to pay her any more compensation, this action being the result. Medical evidence was given to the effect that she was quite capable of light work in June, and the Medical Referee advised the Judge to enter judgment for the respondents, with costs.

According to a Cape newspaper just to hand, judgment was recently delivered by Sir John Kotze in the Supreme Court in the appeal of Elias Jacobs v. The Cape Town Corporation.

The appellant, who was employed by the Corporation, was injured whilst repairing some electric wires. The accident happened on March 23rd, 1916, and on September 5th Jacobs claimed £150 under the Workmen's Compensation Act. The magistrate granted a provisional order for half-wages at the rate of 15s. 6d. a week, with costs, and this amount the Corporation continued to pay until March 23rd last, when they ceased doing so. On April 30th the appellant served notice on the respondents claiming £117 as half of three years' wages, less £39 paid since the date of the injury. To this the Corporation pleaded in bar that a period of 12 months had expired without Elias having taken any further steps to reopen the matter and pursue his claim for compensation for permanent partial incapacity. This was upheld by the magistrate, who dismissed the application with costs. From this decision Elias appealed.

His LORDSHIP remarked that the magistrate based his ruling upon Sec. 20 of the Act, which, if correct, meant that the applicant lost his right to further compensation. The liability of an employer to make periodical payments under a provisional order granted by a magistrate might stop at the expiration of 12 months from the date of the accident, but that did not in any way establish that the right to apply for a fixed sum by way of compensation had lapsed by the effluxion of time. The Court could not, through a forced construction or strained inference, deprive a person of a right given him by the Act. The appeal would be allowed, with costs, the judgment in the Court below on the plea in bar set aside, and the magistrate directed to hear the application on its merits.

HOLT v. A.E.G. ELECTRICAL CO., LTD.

IN the Chancery Division of the High Courts, on Tuesday, Mr. Justice Younger was asked, on behalf of the plaintiff, to adjourn this action generally, with liberty to restore.

MR. GALBRAITH said the plaintiff, who was the central witness, was serving at the Front. The action was on an agreement of service, for a declaration that the defendant company was bound by the agreement, and for damages.

MR. C. J. CONWAY, for defendants, said the entire claim rested upon written documents, and the defence was that certain letters were not binding upon the company, and that they were *ultra vires*. If this defence failed, the amount due could be easily found. The defendants said the consent of the Board of Trade had not been obtained, the company being in the hands of a controller. On this point they were anxious to get his Lordship's decision, as there were other cases depending upon it. The case could be heard in the plaintiff's absence without injustice to him.

MR. GALBRAITH said the case was started in the Manchester District Registry, and the plaintiff was a material witness. Plaintiff was employed as the commercial manager of the company at their head office in London, and was now a private in the British Army in France. The agreements were traversed, and it was alleged there was no consideration for them.

MR. CONWAY said, for the purpose of coming to trial early, he thought he could waive the question of no consideration.

His LORDSHIP said, subject to the question of no consideration being waived, the case would take its ordinary course, when, if it was found necessary to have the plaintiff present, there could be an adjournment. The case, however, could not come on before Monday week.

WIRELESS ENGINEER'S ACTION.

BEFORE Mr. Justice Lush, in the King's Bench Division, on Monday, MR. WHITEHEAD mentioned the case of Elwell against the Universal Radio Syndicate, Ltd., of which, he said, plaintiff's counter-claim was outstanding. Plaintiff applied, as defendant, that the case should stand over till the next sittings. Plaintiff was a distinguished engineer and wireless expert, and the substance of the counter-claim was as to certain contracts he entered into with the British Admiralty and the French Government. The question was whether these were really fraudulent contracts in the sense that they ought to have been entered into with the defendants. The Universal Radio Syndicate was a wireless telegraphic company, in whose employment the plaintiff formerly was. The firm had admitted liability to plaintiff, and had paid money into Court.

MR. HOGG, K.C., said the case for the syndicate would be that the plaintiff whilst in their employ, without their knowledge, got contracts for his own benefit and put the money in his own pocket.

MR. WHITEHEAD said Mr. Elwell was, of course, a material witness. He had a letter from the Ministry of French Marine, in which it was stated that he was indispensable in France at the moment. He was engaged in constructing wireless apparatus and wireless stations. Some inventions of his own were being employed.

MR. HOGG : That there should be some postponement, I think, is clear. But the first application was made on May 7th. It was sworn on May 11th that it was impossible for him to leave France under the contract with the French Government, and the case was ordered to stand out till July 2nd. On June 24th another application was made, again supported by affidavit by Elwell, who then swore that he had a contract with the Italian Government, which would require him to be in Italy for a considerable time. Now an affidavit by a solicitor's clerk stated that he was engaged with the French authorities, and they were told that the Inspector-General charged with work of naval construction certified that the presence of Elwell was indispensable upon the works. He suggested that the matter stand over for a month.

His LORDSHIP said he thought Mr. Elwell should make application to the authorities in France for leave to come over any time the authorities chose to fix.

MR. HOGG said his company desired to be wound up, and wanted its money paid out of Court if it was entitled to it.

MR. JUSTICE LUSH said his Order would be as he had indicated, and the costs of the application would go to the syndicate.

BUSINESS NOTES.

Dissolutions and Liquidations.—**BRITISH CONTINENTAL ELECTRICITY CO., LTD.**—This company is winding up voluntarily, with Mr. C. E. Barker, 21, Finsbury Pavement, E.C. 2, as liquidator.

UNIVERSAL TELEPHONE AND ELECTRICAL CO., LTD.—A meeting is called for November 13th, at 6, Old Jewry, E.C. 2, to hear an account of the winding up from the liquidator, Mr. J. E. Percival.

SCHALL & SCHALL, electrical engineers, 71-75, Cavendish Street, London.—Mr. Karl Friedrich Schall has retired from the partnership. Mr. W. E. Schall will attend to debts, &c., and will alone carry on the business as Schall & Son.

AKROYD & MARSLAND, tool and gange manufacturers, Halifax.—Messrs. F. F. Ackroyd & J. Marsland have dissolved partnership. Mr. Marsland attends to debts, &c.

Developments in Japan.—The British Vice-Consul at Tokio, in a recent report on the formation of new industrial enterprises in Japan since the outbreak of war, states that the chemical industry takes first place in recent developments. In metals, metal goods, machinery and textiles there have been great developments. In regard to electrical supplies and accessories, during the period reviewed by the Consul, six Japanese companies have been organised for the manufacture of electrical supplies and accessories, such as electric motors, dynamos, switches, lamp bulbs, carbon electrodes, carbon brushes, &c. An improved process for the manufacture of micanite has enabled a Japanese company to turn out insulators, both for the home and the export trade. The total combined capital of the six companies referred to amounts to 4,530,000 yen, and they operate 11 factories.

A Westinghouse Works Committee.—There has been formed at the works of the **BRITISH WESTINGHOUSE CO., LTD.**, at Trafford Park, a Works Committee, representing both the firm and the employes, which deals with a variety of matters affecting the welfare of the workpeople. The Committee consists of 14 members in all, one from each section of the works, and two representing the firm, and meetings are held each Monday afternoon. Questions of ventilation, provision of tea canteens, purchasing overalls at cost price, securing cheap tickets for workmen to travel home, suggestions for improved time-keeping, and for improved methods of

production have all been dealt with, and both the firm and the employes—the latter numbering some 8,000—are well satisfied with the success of the experiment to date. The most striking feature of the Committee's work has been in settling the many little differences which arise from time to time in a works of such a large size.

Trading Arrangements with Italy.—In an article on "Importation (under Licence) of Italian Goods into the United Kingdom," the latest issue of the *Journal of the Italian Chamber of Commerce in London* makes the following comment:—"This preferential treatment of the French export trade has caused a great sensation in Italy, and has already aroused a feeling of intense bitterness throughout the Italian commercial world. At the time of going to press negotiations are proceeding between the Italian and British Governments, and it has already been announced that the free importation of silk goods, which was first granted to France, has been extended to Italy and other Allied countries. We hope that the British authorities will recognise that the concessions granted to France should be extended, in their entirety, to Italy, because any difference in treatment, besides being unjustified, might endanger the future economic relations between Great Britain and Italy. The present unfavourable condition of the Italian export trade, a proof of which is furnished by the extremely high rate of exchange, and the adverse balance of the foreign trade, is such as to justify the most sympathetic and liberal treatment at the hands of the British Government, and the extension to Italian trade of the same privileges granted to the French trade. Such a decision would dispel the apprehension caused in Italy as to the possibility of future inequalities of treatment in regard to the economic policy of Great Britain towards the Allies, particularly on the subject of Customs duties."

Scarcity of Electrical Goods in South Africa.—The *South African Mining Journal* for September says:—"Materials are getting very scarce in Johannesburg, and such things as key-holders at 7s. 6d., as compared with 1s. 3d. in pre-war days, are practically unobtainable. Switches have sharply advanced to 42s., being a rise of 15s., and very few only are available at that. Wiring is so scarce in some towns on the reef that one is told to supply his own wire to couple up with the main. Inquiries are active for all electrical material, but business is slow through the acute shortage of materials. Jobbing work and contracts are still taken with a general understanding that approved substitutes can be used. All kinds of electrical cable material are very difficult to obtain, and then it is a matter of negotiation as regards the price. Lamps are being absorbed through wear and tear much faster than supplies arrive for replenishment. Relief is expected from America, and, maybe, from the United Kingdom, as the tension there has been taken off somewhat since America entered the war. And now it would seem that it is more a question of shipping facilities rather than supplies if one is willing to pay the higher values ruling in England. The local demand for motors has fallen off since the Municipality cannot supply new electrical power. The contractors complain that work is anything but abundant, since almost all new work in the shape of extensions has been stopped; of course, in a place like Johannesburg there is always a lot of jobbing work and repairs to be done. Hence, as the staffs have been depleted through the recruiting, the various shops seem quite well employed. The general cry is that we could do more if we could only get the materials."

Book Notices.—*The Trade Apprentice* is the title of a magazine inaugurated at "The British Westinghouse" with the idea of bringing together the apprentices who, owing to the large size of the works in which they are employed, saw little of each other. We understand that in this respect it has been extremely successful. It is edited by Mr. J. C. Prescott, and run by the members of the company's Trade Apprentice School; as it has now reached No. 9 issue, Vol. II, it is evidently well established. Mr. H. A. Carney was the first editor, but was recently obliged to resign the post owing to pressure on his time, and the issue before us contains a cordially appreciative acknowledgment of his pioneer labours, as well as technical articles, a biographical sketch of Michael Faraday, and a humorous account of the T.A.A. sports, as well as other items of local interest, including an entertaining tale of the Ship Canal (described as a "poem"), on the lines of the "Wreck of the Hesperus."

The M. and C. Apprentices' Magazine, the quarterly journal of the apprentices employed at the works of Messrs. Mavor & Coulson, Ltd., for October, has also come to hand. This is now quite a bulky production, and a double number is foreshadowed for the Christmas issue. We note that it appeals not only to the apprentices, to whose enterprise it owes its origin, but also to every grade of employé. A description is given of the recreation camp organised by the firm on the shore of Bardowie Loch, an admirable innovation which deserves the attention of all employers; the remainder of the contents presents a remarkable variety of subjects, ranging from items about shell manufacture to articles on geology, model making, and "penny dreadfuls." The producers are to be congratulated on their success.

Faraday House Journal for the Michaelmas Term contains numerous notes on past and present Faradians, articles on insulation testing and other technical matters, and further additions to the lengthy Roll of Honour of the Institution.

Trade Announcement.—**MESSRS. E. T. PEARSON & CO., LTD.**, of 49 and 50, Watling Street, London, E.C. 1, have acquired the rights for France and the French Colonies of the Wild-Barfield process for hardening steel gauges, tools, &c., recently described in our pages.

Electric Furnaces in France.—La Société d'Applications des Fours Electriques is the name of a new company which has lately been formed in Lyons, with a capital of £20,000, to develop the use of electric furnaces.

Catalogue.—MESSRS. PASS & SEYMOUR (INC.), New York. Eighty-page catalogue of P. & S. handy electric wiring devices.

LIGHTING AND POWER NOTES.

Accrington.—The local Trades Council recently asked the B. of T. to institute an inquiry into the working of the Corporation electricity undertaking. The B. of T., in reply, points out that the undertaking is included in a large scheme for the inter-connection of electricity undertakings in Lancashire, and states that the Committee which has the matter in hand is of opinion that the scheme will result in the general efficiency of the undertakings concerned.

Argentina.—The question of the electric lighting in the city of Tucumán has been arranged. The company has agreed to take a bill of exchange for \$100,000 m/n. guaranteed by the Provincial Government, in part payment of the amount owing to it.

A company has recently been constituted under the name of "La Electrica," the main object of which is to operate electrical power stations. The capital is \$100,000 m/n. divided into 1,000 shares of \$100 each. The board consists of the following gentlemen:—President, Enrique Piccaluga; vice-president, Osvaldo Rigamonte; director, Francisco Varela; alternates, Angel Di Benedetto and Oscar Mele; syndic, Santiago G. Rossi; syndic-substitute, Enrique Bonavia.—*Review of the River Plate.*

Barnsley.—The Electricity and Lighting Committee has authorised a report showing the whole of the work necessary to put the plant in an efficient state, together with an estimate of the cost.

PRICE INCREASE.—The T.C. has decided to increase the charges for electricity by 3d. per unit for lighting and 15 per cent. for power, as from October 1st, 1917.

Barrow.—**LOAN SANCTION.**—The L.G.B. has sanctioned loans of £10,575 for boiler, foundations, steam pipes, &c., and sub-station plant and switchgear, and £5,325 for mains for electricity extensions. The Council has decided that in the future applications for supplies of electricity for premises within 30 yards of any existing distributing main only will be accepted.

Birkenhead.—**WAGES.**—A strike at the electricity generating station has been settled by the Committee giving the men an advance of 1d. per hour, as demanded. The men refused to accept the Arbitrator's award made recently, but the Committee, considering that the award was binding, did not accede to the request for a larger advance. The Chief Industrial Commissioner pointed out that, although the award could not be varied, there was nothing to prevent the parties concerned further considering the matter, with the result that the Committee reopened the question.

Birmingham.—**WAGES.**—The City Council has approved of a further war wage advance of 3s. per week for the manual employés of the Corporation of 18 years and upwards, and 1s. 6d. to those under that age, the increase to take effect as from August 1st. The estimated cost of the proposed advance through-out the Corporation service is £66,580 per annum.

Blackpool.—**WAGES.**—The municipal employés recently asked for the war bonus of 7s. to be increased to 10s.; the Corporation offered 9s. instead, or to submit the matter to arbitration. The employés chose the latter, and the arbitrators have awarded a total bonus of 12s. for men and 9s. for women. The town clerk has been instructed to write to the Committee on Production, pointing out that the award is contrary to the terms of reference, as the amount awarded is in excess of that demanded. In the meantime, workers in the gas and electricity departments have put in a claim for 15s. a week war bonus, on the ground that they are in a certified occupation.

Bradford.—**PRICE REVISION.**—On the Electricity Committee submitting for approval the proposed revised and advanced charges for current (previously published in the ELECTRICAL REVIEW) to the T.C., Mr. J. F. Waugh moved that the minutes be referred back, and said bulk consumers were already supplied cheaply, and he objected to their receiving preferential treatment as compared with the 1d. flat-rate consumers. Charges to bulk users at Bristol and Birmingham had been advanced, but the result feared by the Bradford Committee had not occurred in those cities. In reply, Ald. Robinson said Mr. Waugh, apparently, would prefer that the whole of the extra cost of coal, wages, &c., should come out of the bulk consumers, but, so far as they were concerned, the Committee had arranged that any variation in the price of coal should be met, and the bulk consumers had met them to the extent of £13,000 in regard to the extra cost of coal. The returns of the department proved that the charges for bulk supply were profitable, but the Committee was supplying firms who could produce their own power, and it was desirable, if they wanted a cleaner city, that the power should be produced at the municipal

works. The department had all kinds of consumers to supply, and a general flat rate was out of the question. The minutes were adopted as amended.

Burmah.—The Rangoon Municipal Committee has resolved not to agree to the proposal to enter into a fresh agreement with the Rangoon Electric Tramway Co. for the public lighting of Rangoon for a period of 21 years, but desires that the Roads and Buildings Sub-Committee should further examine the whole question.—*Indian Engineering.*

Cavan.—Mr. J. P. Tierney, of Dublin, has been authorised to prepare a scheme for an installation of electric lighting in the workhouse.

Chile.—The *Diario Oficial* (Santiago) publishes decrees granting concessions for the installation of electric lighting and power systems (overhead transmission) to Don Leopoldo Chasau—in the town of Los Sauces, Department of Angol; Don Rojelio Pinto—in the town of San José de Maipo, Department of La Victoria; Don Eduardo Valdivieso V. (on behalf of Don Erardo Setz H.)—in the town of Lanco, Department of Valdivia.—*Board of Trade Journal.*

Colchester.—**PROPOSED NEW PLANT.**—A report as to the necessity of installing additional plant at the electricity works, in order to be in a position to resume the lighting supply immediately after the war, is to be prepared by the engineer, with a view to a loan being applied for.

Continental.—**FRENCH WATER POWERS.**—In reply to a question on the subject in the French Parliament, the Minister of Agriculture recently stated that, in accordance with a decree issued in December of last year, all questions relating to the utilisation of the power of non-navigable rivers and streams in the country had for the period of the war been transferred from the Ministry of Agriculture to the Ministry of Munitions. At the same time, close co-operation continued to exist between the two departments, with the object of utilising all available water power, and, as affording some idea of the work that had been done, he stated that plant to the extent of 400,000 H.P. had been established, or was in course of construction, in the Alps, the Pyrenees, and in central France. He also pointed out that, in the case of many of the agreements entered into on behalf of the French Government with hydro-electric undertakings, powers had been reserved under which the generating stations were under agreement to supply for a number of years after the war a certain proportion of the current generated at a cheap rate. Several of the plants in question were in connection with factories making explosives with a calcium carbide base. With the cessation of hostilities, it would not be difficult to convert such plants to cyanamide manufacture, and consequently there were good prospects of large and relatively cheap supplies of synthetic nitrate manures, which would be of great benefit to French agriculture.

SPAIN.—La Sociedad Electrica Rocajo has secured a concession to establish a plant to utilise the water power of the River Najerilla near Brieva (Province of Logrono) in the generation of electrical energy for lighting and power purposes.

The Co-operativa Electrica de Santiago de Compostela is the title of a company, with a million pesetas of capital, formed to supply electricity in Compostela.

Dublin.—During a discussion at the Port and Harbour Board, it was mentioned that there was an increasing demand on the north side of the river for electricity, and it was decided that the Board's engineer should consult with the Corporation's engineering authorities on the subject.

Iceland.—It is announced from Copenhagen that a Danish company has just been formed with the object of utilising the water power resources of Iceland.

India.—According to *Indian Engineering*, the extension of the Coonoor water supply is under contemplation. "In connection with the above, it has been suggested that in regard to the question of generating electricity from the Ralliar Waterfalls, it is found that the current thus derived would be sufficient to light the whole station with electricity as well as to supply all the neighbouring estates with power for their factories. The initial outlay would be a lakh and 40,000 rupees, but at present the annual cost of lighting the station is nearly Rs. 6,000, whereas with electricity it would be less than one-third that amount.

Owing to the shortage of electricity meters, and as an alternative to declining to connect new consumers, the Bombay E.L. & T. Co. has submitted to the Corporation a proposal that such new consumers should be charged 1 rupee per point per month, this figure being based on the yield per point of existing consumers of various classes during a recent six months. The Corporation is recommended by its Committee to agree to this as a temporary measure, provided that meters are fitted within one year after the termination of the war.

Leith.—**PRICE INCREASE.**—The T.C. has passed the following increases in the charges for energy:—Power from 1½d. per unit to 1½d. per unit net; lighting from 4½d. to 1½d. per unit net. Previously discounts were given. The changes are necessary to meet an estimated deficit of £4,579.

Limerick.—**WAGES.**—On a demand by the electric lighting staff for an increase of 10s. per week in wages, the Electricity Committee offered 5s., which was accepted.

London.—L.C.C.—The Finance Committee recommends the sanction of the Council to the borrowing of £27,825 by the Poplar B.C. for electricity generating plant.

Morocco.—Under the auspices of the Compania Transatlantica, of Barcelona, Spain, a small central electric lighting station has just been completed in Tangiers. Although the plant at present installed only comprises a 200-H.P. Sulzer-Diesel generating set, it is proposed to extend it up to eight such groups in the near future. The engines are to be adapted to run with tar oils, and also, if necessary, to use sea water for cooling purpose.

New Zealand.—The Government National Efficiency Board has invited Mr. J. Orchiston, Chief Electrical Engineer to the Post and Telegraph Department, to report on his proposal for establishing an industry in New Zealand for producing nitrates from the air. Mr. Orchiston has acquired data dealing with the cost of hydro-electric schemes, and in no case, he said, can electricity be generated as cheaply as by utilising any of the large falls in the south-western sounds of New Zealand. One of the simplest propositions is that presented in utilising the Bowen Falls, in the Milford Sound. He estimates that, after making full allowances for all contingencies, energy could be produced for one-fiftieth part of a penny per unit, or 1 H.P. at a cost of £1 per annum. At the Bowen Falls there is deep water close to the side of the sound, and perfect shelter in all kinds of weather.—*Journal R.S. of Arts.*

Rotherham.—The Electric Light and Tramways Committee has received a communication from the Ministry of Munitions that its present policy is that no facilities will be given to the Sheffield Corporation beyond those already authorised, so long as the Rotherham Corporation has sufficient plant for the inter-supply of current to the Sheffield Corporation on reasonable terms.

St. Anne's-on-Sea.—YEAR'S WORKING.—The annual report of the working of the Council's electricity undertaking for the year ended March 31st last shows a total revenue of £14,952, working expenses amounting to £11,368, and special expenses £1,074, making the total expenses £12,442, and leaving a gross profit of £2,510; with £864 transferred from the war munitions account, making a total of £3,374; and deducting interest and sinking fund, and bank charges, &c., £3,459, a deficit on the year's working of £85 resulted, which has been debited to the reserve fund. During the year 1,494,488 units were sold, an increase of 187,188.

South Africa.—The Works Committee of the Krugersdorp (Transvaal) Municipal Council reports that it has under consideration the question of increasing the charges for electric light connections. It points out that the price of copper wire has risen from 10d. to 4s. per lb., and of other materials by at least 100 per cent.; also that at the present time it is impossible to obtain good cut-outs, and that makeshifts have to be used.

Stratford-on-Avon.—ELECTRICITY PRICES.—A Committee has recommended the T.C. not to accede to the request of the local Electricity Co. for leave to increase the charge for current for the period of the war and 12 months after, from 6d. to 6½d. per unit, but the matter has, by the casting vote of the Mayor, been referred back for re-consideration.

Stretford.—At a recent meeting of the U.D.C. it was reported that the clerk had submitted to the chairman of the Legal and Parliamentary Committee a statement of points which it was desirable should be given in evidence by the representatives of the Urban District Councils' Association before the B. of T. Electric Power Supply Committee. The following is a summary of the statement:—(1) Principle of distribution by local authorities should be retained; (2) that no charge should be made on the general body of ratepayers for the benefit of electricity consumers, and that the outstanding debt of any small superseded station should be taken over by the super-station authority; (3) that the super-station authority should be under obligation to supply energy in bulk; (4) that the super-station authority should be under obligation to supply energy to local authorities at uniform rates; (5) large power consumers should be supplied through the local authority, and not direct from the super-station authority; (6) local authorities should have preponderance of representatives on super-station authority. The Council approved the statement.

Todmorden.—The annual accounts of the Corporation Electricity Department, submitted last week, show an income from sale of current of £3,107; other income, £277; working expenses, £1,094 and a deficit on working of £709. Sinking fund and interest allowances amounted to £1,964, making a total deficit of £2,673, which has been met by a transfer from the district fund revenue account. The deficiency last year was £1,580. The loan capital outstanding at March 31st, 1917, was £19,585.

U.S.A.—The Kansas City Light and Power Co. has contracted with the General Electric Co. (U.S.) for two 25,000-kw. turbo-generators for its new power plant, which is designed for an ultimate capacity of 240,000 kw.

Wakefield.—The electrical engineer reports that during the past year, owing to the pollution of the river with chemical waste, considerable trouble has arisen from corrosion. In October a reserve stock of coal caught fire, occasioning considerable loss, and in February a fire occurred on the H.T. switchboard, interrupting supply for 9½ hours. During the year 4,415,108 units were sold, equal to 83 units per head of population.

Workington.—PROV. ORDER.—The T.C. has decided to apply to the B. of T. for a prov. order for electric supply.

TRAMWAY AND RAILWAY NOTES.

Belfast.—At the meeting of the Tramways Committee, it was reported that the receipts for the past month showed an increase of £1,600 as compared with the corresponding period of last year. A report on the state of the track was also presented.

Birmingham.—ARTERIAL ROADS.—An important report, embodying proposals for reconstructing and widening arterial roads, engaged the attention of the City Council last week. It stated that during the past 20 years £492,375 had been expended by the Tramways Committee and the Public Works Committee in carrying out the widening of parts of the main thoroughfares in connection with general improvements and electric tramway developments. The average yearly outlay amounted to £44,761. Notwithstanding that expenditure (large in comparison with the results achieved), not a single one of the city's main arteries had been so widened that its further widening was not a concern of the present generation. The proposal was to widen the eight great arterial roads which ran into the centre of Birmingham, together with four that led off them, to 110 ft. and 120 ft. The Tramways Committee was contemplating the adoption of the single-deck car, and it was hoped ultimately to run these on independent sleeper tracks. An advantage was that, if in the future it was decided to increase the gauge of the tramways from 3 ft. 6 in. to 4 ft. 8½ in. it could be done upon the sleeper-track system with comparative ease and low cost upon the width provided. The only practicable position for track, in a shopping or business street, was in the centre of the road, consequently it was necessary to provide a carriage way on either side. The minimum width required was 27 ft. for the tramway track and 24 ft. for each of the two carriage ways, making together 75 ft. between the pathways; footpaths 17 ft. 6 in. each, would give a total street width of 110 ft. The 27 ft. of tramway track would provide the necessary standing room for passengers. The cost of the necessary street widenings was estimated at £612,704—an amount which would be spread over a number of years. The tramway manager (Mr. A. Baker) states that the present cars are too heavy and cumbersome (a double-deck car such as now used weighs about 15 tons unloaded, and getting on for 20 tons loaded), that they accentuate the congestion of traffic, are noisy, and that much damage is done to the tramway track. The cost of maintenance, both to the track and rolling stock, is extravagantly heavy. The remedy is the provision of single-deck cars on independent tracks. It is estimated that the annual saving from independent sleeper tracks would be £70,000 in cost of reconstruction and repairs and maintenance of permanent way, £10,000 on repairs and maintenance of rolling stock, and £20,000 in operating expenses accruing from a better time table.

Bury.—The manager of the Corporation Tramways has reported to the Committee that, in consequence of increased rate of wages paid to the employés, it will be necessary to raise the fares; it has been decided to draw up a revised table of fares.

Continental.—SPAIN.—The abridged scheme for an underground electric railway at Madrid, 4 km. in extent, which is about being taken in hand, is estimated to cost 8,000,000 fr., being 4,100,000 fr. for the underground construction works, 1,000,000 fr. for surface works, and 1,650,000 fr. for rolling stock. There will be nine stations; the trains will be made up of five carriages, with accommodation for 250 passengers, the service being every two or three minutes.—*L'Electrotecnica.*

Dover.—At a meeting of the Tramways Committee, it was proposed to levy a special 6d. rate to meet compensation claims arising out of the recent accident; a suggestion was made that a 2s. 6d. rate would be required, which would give some £23,000. A scheme for reducing the gradient on the hill on which the accident took place was considered.

East Ham.—YEAR'S WORKING.—In a recent issue we gave the borough treasurer's figures for the working of the Corporation tramways during 1916-17, showing a deficit of £2,395. According to figures published by Mr. Ullmann, the manager, the deficit amounted to £3,213. During the year 18,619,000 passengers were carried, as against 20,128,000 in the previous year, the car-mileage being also reduced. The revenue per car-mile was 10'04d., as against 9'87d., and the operating cost was 8'83d. per car-mile, or nearly 1d. in excess of 1915-16. Some 40 per cent. of the receipts were from ½d. fares, but these were abolished on March 1st.

Halifax.—DISCOUNT TICKETS.—The Tramways Committee, last week, agreed to grant a request by the organised tradesmen of the town that the Committee should sell tickets in blocks of 500 each, at a discount of 25 per cent.

Leeds.—TRAFFIC RETURNS.—The accounts for the city tramways undertaking for the first six months of the current year up to the end of September were presented to the Tramways Committee on Monday. The total receipts amounted to £296,867, which is a record for six months' working, and an increase of £28,846 on last year's figures. These figures have been attained in spite of a decreased service, 40,724 fewer car-miles having been run. The earnings per car-mile work out at 14'618d., a very high figure, being 1'529d. more than in the corresponding period of last year. The number of passengers carried was 61,823,986—4,565,347 more than last year. The number of cars in use was 238, and the amount per head contributed by the population was 10s. 9d. The working expenses for the half-year total £150,190, an increase of £22,000, being about half the total receipts. The increase in ex-

penditure is attributed to war bonuses and to enhanced cost of materials used in repairs. Traffic expenses amounted to £12,583 and general repairs to £8,869. Increased income-tax and reserve fund charges cover £6,000. The estimate for the whole year provides for a surplus of £55,000 in relief of rates, and this, we gather, is likely to be fulfilled.

London.—L.C.C.—The Highways Committee reports that during the 11 weeks ended October 3rd 127,341,961 passengers were carried on the Council's tramways, a decrease of 3,469,325 as compared with the corresponding period last year. The traffic receipts during the same period amounted to £635,415, an increase of £83,144; the total receipts from April 1st, 1917, show an increase of £187,806 as compared with 1916.

TELEGRAPH AND TELEPHONE NOTES.

A Large Submarine Cable.—The New York Telephone Co. has laid across Raritan Bay a cable nearly 5½ miles in length, containing 74 pairs of wires, and superseding 3,000 miles of overhead wires previously in use on the land route. It is claimed that this is the largest submarine cable in the world.

Argentina.—Early in August the Ministry of Marine was informed that a wireless station was at work in the neighbourhood of Trelew, and a search was made. Eventually it was discovered with the aid of a cruiser, on the premises of a business house in the town of Trelew. Considerable reserve is maintained on the subject.

The concession applied for by Señor A. Schwimmer for the installation of an automatic telephone system in Buenos Aires has been discussed by the Municipal Commissioners, and referred back to the Mayor.—*Review of the River Plate.*

Dewsbury.—The Chamber of Trade has put before the Home Office a scheme of telephone warning to shopkeepers of air raids, so that shop lighting restrictions may be relaxed, at any rate within a quarter-mile radius of the centre of the town. The proposal is that six shops, covering six areas of the town, should receive telephone warning of a raid from the exchange. These six tradesmen would each warn six others, and they, in turn, would warn groups of shopkeepers in their neighbourhoods, as allotted to them. It is held that by this means, the whole of the lights of the 196 shops in the main town area could be extinguished within five minutes of the receipt of the original telephone warning from the exchange. Shops electrically lighted would not need the warning, as their lights would be cut off at the power station. The Home Office has asked the Chamber for further details, pointing out that the scheme presents difficulties, but that it is to receive every consideration. The Chamber is also conferring with the chief constable of the town as to police co-operation.

Dutch Cable Blockade.—Commercial cable communication with Holland was interrupted last week by order of the British Government until such time as the Netherlands Government consents to put a stop to the transit of sand, gravel and scrap metals through Holland from Germany to Belgium.

The use of British cables is a concession which cannot be claimed as a right, as any messages which are allowed to pass do so as an act of grace.

Windhuk (South-West Africa Protectorate).—A party of Union of S.A. members of Parliament, whilst making a tour of the Protectorate, paid a visit to the wireless station at Windhuk, and a description of the station was given to them by Capt. Kellaway. The motive power consists of two Diesel oil engines. The large A.C. generators are designed for a single-phase output of 250 kW. at 500 volts and 350 cycles. The transformers are of the oil type, designed to step up from 500 volts to 52,000 volts. There are five masts each 390 ft. high, weighing roughly 30 tons each, all insulated, and all maintained in position by steel wire cables. The transmitting aerial consists of 20 silicon-bronze cables, 10 running south-east and 10 south-west from the apex. The two receiving aerials consist of ½-in. diameter silicon-bronze cables. The battery comprises 128 Tudor cells of 270 ampere-hour capacity.

It was explained that the transmitting plant of the wireless station was inoperative owing to the removal of essential parts by the Germans. The receiving of messages is being maintained.

CONTRACTS OPEN AND CLOSED.

OPEN.

Dublin.—November 1st. G.N. Railway Co. (Ireland). Six or twelve months' supply of general stores (including several electrical items). See "Official Notices" October 5th.

Grimsby.—October 29th. Corporation. House service boxes and house fuse-boxes and fittings. See "Official Notices" October 12th.

CLOSED.

Bath.—C.C. Five-ton "Sentinel" steam wagon, £970 net: Alley & MacLellan, Ltd.

Cape Town.—Tenders received for the wiring of the new Union Jack Club:—

R. G. Jack	.. .. .	(accepted)	£210
J. A. Woods & Co.	.. .. .		237
Edward A. Shaw & Co.	.. .. .		242

Glasgow.—Tramways Committee. Tenders recommended:—Cable: Liverpool Electric Cable Co., Ltd.; B.I. and Helshy Cables, Ltd.

Hereford.—T.C. Electric motors and pump: Mather and Platt, Ltd., £736.

London.—L.C.C.—Highways Committee. Electric cables for the Council's tramways:—

Western Electric Co., Ltd.	.. .. .	(accepted)	£1,430
W. T. Henley's Telegraph Works Co., Ltd.	.. .. .		1,462
Callender's Cable & Construction Co., Ltd.	.. .. .		1,480
B.I. & Helshy Cables, Ltd.	.. .. .		1,480
Johnson & Phillips, Ltd.	.. .. .		1,480
Siemens Bros. & Co., Ltd.	.. .. .		1,490
W. T. Glover & Co., Ltd.	.. .. .	(part only)	950
(General Manager's estimate, £1,200.)			

Steel tires for tramcars (1,500 driving-wheel and 750 pony-wheel tires). Accepted tenders:—

Brown-Bayley's Steel Works, Ltd.	.. .. .	£7,294
Patent Shaft & Axletree Co., Ltd.	.. .. .	7,990

Southend-on-Sea.—T.C. Tramway undertaking:—

Edgar Allen, Ltd.—Switches, crossings and fish-plates, £54.
Hadfields, Ltd.—Three pairs of points and three crossings, £237.

Sunderland.—T.C. Electricity and Lighting Committee. Steel tubes: Dewhurst Engineering Co.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, October 19th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. "A Comparison of the Working Costs of the Principal Prime Movers," by Mr. Oswald Wans. General meeting.

Junior Institution of Engineers.—Friday, October 19th. At 8 p.m. Lecture on "The Application of Coal Gas to Commercial Vehicles," by Mr. W. A. Tooke.

British Empire Producers' Organisation.—Thursday, October 25th. At 1.30 p.m. At the Waldorf Hotel. Luncheon meeting. Marquis of Graham to preside. Guest, Right Hon. John Hodge, P.C., M.P., Minister of Pensions.

Institution of Civil Engineers.—Thursday, October 25th. At 3.30 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Meeting to consider the establishment of a central organisation for improvement in and better co-ordination of engineering training, and the appointment of a representative committee to initiate action.

NOTES.

Volunteer Notes.—COUNTY OF LONDON VOLUNTEER ENGINEERS (FIELD COMPANIES).—Headquarters, Balderton Street, Oxford Street, W. 1.

Orders for the week, by Lieut.-Colonel C. B. Clay, V.D., commanding:—

Officer for the Week.—Lieut. C. E. Campbell.

Drills.—Week ending Saturday, October 27th, 1917:—

Monday.—No. 3 Company, Left Half. Recruits, signalling, 6.30.

Tuesday.—Physical drill and bayonet exercise, 7.30.

Wednesday.—No. 1 Company, 6.30.

Thursday.—No. 2 Company, 6; signalling, ambulance, 6.30.

Friday.—No. 3 Company, Right Half. Recruits, 6.30.

Musketry.—Belvedere Road. Tuesday, Wednesday, and Thursday, 5.30 to 7.

Note.—The Medical Officer will attend for examination of recruits, &c., on Thursday at 6.

Unless otherwise indicated, all drills take place at Headquarters.

(By order) MACLEOD YEARSLEY, Capt. and Adjutant.

Cranemen's Wages.—There has been correspondence between the Aberdeen Harbour Board and the Chief Industrial Commissioner with respect to the wages of steam and electric cranemen, who have asked for an increase. After full consideration, the Board's Committee has decided that the matter is not one that can be settled by mutual agreement, and has replied to the Industrial Commissioner stating that the difference must be settled by arbitration.

Mechanical Arms.—At the Junior Institution of Engineers, on Monday evening, Mr. E. W. Hobbs read a paper on "Mechanical Arms." The anatomy and mechanics of the natural arm were described, and reference was made to early artificial arm work and to the requirements of an efficient mechanical arm. The effect of the amputation and its bearing on the mechanical arm were discussed, and other points touched upon were:—The vocation of the wearer and its bearing on the mechanical arm; the mechanism of the mechanical arm; the mechanism of the mechanical hand; various types of artificial limbs, their peculiarities and working; and some results achieved. In connection with the paper, Mr. Hobbs has arranged for a demonstration on Saturday, October 27th, at 3 p.m., at the Hall of the Balham Constitutional Club, 241, Balham High Road, S.W. Afterwards he will show his works, which are near at hand to anybody who is specially interested.

Validity of Tungsten Wire (German) Patent Upheld.—

The German patent No. 269,498 (1910) granted to the Allgemeine Elektrizitäts Gesellschaft, with priority from October 6th, 1909, on claim (1) and from February 23rd, 1910, on claim (2), has been upheld successfully against the annulment suit brought by the Wolframlampe A.G. (Augsburg), the Radium G.m.b.H. (Wipperfurth), and the J. Pintsch A.G. (Berlin). One of the most interesting patent cases of recent years is thus decided wholly in favour of the patentees. The patent in question relates to a process for the manufacture of tungsten wire for use in glow lamps. According to the specification, the process consists principally in bringing tungsten powder to the form of a coherent body by suitable means—heating it to 1,000–1,200°C. in an iron tubular furnace, through which hydrogen is passed, and then raising it to near melting point by the passage of current, the metal being again in an atmosphere of hydrogen. Finally, the metal is prepared for use by repeated mechanical working (rolling, hammering, drawing, &c.). The text of the actual claims is:—(1) Process for manufacturing tungsten wire for electric glow lamps, characterised by coherent pieces of tungsten being subjected to mechanical "working" until they become flexible and ductile at ordinary temperatures. (2) Use of initial material in the form of a comparatively coarse powder, the porous body formed therefrom being heated to a very high temperature.

Opposition to this patent and the subsequent action contesting its validity were based on the contention that prolonged mechanical working was a well-known means of securing flexibility and ductility in metals, and its application to an individual metal (tungsten) not previously considered ductile was not sufficient ground for granting patent rights. The Courts did not support this view. The following opinion is interesting:—"The literature submitted shows that many attempts had been made to make tungsten filaments by drawing (instead of by squirting and paste processes), using methods employed in general wire drawing or for the manufacture of other metal filaments (*e.g.*, tantalum). It is clear, however, that one could not simply substitute one metal for the other. All assertions and proposals are, therefore, to be ruled out, in which the behaviour of tungsten is deduced from that of other metals."

The firms in enjoyment of the valuable patent thus maintained are A.E.G., Siemens & Halske, the Deutsche Gasglühlicht A.G., the Bergmann Elektrizitäts Werke A.G., and the firm of Philips (Eindhoven). These firms have now a monopoly in the (German) manufacture of drawn-wire tungsten filament lamps, but this monopoly does not embrace:—(1) The manufacture of "Einkristallfaden," by Pintsch's process (*E.T.Z.*, page 234, 1917); (2) drawn-wire filaments of tungsten alloy, even though tungsten be the chief ingredient; (3) tungsten wire-drawn by the same process for other applications than glow lamps.

The various actions commenced by the A.E.G. in respect of infringements of its Patent No. 269,498 must now be decided against defendants wherever the latter have been making filaments of pure drawn tungsten wire. A considerable portion of the German glow lamp industry is thus paralysed unless the offending members succeed, at the last moment, in securing licences from the A.E.G.—*E.T.Z.*

Ventilation on the Tube Railways.—Referring to this

subject, the *Times* states that it has received numerous inquiries regarding the possibility of disaster to the ventilating apparatus of the tube railways, and as a result has obtained the following statement from the engineer to the London Electric Railway Company:—

"We are unable to anticipate any condition which will render the air in the tube railways unsafe. The tube railways ran for a number of years without any artificial ventilation whatever. There is very considerable ventilation caused by the motion of the trains in the tunnels—quite sufficient in itself to prevent the air becoming unpleasant. The shutting down of the whole of the electrical supply on the London Electric Railways would not affect the running of the fans in that we have an alternative means of power supply from a quite independent source. Individual damage to one station, or one fan, would only put that fan out of commission, and the fans at adjacent stations would keep the ventilation going."

We stated in our last issue that the risk was small.

The A.S.E.—The *Times* states that the Executive Council of the Amalgamated Society of Engineers has passed a resolution recommending that the Society should secede from the Engineering and Shipbuilding Trades' Federation. The opinion of members will be obtained by a ballot. Although the engineers' membership is practically half that of the whole of the Unions represented, their representation on the Federation is only equal to that of the smaller Unions, and this fact has caused considerable irritation.

L.C.C. Electrical Employees.—The Highways Committee reports that leading cable hands, cable hands, overhead linemen, feeder pillar hands and watchmen (Southern Section) in the electrical branch of the tramway department have asked that their war bonus may be increased to 19s. a week, that men paid by the hour be guaranteed minimum wages for 50 hours a week, and that men paid by the shift, day, or week, be guaranteed minimum wages for six shifts or days a week, and that their requests be referred to the appropriate Conciliation Board in the event of the Council not acceding thereto. A fitter's labourer and a skilled labourer on the sub-station repairs staff have asked for additional war wages of 12s. a week, and switchboard attendants and temporary sub-station

attendants (Northern Section) have asked for an additional war bonus of 8s. a week. The Committee recommends that the applications be referred to the Electrical Conciliation Board.

Foreign Trade.—SEPTEMBER FIGURES.—The official returns of imports and exports during last month contain the following electrical and machinery figures:—

	Imports.	September, 1917.	Inc. or dec.	9 months, 1917.	Inc. or dec.
Electrical goods	...	91,513	— 38,036	— 189,955	
Machinery	...	805,792	+ 214,815	— 63,313	
EXPORTS.					
Electrical goods	...	186,999	— 210,282	— 855,882	
Machinery	...	1,171,666	— 290,552	+ 126,659	

Motive Power from Plant Life.—Lecturing, last week, at the Austin Works, Northfield, Prof. F. W. Burstall, of Birmingham University, said the question of suitable fuels for automobiles had become a serious problem. It had long been predicted that a time would come when some other fuel would have to be employed unless the use of the mechanically-propelled vehicle was to be seriously retarded. The advent of the war and the extensive use of the internal-combustion motor had caused a shortage of petrol much more serious than would have been the case in times of peace. The position would not to any great extent be relieved by the advent of peace, owing to the fact that as time went on the use of small motors would be much extended.

Prof. Burstall outlined some of the methods which might be used for the production of fuel. Many of our ablest men, he said, had been working on this problem for a considerable time. The amount of light spirit derived from carbonaceous material was a limited quality, and very much less than the world's demand. One alternative was to employ an engine capable of dealing with the heavier oils, as was being done in many directions by the heating and working-up of the heavy oil into a gas. Another was the use of gas in a more or less compressed state, which undoubtedly had many features to recommend it. Such solutions were only partial. Alcohol formed practically an ideal substance for engine purposes, but its use as fuel had been retarded by its high price. For the main part, alcohol for manufacturing purposes was derived from starch which was unsuitable for food, and the scarcity of the raw product would most certainly increase its price as the demand increased. We did not know how far the direct change from sunlight to starch could be carried out in suitable localities in suitable plants, but there was no doubt the energy was there in quantities sufficient to satisfy all the demands; what had to be learnt was how to utilise and store up that energy in a form rendering its applications simple and effective.—*Birmingham Daily Post*.

Prize Essay.—"Hydro-Electric Power in India: its Present Position and Possible Future Development" is the subject selected by the syndicate of the Bombay University for competitive essays for the Ashburner Prize for 1919.—*Indian Textile Journal*.

Patents and Alien Enemies.—Application has been made to the Board of Trade by Messrs. J. S. Highfield, A. A. C. Swinton and P. D. Tuckett, to avoid or suspend 17 patents granted to Farbwerke vorm. Meister, Lucius & Brüning, Schwerin, and Ges. für Elektro-Osmose m.b.H. for processes relating to electro-osmosis and similar purposes; and for the grant of licences under "Applications to be vested in the Custodian," in respect to 17 applications in the name of the Ges. für Elektro-Osmos m.b.H. and Elektro-Osmos Akt.-Ges. (Graf Schwerin Ges.), of a similar nature.

The Association Movement.—The following important letter reaches us just as we go to press:—

"My attention has been called by several members of the Cable-Makers' Association to an article by Mr. H. H. Berry in your last issue, in which he appears to claim that he is the founder of the C.M.A. I have myself, as a director of W. T. Glover & Co., Ltd., been closely associated with the C.M.A. for over 14 years, and in that time have never heard Mr. Berry's name suggested as connected with the foundation of the Association. From inquiries made since Mr. Berry's article appeared, it would seem that he certainly had the idea to found a trade organisation, and took some steps in that direction; but these came to nothing. The actual genesis of the C.M.A. came in quite another direction, springing, I believe, from a beginning made by Mr. James Taylor (Helsby Telegraph Co., Ltd.) and Mr. George Sutton (Henley's Telegraph Works Co., Ltd.). But the definite decision to found the Cable-Makers' Association was taken at a meeting convened in 1898 by Mr. Henry Edmunds, then chairman of W. T. Glover & Co., Ltd., and the first formal meeting, at which the foundation was accomplished, was held on January 10th, 1899, when the following signed the roll in the order given:—

"Henry Edmunds (chair), Alex. Siemens, J. J. Easton, W. P. J. Fawcus, James Taylor, Francis Lamb, W. E. Gray, Jas. Connolly, G. Sutton, R. J. Hatton, W. Claude Johnson, J. Paterson, Godfrey Samuelson, A. H. Howard.

"It is with no wish or intention of in any way belittling Mr. Berry's efforts in connection with the Association movement that I am writing, but historical accuracy and justice to other early workers in the now fashionable field of trade organisation make this correction necessary."

"LLEWELYN B. ATKINSON.

"Secretary, Cable-Makers' Association,

"Sardinia House, Kingsway, W.C. 2.

"October 18th, 1917."

Fuel Research.—The Report of the Fuel Research Board to the Department of Scientific and Industrial Research on their scheme of research and on the establishment of a fuel research station has been issued. It states that in the first report (which was not published) the Board proposed two main lines of research: a survey and classification of the coal seams in the various mining districts by means of chemical and physical tests in the laboratory; and an investigation of the practical problems which must be solved if any large proportion of the raw coal at present burned in its natural state is to be replaced by the various forms of fuel obtainable from coal by carbonisation and gasification processes. The two lines can be most satisfactorily dealt with side by side. In preparation for the organisation for the first line, however, an experimental study of standard methods for the examination of samples of coal in the laboratory has been made, and as a result of experimental work carried out in the Fuel Laboratory of the Imperial College of Science and Technology a test has been elaborated which, by direct weighing and measurement, gives the yields of gas, oil, water, and carbonaceous residue which results from carbonisation at any definite temperature, with simple apparatus, which is being standardised. The representatives of the coal owners show every disposition to co-operate in the work of collection and registration of samples when the Board is ready for them.

The second line of inquiry has been led up to by a variety of influences during the past eight or ten years, including the demands for cheaper and more ample supplies of electrical energy, for home supplies of fuel oil for the Navy and of motor spirit for the Transport and Air Services, and for smokeless domestic fuel, due to the growth of public opinion on the subject of smoke prevention. The only development which would satisfy all these needs simultaneously would be the replacement of a large proportion of the raw coal which is at present burned in boilers, furnaces, and domestic fires, by manufactured fuels prepared from raw coal by submitting it to distillation. The gas retort and coke oven have become highly developed appliances for the carbonisation of coal at temperatures ranging from 900° to $1,200^{\circ}$ C., on which subject a great amount of experience and trustworthy data are available; but as regards the carbonisation of coal at low temperatures there is no such body of experience and information in existence. The way is clearly open for a serious attempt to determine whether an economical and efficient apparatus can be devised for the carbonisation of coal at low temperatures, and whether, by its use, products will be obtained of a collective value greater than that of the original coal, plus the cost of carbonisation and handling. The evolution of such an apparatus is at the root of the whole matter.

The questions before the Board are whether the 35 to 40 million tons of raw coal used annually for domestic heating can be replaced by smokeless fuel prepared by the carbonisation of the coal; whether adequate supplies of fuel oil for the Navy can be thus obtained; whether supplies of town gas can be produced more economically by new methods of carbonisation; whether electric power can be obtained more cheaply if the coal used for steam raising is first subjected to the processes of carbonisation and gasification; whether more scientific methods of using fuel will enable the peat deposits of the United Kingdom to be utilised for industrial purposes; and whether the use of gaseous fuel in industrial operations can be forwarded by the development of more scientific methods of combustion. The answers to these questions will only be obtained by co-ordinated research carried out on the lines of a broad and well-considered scheme.

Outlets for all the products of carbonisation must be found; no new scheme can be justified if it can only live by poaching on the preserves of the existing industries. The Fuel Research Board, which is in touch with other Government departments, is exceptionally placed for the furtherance of schemes which involve the finding of large outlets for such products.

Enormous quantities of coke would be produced, and its disposal at a profitable price is a vital question; the research scheme must, therefore, include a very complete inquiry as to the use and value of this coke for the direct firing of steam boilers; its gasification in producers and recovery of its nitrogen as ammonia; and its use for industrial and domestic heating.

As an illustration of the complicated inquiries which will have to be conducted before an answer can be given to what seems to be a simple question, the Board points out that there is a very general belief among electrical experts that the future of British industry will be greatly affected by the cost at which power in bulk can be supplied in the form of electricity. It has been proposed, for instance, that large electrochemical works should be established in this country for the manufacture of products which in the past have been manufactured in parts of the world where cheap water power is available. In this connection it has been suggested that the cost of producing power from coal in this country would be substantially reduced if, instead of burning the coal directly under the steam boilers, it were first subjected to carbonisation and gasification processes which, in addition to fuel gas, would yield valuable by-products. Plausible statements have been issued showing the enormous savings or profits which would accrue if schemes of this sort were adopted. Unfortunately these estimates have generally been made on a very slender foundation of knowledge and experience. On the other hand, those who by experience and practice are best qualified to judge, hesitate to prophesy as to what the economic result of a combined carbonisation and power generating scheme would be, but they agree that the interests at stake are so great that the question ought to be authoritatively answered once for all. But no answer can be accepted which is not founded on the complete working out of the scheme, no important step in the series of operations being omitted or shurred over. This series of operations will start from the mechanical preparation of the coal

and its conversion into solid, liquid, and gaseous products by carbonisation. It will end with the delivery of a known weight of high-pressure steam under the conditions most favourable for power production by turbo-generators. In the proposed scheme of research the investigation of each of the steps involved in the above inquiry is provided for. Three, at least, of these steps involve pioneering work on an industrial scale, and the work may occupy a considerable time. The Board realise that it is possible that the net result of this particular inquiry may be to show that purely as a means of cheapening the cost of electric power, the use of carbonisation methods has not much to commend it, but that certain incidental advantages will justify its use in particular cases.

A Fuel Research station, fully equipped for carrying out operations on an industrial scale, has been planned, and Dr. Carpenter, on behalf of the South Metropolitan Gas Co., has offered to lease to the Government, at a nominal rent, sufficient land at the East Greenwich Gas Works for the purpose, as well as to assist in its design and erection, and to purchase at market prices the surplus products resulting from its operation.

The Report is signed by Sir George Beilby, Director of Fuel Research; the other members are Sir Charles A. Parsons, Sir Richard Redmayne, and Sir Richard Threlfall, with Prof. W. A. Bone as consultant.

Engineers' War Bonus.—The Minister of Munitions announces the granting of a $12\frac{1}{2}$ per cent. bonus on the earnings of fully qualified skilled engineers and moulders rated at or above the current district time rate for turners or fitters while employed on or in connection with munition work and paid at plain time rates without the addition of any bonus. This new order means that the skilled man is put on terms of equality with the unskilled or semi-skilled man, who, paid on piecework for mechanical production, has been able to earn more than the skilled man who taught him his job. The new bonus does not interfere with or substitute bonuses to skilled men dependent on time-keeping and on output and war advances to meet the cost of living, but it does not apply to workmen paid an upstanding wage which covers overtime, or other allowances. It accrues from the beginning of the first full pay day following October 12th, and the first payment must be made by the first full pay day in November.—*Manchester Daily Dispatch.*

Fire in Leipzig Telephone Exchange.—On August 9th a serious fire occurred on the switchboard of the Leipzig Telephone Exchange, the cause being apparently the failure of a fuse to act. The installation consists of a central battery system, with accommodation for 20,000 connections provided on two separate series of boards. The fire broke out near the end of the first set of boards, and, although it was detected soon after its outbreak, it spread so rapidly that the whole of a multiple board was destroyed, and 11,000 subscribers were cut off. Incoming trunk service could be maintained, and about 5,000 subscribers served by semi-automatic equipment were not directly affected by the disaster. In order to restore communication as quickly as possible, the multiple board was cut at the point of the fire. About 4,000 lines (the call signals for which lay between the main distributing frame and the seat of the fire) were restored to service within two days. A start was then made in bridging the burnt-out sections, and, although space was so restricted that only a few men could work at once, more than 80,000 soldered joints were made, and regular service was restored "within a few days."—*E.T.Z.*

The Leaving Certificate and Munitions Work.—With regard to the Order of the Minister of Munitions abolishing the Leaving Certificate from October 15th, it is to be hoped that those who are engaged in the manufacture of munitions will not allow this alteration to operate in such a way as to disorganise work, impeding output and creating temporary unemployment. We trust that the action taken in conference with Trade Unions and Associations of Employers will be found to sufficiently meet the position. It should be borne in mind that skilled men must not be engaged or employed to replace unskilled or semi-skilled men employed on or in connection with munitions work, or to do work previously done in the establishment by such unskilled or semi-skilled men; that men must not be engaged or employed to replace women employed on or in connection with munitions work, or to do work previously done in the establishment by such women; and that employers must not engage labour for munitions work except to replace men who may leave, or to carry out orders in hand on which a blitional men may be immediately employed.

Fatalities.—A verdict of "Accidental death" was returned at the inquest on John Ashcroft (27), labourer, of Hooley Hill, who was killed at Messrs. Jones's sewing-machine works, Guide Bridge. The evidence was that the deceased, a discharged soldier, was working about 10 yards from the electric switchboard. All at once the lights were turned on, and someone cried, "Look at Johnny!" Ashcroft was seen with his right hand on the switch and his head thrown backwards. He was released, and a doctor sent for, but the man died before he reached the infirmary. The switch carried A.C., 210 volts, and the only explanation that could be offered was that one of the covers had become loose and formed a contact with the terminals, and the man might have put his hand on the cover. The switches were of an approved type, and were renewed in February. This one was tried next day and found all right.

During a storm at Durban, early in September, an electric light wire fell on a rickshaw boy, killing him. The bare feet and scanty clothing of the native would put him at a disadvantage compared with a man dressed in the European style.

Association of Electrical Station Engineers.—A meeting was held in Manchester on October 11th, at which 36 engineers were present. The following resolutions were carried unanimously:—"That the engineers in the Manchester district be urged to join the A.E.S.E., and endeavour to run the branch on the best possible lines."

"That this meeting of Manchester staff engineers expresses a vote of confidence in the London Branch in their claim to represent the interests of staff engineers as against that of the E.T.U."

Officials and a Committee were provisionally appointed, and it was suggested that the A.E.S.E. should be open to accept mechanical engineers as well as electrical engineers holding staff appointments. The next general meeting is to be held on October 25th, place and time to be announced.

London Power Station Engineers.—The following letter has been addressed by the Association of Electrical Station Engineers to all chief engineers and London Borough Councils:—

Sir,—I am instructed by the Executive Committee of the above Association representing the following engineering grades of power station technical assistants of London electricity supply authorities:—

Engineers-in-Charge.
Assistant do.
Junior do.
Mains Assistants.
Meter Superintendents.
Draughtsmen.
Testing Engineers.
Installation Inspectors.
Commercial Assistants and
Publicity Engineers.

To request immediate consideration of the following resolutions passed at a recent conference of power station engineers represented by this Association, and to ask that you will bring the matter before your Council at the earliest possible moment.

1. That in view of

- (a) The abnormal increase in the cost of living;
- (b) The fact that operative staffs have been met in this matter by various awards of the Committee of Production (Ministry of Munitions).

A request be made that

A bonus or war wage of 15s. per week be granted to all engineering assistants in the above mentioned grades dating from August 1st, 1917.

2. That in view of

- (a) The anomalies in remuneration of engineering assistants in the above-mentioned grades created during the past three years by the fact that no uniformity of treatment has obtained amongst supply authorities on the question of annual increments for added responsibilities;
- (b) The fact that the remuneration of such assistants has at no time been commensurate with the qualifications demanded.

A request be made that

A 25 per cent. increase of the pre-war (July, 1914) salary attaching to the offices of the engineering assistants in the before-mentioned grades be granted to all such assistants.

3. That in view of

The lack of uniformity obtaining in London power stations amongst engineering assistants engaged on shift duties in the matter of

- (a) The number of hours per shift;
- (b) The number of shifts per week.

A request be made that

- (a) A normal shift shall consist of eight hours;
- (b) A normal shift week shall consist of six 8-hour shifts.

qualified as follows:—

That where the staff arrangements permit, the above concession be immediately made.

That where depletion of staffs due to war emergency do not permit, an undertaking be given that such condition shall obtain as soon after the cessation of hostilities as is practicable, or within a definite period of such date.

I shall be glad to have your assurance that the above matters will receive your careful consideration.

Yours faithfully,

W. ARTHUR JONES, A.M.I.E.E.

Hon. Secretary, A.E.S.E. (London).

The Association of Engineering and Shipbuilding Draughtsmen: London Branch.—The annual general meeting of this Branch was held on September 22nd, when about 350 members were present. Mr. E. H. Walker (President) was in the chair, and gave a very satisfactory report of the work of the London Branch since its formation in February, 1917. Interviews have been held with the Ministry of Munitions on the subject of leaving certificates, &c., and the Association has been represented at several arbitration cases concerning draughtsmen. Owing to the largely increased membership in the London area, it has been decided to form a new branch for S.E. London and district, the Acting Hon. Secretary's address being 12, The Brent, Dartford, Kent. The Association is at present being entirely reorganised on lines more in keeping with its national character; the headquarters are to be shortly removed to London, and a general secretary will be appointed to give his whole time to the Association. The membership of the London area is now about 700, and new members

are coming in daily. The London Hon. Secretary's address is 38, Craster Road, S.W. 2, to whom inquiries should be addressed.

Association of Mining Electrical Engineers.—The annual meeting of the North of England Branch of the Association was held in Newcastle-upon-Tyne, on Saturday last. Mr. Thos. H. Day, the hon. secretary, in his report stated that the war had greatly hampered their work, but interest in the Association was reviving now, and they expected a good year; there were 110 members in the district. In his financial report, Mr. Day said that not only was there a credit balance for the year, but there was in hand and invested practically £70. The election of officers resulted as follows:—President, Mr. C. A. Nelson (Wallsend and Hebburn Collieries); vice-presidents, Messrs. J. P. Foster (Leaholme) and S. A. Simon (Blackhill); secretary and treasurer, Thos. H. Day (Benton).

Perth Electricity Employees: Wages Award.—From a newspaper report that has been sent to us we gather that Sir Richard Lodge, of Edinburgh, recently heard the case of the Perth Corporation electricity works employees, and he has now given his award. Representatives of the undertaking and of the employees stated the points at issue. The advances awarded (to be paid from October 1st, 1917) are as follows:—Mains engineer, 5s. per week; shift engineers, 5s. per week; switchboard attendants, 3s. per week; fitters, 2s. per week; fitter's mate, 1s. per week; driver, 5s. per week; firemen, 7s. per week; joiner, 7s. per week.

Australian Metal Co. and the A.E.G.—We notice in the list of creditors in the winding up of the Australian Metal Co., Ltd., the following entries:—

Allgemeine Elektrizitäts Gesellschaft, Berlin, £12,641, £16,230, and £1476.

Electroculture.—Engineers and others who are endeavouring to interest agriculturists, &c., in electrocultural work, will be interested to know that Mr. W. T. Kerr, city electrical engineer, of Hereford, has had a series of lantern slides of electroculture installations prepared for lecturing purposes.

Apprenticeship in Electricity Supply.—In the course of correspondence recently, the engineer and manager of a small electricity supply system gave us the following particulars of the system of training given to the apprentices under his charge:—

In the first place, we distinctly state that the apprentice is to be taught engineering in connection with our generating station work and distribution system, and do not profess to turn out an electrical engineer for any branch of the business.

Our apprentices are employed on generating station work and on distribution and wiring work on alternate weeks during their first year. The latter includes cooker, motor, and heater installation and maintenance.

On meter testing, installation testing, and suchlike work in their second year.

During their third year they are employed in the office, where they learn book-keeping, stock-keeping, estimating, and mains map and record keeping, &c.

During the last six months they are paid a commission on all new connections canvassed for by them, in addition to a small wage.

We continue them in our employment at 30s. per week, plus this commission, when they are out of their apprenticeship.

Our wiring contracts are not large, the maximum at the present unsettled time being about £50, two or three of which we obtain each year together with numerous small contracts.

We have modern instruments for mains and meter testing, do our own calibration and repair of the latter, and carry out all our own mechanical repairs. Our book-keeping system is as modern as a high-class auditor can keep it, and our distribution work is all carried out in as modern a manner as in most large plants.

The class of youth we take could not afford to take a mechanical apprenticeship, and if they could not get a start at a small outlay, they would have no choice of a livelihood beyond a shop assistant or trade.

Only two apprentices have completed with us to date. One was appointed assistant electrical engineer at a Government station at £150 per annum, and the second had the choice of two posts as improver, at 25s. per week. Both were less than two months completed when they left.

From the foregoing you will see that, although everything is on a small scale, all learned is up-to-date work, as far as my knowledge and experience can make it.

We have often been impressed with the advantages of apprenticeship in a small undertaking, whether it be a factory or a power station, as the learner has a far better chance of acquiring experience in all branches of the business than in a large organisation, except in those cases where a special scheme of instruction is in force; and the system outlined by our correspondent appears to be admirably devised to attain the desired end.

The Decimal System.—In the House of Commons, on Wednesday, Dr. Addison informed Mr. King that the question of adopting a decimal system of weights, measures, and coinage was being considered by the Committee on Commercial Policy After the War.

Electricity in Aviation.—A big German bombing machine which lately landed in Holland was fitted with an electric installation driven by motor for the purpose of warming the aviator.—*Daily Telegraph*.

Appointment Vacant.—Assistant electrical engineer (£300), for the Government Railway Department, Gold Coast. See our advertisement pages to-day.

The Whitley Report and Industrial Unrest.—Mr. Neville Chamberlain, presiding, in Birmingham, at an address by Mr. Wilfrid Hill on "Industrial Unrest: Its Causes and the Solution," to the Birmingham Business Club, said that industrial unrest was nothing new; we had it before the war, and after the war we should be face to face with a great many problems under changed conditions which it would take all our statesmanship to solve. It was the business men, the managers, and the workpeople engaged in industry who best knew what were the difficulties and what were the possibilities. The proposals of the Whitley Commission were not going to satisfy everybody. Certain men who were frankly revolutionary in their aims would not accept an olive branch of any kind. There were, however, more moderate and more practical and sensible men, who were prepared to come to terms, if terms could be arranged of a reasonable character, and who were sincerely and patriotically anxious to promote the future prosperity of the country.

Mr. Wilfrid Hill, who is a member of the Reconstruction Committee on Relations between Employers and Employed, said that in the interests of the community it was high time that masters and men ceased fighting each other and became allies, joining their forces to fight the foreign foes of Britain's commercial supremacy. Competition abroad necessitated co-operation at home. The problem was to get rid of friction, and that could be accomplished by conciliation, not conflict. Realising this, the Government were engaged in an honest effort not only to investigate the causes of Labour unrest, but to facilitate and expedite their removal. With this object they had set up a Reconstruction Committee, which would make it its business to provide opportunities for employers and employed to meet and reason together. The proposals of the peacemakers, acting on behalf of the Government, were:—(1) A Workshop Committee in every factory, to be composed of representatives of the masters and workmen in equal numbers. They would meet fortnightly, in business hours. In the initial stages it was suggested that a representative of the Government should attend the meetings of these Committees in a purely advisory capacity. Next (2) there should be a Joint Industrial Council in every industrial district, to consist of representatives of the two sections in equal numbers, their meetings to be attended, for a time, at any rate, by a representative of the Government. These Local Committees would constitute a first court of appeal, to which grievances and knotty questions not satisfactorily settled by a Workshop Committee could be referred. They would also bring the firms of a district into closer touch, and substitute friendly co-operation for ruthless competition. Then (3) there should be a National Industrial Council composed of representatives of Employers' Federations and Trade Unions, in equal numbers. This would be a final court of appeal. It was not proposed at present to arm the National Council with power to enforce its decisions or to impose penalties. It would serve as an arbitrator, seeking to prevent quarrels between friends rather than to act as a judge pronouncing sentence on criminals. The triple organisation scheme of the Reconstruction Committee provided machinery which should make conciliation possible, and all that was needed was the good will of both employers and employed.—*Morning Post*.

Training of Disabled Soldiers.—Portsmouth Corporation is arranging to train disabled soldiers in mechanical, motor, and electrical engineering and acetylene welding.—*The Times*.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station Officials.—Worcester T.C. has increased the salary of Mr. A. W. POWELL, on his appointment as assistant engineer-in-charge at the electricity works, from £114 to £127 per annum; and that of Mr. H. CHRISTOPHER, costs clerk, from £117 to £127 per annum.

General.—Sir MAURICE FITZMAURICE, C.M.G., has been appointed to fill the vacancy on the Advisory Council of the Committee of the Privy Council for Scientific and Industrial Research, caused by the retirement, by rotation, of Mr. W. Duddell, C.B.E., F.R.S.

On October 11th, at Cardiff, Mr. J. G. BOMFORD, managing director of Messrs. Booth & Bonford, Ltd., electrical engineers, Cardiff, was married to Gladys, daughter of Mr. and Mrs. Walter Lewis, of Cardiff.

The *Indian Textile Journal* states that H.E. the Governor in Council has appointed Mr. T. G. SULLIVAN, temporary assistant electrical engineer, as electric inspector. Mr. Sullivan will be under the orders of the electrical engineer to the Government, and will exercise the powers and perform the functions of the electric inspector in the Bombay Presidency, excluding Sind.

Mr. T. E. ALLAN, of Lincoln, who has been connected with the management of Messrs. Robey & Co., Ltd., for several years, has been appointed to a seat on the board of the company.

Roll of Honour.—Gunner GEORGE DRAKE, R.F.A., formerly in the golf ball department of the India-Rubber Co., Silvertown, was awarded the Military Medal on September 28th. Private W. J. BALKWELL, Bedford Regiment, formerly in the

gutta-percha department of the same company, was very badly wounded in France recently.

Corporal C. C. J. SMITH, formerly on the Maidstone Corporation tramway staff, is reported killed, after being missing since June 7th.

Lance-Corporal T. H. ANDREWS, who was in civil life electrical engineer at the Star Picture Theatre, Leicester, has died of wounds received in action.

The D.C.M. for gallantry has been awarded to Lance-Corporal J. H. ENTICOTT, Oxford and Bucks Light Infantry, who was at the Rugby works of the B.T.H. Co. He had previously gained the Military Medal and bar.

Private A. W. JACOBS, City of London Fusiliers, who has fallen in action, was on the staff of Messrs. Johnson and Phillips, Ltd., Charlton.

The Military Medal for bravery has been awarded to Sergeant R. BAINBRIDGE, R.G.A., who was on the York Corporation tramway staff.

Second-Lieutenant N. C. WHITTALL, Royal Fusiliers, attached to the R.F.C., who has been killed whilst flying in France, took his commission in June, 1915, whilst with Messrs. Elliott Bros., Ltd., Lewisham.

At Bolton, last week, the Mayor presented the D.C.M. to Lance-Corporal JOHN WHARTON, R.E. The award had been granted for services connected with the Intelligence Department of the Forces. Lance-Corporal Wharton was engaged as an electrician with Mr. James Morris, of Bolton.

Sapper R. M. BOND, R.E., who has been killed in action, was employed in the drawing office of Messrs. Dick, Kerr and Co., Ltd., Preston.

Corporal H. THORNTON, R.E., reported wounded, was in the employ of Messrs. A. R. Farrer & Co., electrical engineers, Bradford.

Private F. WILKINSON, York and Lancaster Regiment, who has been killed by an enemy sniper, was an apprentice with Mr. V. Ferrand, electrician, Bingley.

Private W. BROWN, an employé of Messrs. Kennedy, Stark and Co., electricians, of Glasgow and Paisley, has been awarded the Military Medal.

Private J. ANDERSON, formerly an apprentice wireman in the Glasgow Corporation electricity department, has been killed in action.

Acting Corporal-of-Horse A. E. JACKSON, killed in action, was employed by the Electric & Ordnance Accessories Co., at Aston.

Corporal H. BOOTH, of the Royal Welsh Fusiliers, killed in action, was employed by the British Westinghouse Co., Ltd., Trafford Park.

Lance-Corporal J. WALMSLEY, Loyal North Lancashire Regiment, who gained the Military Medal in July, has been killed in action, aged 32. He was employed by Messrs. Dick, Kerr and Co., Ltd., Preston.

Obituary.—Mr. W. R. SYKES.—We regret to record the death, which occurred on October 2nd, of Mr. W. R. Sykes, of railway signalling fame. He was the inventor of the lock-and-block signal, and some 18 years ago formed the W. R. Sykes Interlocking Signal Co. He was connected with the electrical and other signalling work on a large number of railways. Mr. Sykes was 77 years of age.

Mr. R. BROCKLEBANK.—The death has taken place of Mr. Robert Brocklebank, Llandudno, who was on the staff of Messrs. Lance & Co., electricians, and formerly secretary to the Chester Engineering Co., Ltd. He was in his 61st year.

HERR R. O. HEINRICH.—The death is reported from Berlin of Herr R. O. Heinrich, the director of the Weston Instrument Co., of that city.

Will.—Mr. F. O. ERICHSEN, A.M.Inst.C.E., director of Messrs. James Simpson & Co., Ltd., engineers, left £8,806.

NEW COMPANIES REGISTERED.

Grosvenor Engineering Works, Ltd. (148,632).—Private company. Registered October 8th. Capital, £2,000 in £1 shares (1,900 7 per cent. cum. pref.). To carry on the business of electrical engineers and contractors, makers of and dealers in munitions, submarines, aeroplanes, aircraft, and components, agricultural implements, boilers, &c. The subscribers (each with one ord. share) are:—R. J. Murray, Merton Grange, Milner Road, Bournemouth, engineer; A. E. Morgan, The Pines, Penn Hill, Avenue, Parkstone, Dorset, motor engineer. The first directors are: R. P. Murray and A. E. Morgan. Secretary: C. Sutton. Registered office: The office of the Grosvenor Garage (Bournemouth), Ltd., Poole Hill, Bournemouth.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Creed & Co., Ltd.—Satisfaction in full (a) on April 26th, 1917, of debentures dated October 3rd, 1912, securing £3,525, and (b) on August 16th, 1917, of two mortgages (one collateral) dated February 4th, 1915, securing £1,500.

Torquay Tramways Co., Ltd.—Memorandum of satisfaction to the extent of £900 on September 28th, 1917, of charge dated March 8th, 1911, securing £60,000 has been filed.

Birmingham and District Power & Traction Co., Ltd. (19,077).—Capital, £700,000 in £1 shares (250,000 pref.). Return dated June 25th, 1917, 146,846 pref. and 112,331 ord. taken up; £559,789 paid. Mortgages and charges: £394,433.

Bat Meter Co., Ltd. (99,327).—Capital, £20,000 in 41 shares (12,000 pref.). Return dated August 24th, 1917, 10,683 pref. and 8,000 ord. taken up; £1 per share called up on £23 pref. and 15s. per share on 10,260 pref.; £8,118 paid; £8,000 considered as paid on 8,000 ord. Mortgages and charges: Nil.

Llangollen and District Electric Light & Power Co., Ltd.—Debiture dated September 20th, 1917, to secure £200, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: T. O. Ockleston and H. Wilson, 3, Tithebarn Street, Liverpool.

Notable Electric Co., Ltd.—Particulars of £2,000 debentures created September 14th, 1917, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's property, present and future, including uncalled capital. No trustees.

General Cable Manufacturing Co., Ltd.—Memorandum of satisfaction in full on July 26th, 1916, of debenture dated June 24th, 1915, securing £1,000, has been filed.

CITY NOTES.

Eastern Extension, Australasia, and China Telegraph Co., Ltd. The report for 1916 states that the gross receipts amounted to £1,221,497, against £950,080 for the previous year. The working expenses, including £74,608 for the maintenance of cables, absorbed £430,244, against £386,672 for the previous year, leaving £791,253, plus £38,816 brought forward. From the balance £246,853 was provided for income-tax and excess profits duty payable in England, and £30,096 for the interest on the mortgage debenture stock, leaving £553,121, out of which four dividends of 1½ per cent. each and a bonus of 2 per cent., amounting together to £240,000, were paid, making a total distribution for the year 1916 of 8 per cent., free of income-tax. The balance of £313,121 has been disposed of by transferring £250,000 to the general reserve fund, and carrying forward £63,121 to the next account. The agreement entered into by the French Government with the company in 1884, for providing and maintaining under a subsidy arrangement cable communication between Cochinchina and Tonquin having expired, the cable has been sold and transferred to the Government. After crediting capital expenditure with the cost of the cable (£121,455), which was originally debited to that account, the loss resulting from the transaction, amounting to £66,154, has been debited to the general reserve fund. Under arrangements made with the Governments of the Australian Commonwealth and New Zealand, the company's cable stations at La Perouse (near Sydney) and Wakapuaka (near Nelson) have been closed, and its cables between Australia and New Zealand extended to Wellington, where they are now being worked direct with Sydney under greatly improved conditions. The cost of the extensions and partial renewals of the cables will be debited to the general reserve fund in the current year's accounts.—*Financial Times*.

Eastern Telegraph Co., Ltd. The report for 1916, now issued, shows that the revenue was £2,519,283, less £707,038 for ordinary expenses and £352,905 for expenditure relating to maintenance of cables, income-tax payable abroad, and special war payments to staff and other expenses in connection with the war, leaving £1,459,340, plus £26,638 brought forward. After providing for income-tax and excess profits duty payable in England, interest on mortgage debenture stock, and preference dividends, absorbing £596,290, the balance is £889,688, out of which £500,000 has been placed to general reserve, £10,000 to insurance of war risk at stations fund, and £5,000 to insurance of goods in transit fund. The total distribution for the year 1916 is 8 per cent., free of income-tax, leaving £54,688 to carry forward. The general reserve fund has been charged with £11,951 in respect of loss on sale and redemption of investments and certain special expenditure, and with £150,000 as a further provision on account of investment fluctuations. After crediting the above £500,000, the net addition to the fund for the year is £338,049. The vacancy on the board caused by the death of Lord Allerton has been filled by the appointment of Sir R. M. Kindersley, K.B.E.

German Companies. The *Elektrotechnische Fabrik Rheindt, Max Schorch & Co., A.G., of Rheindt*, whose operations are now chiefly devoted to the production of war material, reports gross profits of £40,000 for the first half of 1917, as compared with £49,000 in the whole of last year. After making provision for depreciation, the net profits and large balance forward are returned at £45,000, as against £30,000 in 1916, the dividend being 10 per cent. for the six months, as contrasted with 15 per cent. in 1916.

The *Elektrizitäts A.G. vorm. H. Pöge, of Chemnitz*, reports a substantial increase in the turnover in 1916-17, and an advance in the net profits from £88,000 in 1915-16 to £127,000 last year. It is proposed to pay a dividend of 20 per cent., as compared with a rate of 15 per cent. in 1915-16. The share capital is to be raised by £75,000 to £300,000 for the extension of the works and the provision of additional working capital.

The *Gasglühlicht Gesellschaft (Auer), of Berlin*, records a turnover, including war materials, three times greater in 1916-17 than in the most favourable year of peace. The net

profits are £717,000, as against £500,000 in 1915-16. It is proposed to distribute 25 per cent. on ordinary shares for £396,000, as in the previous year, and 5 per cent. on preference capital for £410,000, and to devote £106,000 to the repurchase of a further block of preference shares for cancellation.

The directors of the *Kabelwerk Rheindt A.G., of Rheindt*, after appropriating only £1,100 for depreciation in 1916-17, as contrasted with £61,000 in the previous year, report net profits of £221,000, as against £184,000 in 1915-16. It is intended to pay a dividend of 20 per cent., as compared with 30 per cent., in the form of the allocation of the divisible amount to the payment of a first instalment of 50 per cent. on a proposed share capital increase by £100,000 to £350,000, whilst the remaining half will be called up at a subsequent date.

The financial statement of the *Elektrowerke A.G., of Berlin*, the ownership of which has now been transferred to the Imperial Government, shows a loss of £2,100 in 1916-17, which follows a loss of practically the same amount in the preceding year. Although the undertaking only has a share capital of £250,000, advances of a total of £2,000,000 were made by the A.E.G. and the Berlin Electricity Works Co., and the taking over of the entire undertaking by the State has been accompanied by the substitution of State directors in place of the private representatives.

The report of the *Brandenburg Carbid und Elektrizitäts Werke A.G., of Berlin*, states that the company's water powers were being fully utilised, and the steam plant had to be worked to a greater extent in order to meet the demand for energy. The working results, which apply to the year ended on March 31st, 1917, were unfavourably affected by the scarcity of labour and the difficulties in procuring supplies of raw materials. In the autumn of 1916 the sale of calcium carbide was brought under governmental control, and the prices thereby fixed left only a moderate profit. The *Norsk Elektrokemisk Aktieselskab* was again able to pay a dividend of 10 per cent. for 1916, although the water and transport conditions were unfavourable. The accounts of the *Brandenburg Co.* show net profits of £14,700, as contrasted with £14,400 in 1915-16, and a dividend of 7 per cent. is proposed, as in the previous year.

Montreal Light, Heat & Power Co., Ltd.—Dividend of 2 per cent. on the paid-up capital stock for the quarter to October 31st.

Anglo-Portuguese Telephone Co., Ltd.—Interim dividend of 3 per cent., less income-tax.

Kaministiquia Power Co.—Dividend at the rate of 7 per cent. per annum on the capital stock for the quarter to October 31st.

Fellows Magneto Co., Ltd.—The directors report that the value of the output in May was £4,384; in June, £5,350; and in July, £7,263. It is hoped that by the end of December the monthly output will exceed £14,000 in value. Additional capital expenditure since the company started trading amounts to £27,000. On August 31st the company's liquid funds amounted to £18,569. Treasury consent has been granted for a further issue of £40,000 in preferred shares, but a decision has not yet been come to as to when this issue will be made. The directors hope to be able to recommend an ordinary dividend with the final dividend on the preferred shares for the current year.

Tubes, Ltd.—The directors in their report refer with regret to the death of the chairman, Captain John Chamberlain, M.C., who was killed in France on May 14th of this year. This deplorable event made a reconstruction of the board desirable, and Mr. Arthur Chamberlain, J.P., and Mr. James Rollason, J.P., have accepted seats on the board. The directors are still unable to present the accounts for the years ended April 30th, 1916, and 1917. The shareholders will be asked to confirm the payment of the interim dividends made on December 23rd and July 25th last, which the directors are satisfied have been earned during the year ended April 30th, 1917.

Electric Supply Co. of Victoria, Ltd.—In their report for the year ended March 31st, 1917, the directors show that the lamps connected increased from 166,253 to 188,402, and the passengers carried from 4,877,325 to 4,803,895. The trading account shows a gross profit of £31,218, as against £30,702 for the previous year. The balance to credit of profit and loss account is £29,528, plus £6,433 brought forward. There has been paid for debenture interest £7,393, and transferred to debenture stock redemption account £6,892, leaving £21,677, out of which £5,250 is required to pay on account of arrears of preference dividend, and £16,427 is to be carried forward.

Calcutta Electric Supply Corporation, Ltd.—The number of units sold to consumers during the five weeks ended August 31st, 1917, was 2,982,020, compared with 2,616,727 units in 1916.

Brisbane Electric Tramways Investment Co., Ltd.—Interim dividend, 8 per cent. per annum (4s. per share), free of tax, on ordinary shares for the half-year.

Calcutta Tramways Co., Ltd.—Interim dividend on the ordinary shares at the rate of 2½ per cent., free of tax.

Lima Light, Power & Tramways Co.—Dividend of 1½ per cent., in Lima, on the shares.

Parsons Marine Steam Turbine Co., Ltd.—It has not been possible to complete the accounts for the year ended June 30th, 1916, nor for the year ended June 30th, 1917, but a dividend of 15 per cent., free of income-tax, payable on 17th inst., is recommended, making 25 per cent. for the year. No further dividend for the year will be declared.

National Telewriter Co., Ltd.—The report for the year ended June 30th states that the results of operations, owing to the decrease in business in consequence of the war, show a loss of £240, as compared with a profit of £1,020 for the previous year.—*Financial Times*.

Lancashire Dynamo & Motor Co., Ltd.—Dividend of 5 per cent. (actual) on the ordinary shares, free of tax.

United River Plate Telephone Co., Ltd.—Interim dividend of 3 per cent. (3s. per share) on the ordinary share capital, free of income tax, for the half-year to June 30th.

STOCKS AND SHARES.

TUESDAY EVENING.

THE strength of the investment markets continues with little abatement. The news from the Western Front is helping markets generally, and the publication of the results so far achieved with the issue of the new War Bonds is regarded with considerable satisfaction. Russian news is, of course, disappointing, although it is thought that this will have comparatively slight effect upon the course of the war. Money remains reasonably cheap. There is a strong demand for investment securities of all kinds, but some of the home railway stocks underwent a trifling reaction after their previous rises.

Metropolitan Consolidated has risen $\frac{1}{2}$ on the week, and the Deferred dividend stock hardened to 22, while there has been a little business in Surplus Lands on the basis of 48. Districts are unchanged at 16 $\frac{1}{2}$, and in the Underground issues, the Income bonds have risen to 84, the £10 shares being still quoted 1 $\frac{1}{2}$ and the 1s. shares at 6s. 3d.

Home electricity shares are as firm as ever. Bromptons rose to 6 $\frac{1}{2}$, changing hands the other day at 6 9/16, and the 7 per cent. Preference shares have been sold at 6 $\frac{1}{2}$. City of London have advanced to 13, with business at 13 1/16, but Counties at 11 show a slight fall. London Electrics, although business was marked the other day at 15s., are not offered below £1. The company's 4 per cent. First Mortgage debenture stock changed hands on Monday at 82. Metropolitans hold their rise at 3 $\frac{1}{2}$. St. James's are being dealt in round about 7, but are more easy to sell than they are to buy. In the case of the other shares, the principal difficulty is to get the offer of any reasonable quantity.

Victoria Falls Preference are being bought by the provinces, and the price shows a good deal of strength at 24s., the 5 $\frac{1}{2}$ per cent. debentures being 105 $\frac{1}{2}$, while the ordinary shares hold their previous price of 19s. South Wales Electric ordinary came to market the other day at a shilling.

In the foreign group, Anglo-Argentine Tramways first preference are down 1/16 to 3 $\frac{1}{4}$, in consequence of the gravity of the strike situation. The Argentine Government, however, is apparently bent on strong measures for suppressing the trouble, and after a spasm of acute flatness, Argentine railway stocks recovered sharply, which had a sympathetic influence upon other industrials connected with the country. Brazil Traction are a point lower at 45. There is little change from day to day in the course of the Rio exchange, and until the rate takes a distinct turn for the better, it is hardly likely that Brazilian securities will undergo improvement. Rio Tramway first mortgage bonds keep very hard, however, at 87 $\frac{1}{2}$, and there has been a little business lately in the company's 5 per cent. mortgage bonds at or about 78 $\frac{1}{2}$. Mexican issues are quiet, a little undecided it may be, but attracting scarcely any active attention for the time being. Mexican Light and Power Preferred 7 per cent. Preference was done the other day at 34; the company's deposit receipts for the bonds stand a trifle higher than the actual bonds themselves. Mexican Northern Power Gold bonds, nominally 10/11, were negotiated this week at 12 $\frac{1}{2}$, and Monterey Fives at 27. Canadian industrials remain depressed.

The telegraph list is very steady. A lot of business is being done in the Marconi issues. Eastern Extension shares were ex 3s. dividend last Thursday, and Eastern Telegraph stock ex 30s. No changes, however, have been made in the prices, and this applies also to Cuba Submarine Telegraph, the dividend in the last named being 5s. a share. Cuba 10 per cent. Preference, by the way, are quoted at 14 $\frac{1}{2}$, which is £2 lower than at the outbreak of war, although the ordinary at 8 $\frac{1}{2}$ are 5s. higher. Eastern Telegraph ordinary stock, incidentally, is 1s. points higher than it was at the end of July, 1911. Great Northern maintain their rise at 39. West India and Panama shares receded to 30s., though there is not much business doing in them. Marconis have risen to 3 $\frac{1}{2}$, but the feature

of the week is the strength and activity of the market in American Marconis about 22s. 3d. and Canadian Marconis at 12s. A strong Stock Exchange tip was circulated to buy the former on the strength of vague statements as to the remarkable prosperity which the American Marconi Co. is enjoying, and a good many speculators helped themselves to shares. A bit of a bull account in them was built up, and at 23s. 9d. shares came in freely. Canadians have been a dark market for some time past, and the rise is due to sympathy with the advance in American Marconis. Marconi Marines are very firm at 52s. 3d., and the preference shares of the parent company keep about 2 15/16.

British Insulated ordinary are the main feature of strength amongst industrials, the price putting on 15s. to 14 $\frac{1}{2}$. India-Rubbers gained 5s. to 14, and General Electrics of both classes have gone ahead, the ordinary to 17 $\frac{1}{2}$ and the preference to 10 $\frac{1}{2}$. Babcock & Wilcox have recovered to 3 $\frac{1}{2}$. Edisons are easier at 20s. 6d., interest having died out in them for the time being, and British Westinghouse preference eased off to 3.

The rubber market has been somewhat upset by a sharp break in the price of some of the Java shares, due to the situation that has arisen between this country and Holland. Moreover, the price of the material shows dulness at 2s. 7 $\frac{1}{2}$ d. per lb. Nevertheless, there is a considerable amount of business going on. Iron, coal, and steel shares are strong, and in some of the markets connected with the baser metals, more particularly for that of copper, rather more activity has developed, though without much change in prices. The Stock Exchange as a whole is actively employed, and the tone throughout the markets keeps distinctly good.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.						
	Dividend		Price Oct. 16, 1917.	Rise or fall this week.	Yield p.o.	
	1915.	1916.				
Brompton Ordinary	10	9	6 $\frac{1}{2}$	+	$\frac{1}{2}$	25 16 1
Charing Cross Ordinary ..	5	6	8 $\frac{1}{2}$	—	—	6 9
do. do. do. 4 $\frac{1}{2}$ Pref. ..	4 $\frac{1}{2}$	4 $\frac{1}{2}$	8 $\frac{1}{2}$	—	—	6 18
Chelsea	4	8	2 $\frac{1}{2}$	—	—	5 9
City of London	8	8	13	+	$\frac{1}{2}$	6 8 3
do. do. 6 per cent. Pref. ..	6	6	10 $\frac{1}{2}$	—	—	6 18
County of London	7	7	11	—	$\frac{1}{2}$	6 7
do. do. 6 per cent. Pref. ..	8	6	10	—	—	6 0 0
Kensington Ordinary	7	6	6 $\frac{1}{2}$	—	—	5 14 8
London Electric	8	8	1	—	—	NH
do. do. 6 per cent. Pref. ..	6	4	8 $\frac{1}{2}$	—	—	6 8 8
Metropolitan	8	8	8 $\frac{1}{2}$	—	—	4 12 4
do. do. 4 $\frac{1}{2}$ per cent. Pref. ..	4 $\frac{1}{2}$	4 $\frac{1}{2}$	8 $\frac{1}{2}$	—	—	7 4 0
St. James' and Pall Mall ..	8	8	7	—	—	6 14 6
South London	6	5	2 $\frac{1}{2}$	—	—	7 6 6
South Metropolitan Pref. ..	7	7	21/6	—	—	8 10 3
Westminster Ordinary	7	7	6 $\frac{1}{2}$	—	—	6 8 8
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	6	6	99	—	—	6 1 0
do. do. Def.	88/8	1 $\frac{1}{2}$	28 $\frac{1}{2}$	+	$\frac{1}{2}$	6 9 0
Chile Telephone	8	8	7 $\frac{1}{2}$	—	—	5 11 4
Cuba Sub. Ord.	5	5	8 $\frac{1}{2}$	—	—	5 14 3
Eastern Extension	8	8	14 $\frac{1}{2}$ xd	+	8/-	5 8 4
Eastern Tel. Ord.	8	8	14 $\frac{1}{2}$ xd	+	1 $\frac{1}{2}$	5 7 9
Globe Tel. and T. Ord. ..	7	7	18 $\frac{1}{2}$	+	$\frac{1}{2}$	5 6 8
do. do. Pref.	6	6	10 $\frac{1}{2}$	—	—	5 15 8
Great Northern Tel.	22	24	89	—	—	6 8 1
Indo-European	13	13	68 $\frac{1}{2}$	—	—	6 1 6
Marconi	10	16	3 $\frac{1}{2}$	+	$\frac{1}{2}$	4 5 9
Oriental Telephone Ord. ..	10	10	8 $\frac{1}{2}$	—	—	3 1 6
United R. Plate Tel.	8	8	6 $\frac{1}{2}$	—	—	5 16 4
West India and Pan.	6d.	6d.	1 $\frac{1}{2}$	—	$\frac{1}{2}$	3 6 8
Western Telegraph	8	8	14 $\frac{1}{2}$	—	—	5 10 4
HOME RAILS.						
Central London, Ord. Assented	4	4	60 $\frac{1}{2}$	—	—	6 12 8
Metropolitan	1	1	24 $\frac{1}{2}$	+	$\frac{1}{2}$	4 1 6
do. do. District	NH	NH	16 $\frac{1}{2}$	—	—	NH
Underground Electric Ordinary	NH	NH	1 $\frac{1}{2}$	—	—	NH
do. do. "A"	NH	NH	6/3	—	—	NH
do. do. Income	6	4	6 $\frac{1}{2}$	—	—	4 15 3
FOREIGN TRAMS, &c.						
	Dividend					
	1915.	1916.				
Adelaide Sup. 6 per cent. Pref.	6	8	4 $\frac{1}{2}$	—	—	6 3 1
Anglo-Arg. Trams, First Pref. ..	5 $\frac{1}{2}$	5 $\frac{1}{2}$	8 $\frac{1}{2}$	—	$\frac{1}{2}$	8 16 0
do. do. 2nd Pref.	5 $\frac{1}{2}$	—	2 $\frac{1}{2}$	—	—	—
do. do. 5 Deb.	6	5	6 $\frac{1}{2}$	—	—	7 8 3
Brazil Traction	4	4	45	—	—	—
Bombay Electric Pref.	8	8	9 $\frac{1}{2}$	—	—	6 4 8
British Columbia Elec. Rly. Pfce. ..	5	5	40 $\frac{1}{2}$	—	—	12 4 10
do. do. Preferred	NH	NH	30	—	—	NH
do. do. do. Deferred	NH	NH	27 $\frac{1}{2}$	—	—	NH
do. do. do. Deb.	4 $\frac{1}{2}$	4 $\frac{1}{2}$	50	—	—	6 10 0
Mexico Trams 5 per cent. Bonds	NH	NH	46 $\frac{1}{2}$	—	—	NH
do. do. 8 per cent. Bonds ..	NH	NH	40	—	—	NH
Mexican Light Common	NH	NH	22 $\frac{1}{2}$	—	—	NH
do. do. Pref.	NH	NH	85	—	—	NH
do. do. 1st Bonds	NH	NH	46 $\frac{1}{2}$	—	—	—
MANUFACTURING COMPANIES.						
Babcock & Wilcox	15	15	8 $\frac{1}{2}$	+	$\frac{1}{4}$	4 12 4
British Aluminium Ord. ..	7	10	1 $\frac{1}{2}$	—	—	3 3 1
British Insulated Ord.	17 $\frac{1}{2}$	20	14 $\frac{1}{2}$	+	$\frac{1}{2}$	6 15 7
British Westinghouse Pref. ..	7 $\frac{1}{2}$	7 $\frac{1}{2}$	3	+	$\frac{1}{2}$	5 0 0
Callenders	20	20	14 $\frac{1}{2}$	—	—	6 16 0
do. do. 6 Pref.	5	5	4 $\frac{1}{2}$	—	—	6 1 8
Castner-Kellner	22	22	8 $\frac{1}{2}$	—	—	6 8 0
Edison Swan, fully paid ..	—	—	—	—	—	NH
do. do. 4 per cent. Deb. ..	4	4	72 $\frac{1}{2}$	—	—	5 10 4
Electric Construction	7 $\frac{1}{2}$	7 $\frac{1}{2}$	1	—	—	7 10 0
Gen. Elec. Pref.	8	6	10 $\frac{1}{2}$	+	$\frac{1}{2}$	5 14 3
do. do. Ord.	10	10	17 $\frac{1}{2}$	+	$\frac{1}{2}$	5 12 0
Henley	25	25	15 $\frac{1}{2}$	—	—	7 14 8
do. do. 4 $\frac{1}{2}$ Pref.	4 $\frac{1}{2}$	4 $\frac{1}{2}$	4	—	—	5 12 6
India-Rubber	10	10	14	+	$\frac{1}{2}$	5 2 10
Telegraph Con.	20	20	10	+	1	5 6 0

* Dividends paid free of income-tax.

THE HIGH-TENSION MAGNETO.*

(Continued from page 335.)

The special "spark-gap" distributor is used in the type "A" magneto, and has proved to be thoroughly reliable and satisfactory. The distributor brush is made of steel, and has V grooves in its active face with a central slot for taking the square head of the locking screw. It is of rectangular section, and is free to move in a brass tube moulded into the insulation. A spring forces the brush outwards against the head of the locking screw. Obviously, the screw is automatically locked, and the air gap between the face of the brush and the track of the distributor can be readily adjusted by first depressing the brush until the head of the screw is clear and then turning the latter either one way or the other. A quarter of a turn on the screw, which gives the

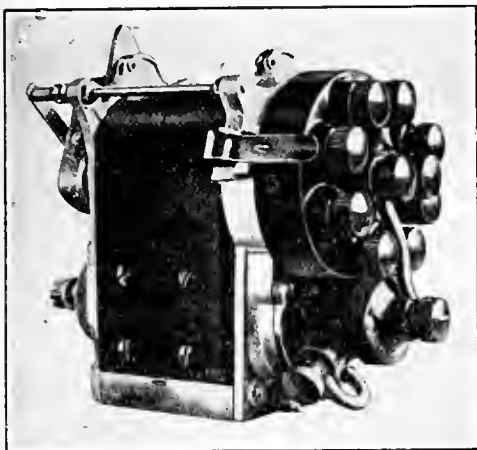


FIG. 14.—THE B.T.H. TYPE A S S MAGNETO.

minimum adjustment, alters the air gap by 0.002 in. When properly adjusted, the air gap should be between .01 in. and .014 in. The amount of wear on the face of the brush after continuous use is so small as to be almost negligible.

It does not seem to be generally appreciated that the manufacture of magnetos can only be undertaken successfully if very skilled labour is available, and the necessary steps are taken to machine all the component parts to extremely fine limits. The type "A" magneto is so complicated in design that the difficulties encountered in manufacturing it on a commercial basis are, without doubt, much greater than in the case of any other type of magneto being produced in England at the present time.

Take, for example, the rotating sleeve inductor. It comprises two soft iron segments which are secured by means of screws and dowel pins to a non-magnetic nickel steel end plate and spindle on the one hand, and to a gun-metal end plate carrying the distributor gear-wheel driving pinion on the other. The whole combination has to run on three ball bearings, all of which must be in perfect alignment. The outer race of one bearing is carried by the aluminium driving

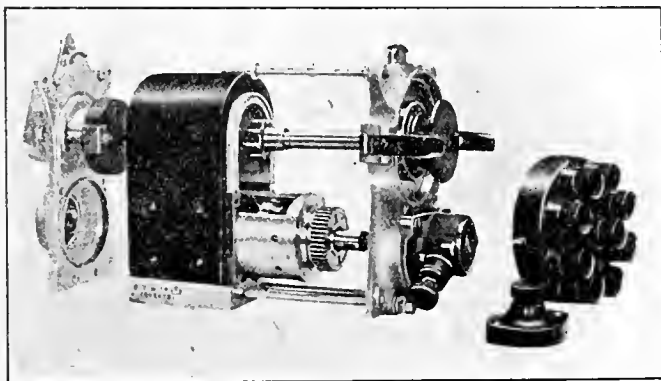


FIG. 15.—PARTS OF THE A S S MAGNETO.

end plate, whilst the inner races of the other two are securely fixed to the respective ends of the stationary armature end-plates. The clearance on each side of the sleeve inductor is only 0.006 in., and it is clear, therefore, that extraordinary precautions must be taken in manufacture to ensure that after assembly the sleeve will be perfectly free, and neither too tight nor too loose in its bearings.

In the manufacture of the type "A" magneto no fewer than 716 limit gauges are employed; 179 gauges constitute

one complete set, and four sets of gauges are in use, being allocated respectively to shop use, shop inspectors, Government inspectors, and check purposes in the tool-room. The shop gauges are made to somewhat finer limits than are specified on the drawing, so that the rejections made by the inspection department are reduced to an absolute minimum. The finer limit gauges are checked in the tool-room every day, whilst other gauges are checked periodically, the frequency of the inspection being dependent upon the degree of accuracy worked to and the liability of the gauge to wear in use. When the "go" end of a gauge (which is made somewhat larger than the minimum diameter specified) has worn down to the drawing dimension, the gauge is passed on to the inspectors for use in inspecting the work. This arrangement ensures that there is always an ample supply of very accurate gauges in the inspection department, because the wear on gauges used in the shops is much more rapid than the wear from use by the inspectors. Furthermore, each gauge has, by this method of working, a more extended life. Gauges are

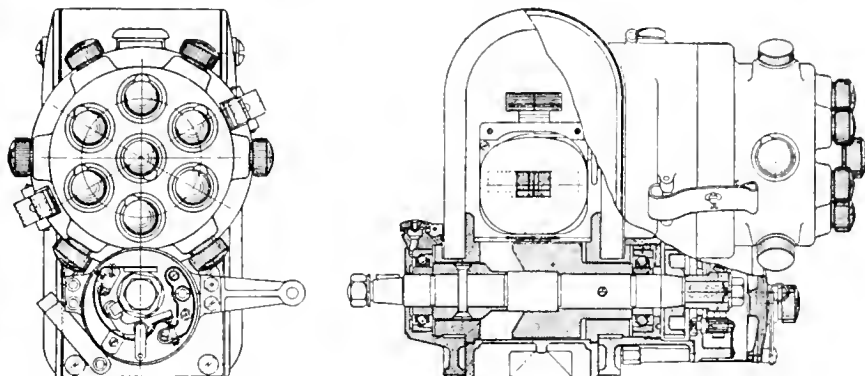


FIG. 16.—ASSEMBLY OF B.T.H. 12-CYLINDER POLAR INDUCTOR TYPE MAGNETO.

withdrawn from the inspection department for very slight errors from drawing dimensions, and the cost of maintaining a large number of gauges within narrow limits of accuracy is naturally quite a considerable item.

The finest limits worked to are for the hole in the contact-breaker cam and the end of the distributor brush spindle, on which the cam is fitted. These limits are:—

Hole in cam	Maximum diameter	13.005 mm.
	Minimum diameter	12.995 mm.
	Tolerance	0.01 mm.
End of spindle	Maximum diameter	12.995 mm.
	Minimum diameter	12.988 mm.
	Tolerance	0.007 mm.

The B.T.H. Co. has recently developed a polar inductor type magneto, more especially for 12-cylinder working, although it is proposed to standardise an 8-cylinder machine of exactly the same design by simply changing the distributing mechanism and gearing. This is the first 12-cylinder magneto to be developed and standardised in this country. Several

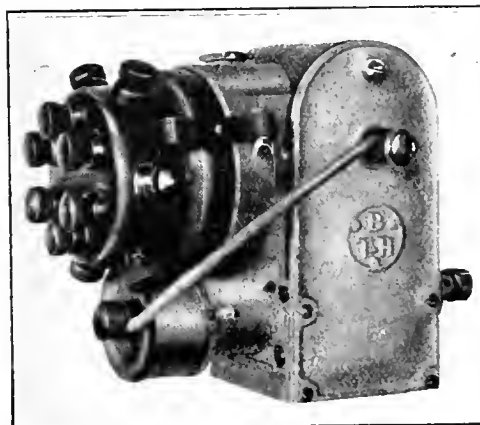


FIG. 17.—B.T.H. POLAR INDUCTOR TYPE MAGNETO.

models have already been constructed and tested with entirely satisfactory results on engines in the test shop, as well as in the air. It is designed to give four sparks per revolution, and the 12-cylinder model runs at $1\frac{1}{2}$ times engine speed.

The basic principle embodied in this design of producing the requisite flux reversals in a stationary laminated armature circuit, by means of a rotating polar inductor co-operating with fixed permanent magnets, is a British invention made by Mr. T. B. Murray, of the Albion Motor Car Co., and first disclosed by him in patent specification No. 14,737, dated June 28th, 1906. This patent is now void.

This magneto is inherently of much simpler construction than the sleeve inductor machine, because the sleeve inductor,

* Abstract of paper read by Mr. A. P. YOUNG, A.M.I.E.E., before the AERONAUTICAL SOCIETY.

which is a very difficult part to manufacture, is replaced by a polar inductor so designed that it can be easily made, and which at the same time is a more rigid and reliable mechanical structure. Other features in the design combine greatly to simplify the manufacturing problems, and it is anticipated that, other things being equal, the output of magnetos will rise very considerably after the change over from one type to the other has been completely effected—a fact of vital importance at the present critical juncture.

A sectional view of the machine is given in fig. 16. The polar inductor consists of a "straight-through" shaft made of non-magnetic nickel steel, on to which two polar inductors are first pressed up against a shoulder, and then finally riveted in position to the shaft. The ends of the magnets are secured to two soft-iron pole-pieces, near the top of each, by means of screws. There is an extremely fine air gap between

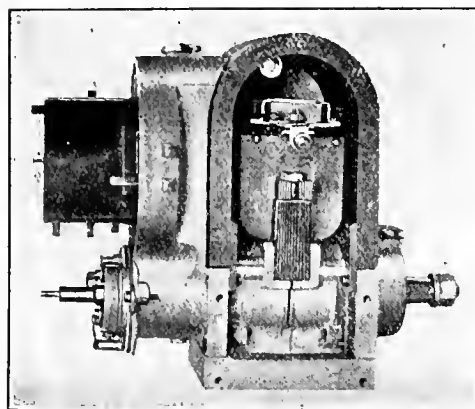


FIG. 18.—COMPONENT PARTS OF POLAR INDUCTOR MAGNETO.

the inside face of each pole piece and the outside surface of the annular portion of the inductor which it surrounds.

The magnet flux, therefore, passes through this fine annular air gap in a radial direction, and flows from one inductor to the other through the laminated armature circuit. The armature windings are carried by a brass spool, which is secured to a laminated iron core, which, in turn, is fixed by means of two clamping screws to two upright laminated projections. These are fixed in the central casting which carries the pole pieces, and also provides the base of the machine.

The contact breaker is operated by a four-part cam fixed to the end of the driving shaft. The contact breaker lever is specially designed so as to give a very low moment of inertia, and tests have shown that it will function satisfactorily when making 16,000 breaks per minute. This frequency corresponds to a speed of 4,000 R.P.M.

The distributor is of special design, having three distinct

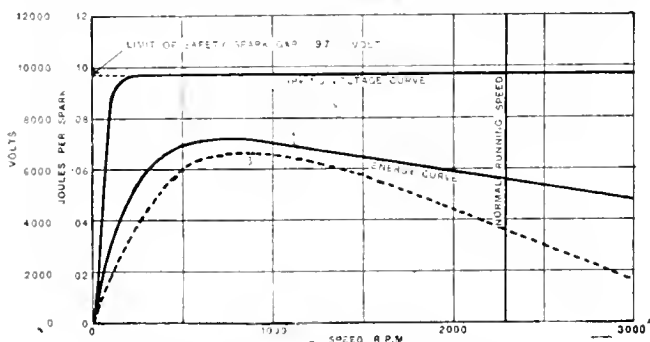


FIG. 19.—SPARKING VOLTAGE AND ENERGY CURVES.

tracks, two of which are the distributing tracks, each provided with six segments. The brush-holder contains five carbon brushes, and the safety gap is incorporated in the brush-holder and rotates with it. A gauze window is provided in the front of the distributor, and in consequence of the rotation of the brush-holder any products of ionisation have an easy chance of escape. This arrangement is much to be preferred to a totally enclosed stationary type of safety gap, where the silent brush discharge is always liable to produce injurious results.

A good idea of the general appearance of this magneto can be formed by referring to fig. 17, which gives an outside view of the machine, while the component parts are clearly depicted in fig. 18.

The magneto possesses excellent sparking characteristics at low speeds, as shown by the curve in fig. 19, which has been plotted from results of an actual test. The energy output, although not abnormally high, is very satisfactory for an inductor-type magneto. The curve plotted from the figures obtained by a calorimeter test is also given in fig. 19.

It should be noted that the maximum energy output, which is reached at a speed of about 800 R.P.M., is as large as .072 joule.

Special precautions have been taken in the design of the

magnetic circuit as well as in the choice of suitable magnetic material to ensure that the effect of eddy-current damping is reduced to an absolute minimum. As a result of this, the falling-off in the energy output as the speed is increased beyond the maximum point on the curve is not very marked, and for the sake of comparison curve 3 (shown dotted), which has been plotted from the figures obtained on testing a 12-cylinder polar inductor-type magneto of American manufacture, is added. In this case the effect of eddy-current damping at high speeds is very pronounced indeed, and the energy output, which reaches a maximum of .065 joule at about 800 R.P.M., falls away to only .015 joule at 3,000 R.P.M. There is no doubt that by paying more careful attention to the design of the magnetic circuit as referred to above the characteristic of this particular magneto, so far as energy output is concerned, could be improved.

Fig. 20 shows two curves, one giving the variation in the open-circuit primary voltage (R.M.S. value) with the speed and the other the variation in the short-circuit primary-current

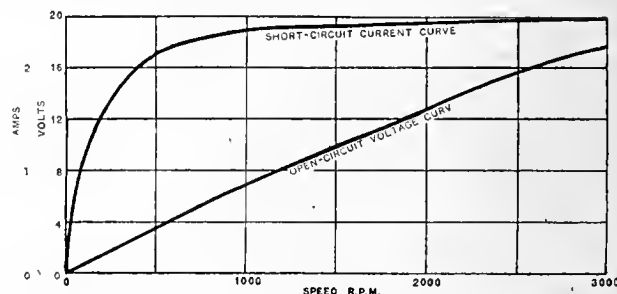


FIG. 20.—SHORT-CIRCUIT CURRENT AND OPEN-CIRCUIT VOLTAGE CURVES.

(R.M.S. value) corresponding to the same range of speed. The open-circuit voltage curve is practically a straight line passing through the origin, which confirms the view that the eddy-current damping in the magnetic circuit is extremely small. With most types of magnetos the open-circuit primary-voltage curve shows a distinct drop with increase in speed, due to the fact that the active armature core flux diminishes as the speed is raised. This drop is fairly pronounced in the case of the sleeve inductor-type magneto already described, as shown by the open-circuit voltage curve given in fig. 11.

The short-circuit current, on the other hand, remains substantially constant for all speeds above about 600 R.P.M., and this test, in which the magneto is run with the primary short-circuited through an ammeter of negligible resistance, is analogous to the case of an alternator running on short circuit. Every electrical engineer knows that in the latter case the short-circuit current is practically independent of the speed, due to the fact that the induced E.M.F. in the short-circuited winding varies in almost strict proportion to the reactance of the winding.

The primary voltage kick at the instant of "break" was determined at different speeds by using a Kenotron in conformity with the method of testing previously referred to. The voltage increased with the speed up to 3,000 R.P.M., very rapidly at first, but not so rapidly at very high speeds. Abnormally high voltages were measured, these being considerably in excess of any figures that the author has been able to obtain by testing in the same manner any rotating armature type of magneto. When the ratio between the primary and secondary turns is taken into consideration, one is led to the conclusion that at the instant when the high-tension spark is initiated an abnormally high voltage is induced in the secondary, this voltage being greatly in excess of any figure that has been previously assumed.

The input, output, and efficiency curves are given in fig. 21. The input curve has been plotted from the values of the power

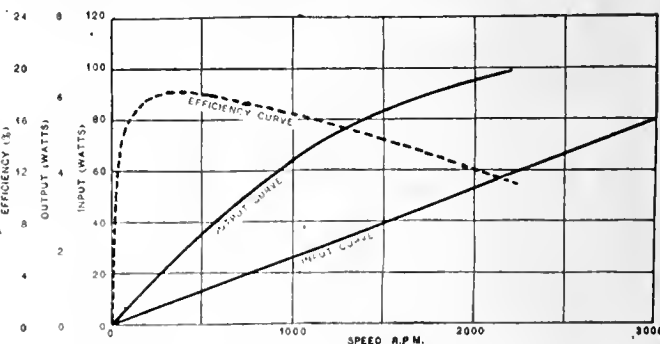


FIG. 21.—INPUT, OUTPUT, AND EFFICIENCY CURVES.

required to drive the magneto at different speeds as measured by an electrical method, while the output curve is calculated from the spark energy curve given in fig. 19. The efficiency curve has been calculated in the usual manner, and is substantially in agreement with the curve for the type "A" magneto given in fig. 13.

(To be continued.)

A MAGNETIC STEEL BAND DRIVE.

By P. L. WESTON.

(Abstract of paper read before the ELECTRICAL ASSOCIATION OF AUSTRALIA, N.E.W. SECTION.)

EXPERIMENTS made by the author in 1908 showed that magnetic pulleys could be devised which would efficiently attract steel bands as thin as 0.03 in. In 1916 he resumed the experiments, and found that good magnetic adhesion could be obtained with band thicknesses of 0.015 in. and upwards. The pulleys were 9 in. in diameter, and contained a single magnetic circuit, formed by two disks 25 mils thick with a winding space 1.75 in. deep and 40 mils wide, the current being led in through slip-rings. The total face of the pulley was 90 mils wide, and brass cheeks were provided. The band was $\frac{1}{2}$ in. wide and 15 mils thick. The pulley centres were 20 in. apart, and the pulleys were run at 1,500 R.P.M. for 300 hours, with a net difference of tensions of 20 lb. Slip took place when the difference of tensions was 45 to 50 lb., with 60 ampere-turns excitation, representing 5 watts for each pulley, and the tension in the slack side practically zero. The coefficient of friction was 0.265, and there was no appreciable wear on the band or pulleys. Up to 47 lb. difference of tensions the measured slip was almost identical with the normal calculated creep of the band due to stretching of the driving side of the band.

In another experiment, driving from a 10-in. pulley on a steam turbine to a 27-in. pulley at 29-in. centres, width of active face of pulley 80 mils, a band $\frac{1}{2}$ in. wide and 20 mils thick transmitted up to 20 H.P. at a turbine speed of 4,200 R.P.M., corresponding to a difference of tensions of 60 lb. The excitation of the small pulley was 50 ampere-turns, and that of the large pulley 12, the total power consumed being 25 watts.

The author discusses the theory of the drive, and shows for a 15-mil band on a 10-in. pulley, with an arc of contact of 150 deg., and a slack side tension of 50 lb., the maximum difference of tensions will be about 400 lb. A normal working value would be 250 lb., making the bending stress 45,000

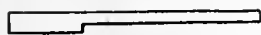


FIG. 1.—SECTION OF STRIP.

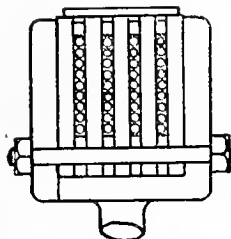


FIG. 2.—SECTION OF MAGNETIC PULLEY.

lb. per sq. in., and the direct stress 20,000 lb. per sq. in. Advantages are gained by using thicker bands. For bands of ordinary band-saw steel with silver-soldered joints, if the ratio of band thicknesses to pulley diameter does not exceed 1/1,000, a life of many millions of bends may be expected. For a 24-ft. band at a band speed of 10,000 ft. per minute, 40 million bends over the smaller pulley represent 1,600 hours' running; such a band 1 in. wide would transmit 50 B.H.P., and would cost, say, 10s., so that on a life of 1,000 hours the cost of band renewals would be insignificant, while power would be saved owing to the unusually high efficiency of the drive. The satisfactory endurance of band-saws with ordinary silver-soldered joints under very strenuous conditions leaves no doubt as to the endurance of similar steel bands for power purposes. For very high-class drives welded bands, or endless bands rolled from a solid ring of steel, might be worth while, and probably the best material would be an alloy such as chrome vanadium spring steel, which would have an extremely high elastic limit when rolled in such thin sections and suitably tempered.

For the smaller pulley of a combination the construction adopted is virtually a double-threaded screw with rectangular threads of small pitch and relatively deep grooves, as shown in section in fig. 2. This construction could be readily made up of two helices of iron strip, of the section shown in fig. 1, rolled in conical rolls to the required pulley radius, and riveted together to form the pulley rim. In general, the pole thickness will be from twice to two and a half times the band thickness, and the winding spaces can be 40 to 50 mils wide and 0.7 to 1.5 in. deep. With these proportions 60 ampere-turns will usually give sufficient excitation, and the magnetising watts amount only to a small fraction of 1 per cent. of the power transmitted. For the larger pulley of a combination, owing to the longer arc of contact, the magnetic circuits can either be reduced in strength or more widely spaced. Fig. 3 shows a design in which the active poles are narrow zones of one polarity formed of iron disks or segments, alternating with wide zones of the opposite polarity. To increase the width of both N and S pole faces is inefficient, since the adhesion varies as the square of the

flux density, and hence good attraction is secured only if the density of flux in the pole face is fairly high.

In a suitable design the sum of magnetising watts and the loss due to creep can be generally made from .2 to .5 per cent. of the transmitted power. Other losses comprise windage, hysteresis, and eddy currents, and increased friction of bearings. Hysteresis and eddy-current losses are found to be very small, and the remaining losses are almost negligible. It can be concluded, then, that an overall efficiency of well over 99 per cent. can be obtained, and 99.5 per cent. seems quite attainable.

Owing to the extremely small values of the slip, the rate of wear can only be quite small, as proved by test.

The band speed in general should be kept as high as possible, subject to the limitations of safe pulley design, to resist centrifugal force. At speeds over 10,000 ft. per minute for pulleys of small diameter, and above 15,000 ft. per minute for larger pulleys, the effect of centrifugal force in the band may have to be considered.

In the Bloesser drive, steel bands from 1 to 8 in. wide are run on cork-faced pulleys. The conditions laid down for successful working are (1) that the initial tension is to be as high as possible, without overstraining the band; and (2) that the pulley diameters are to be as large as possible.

The cork face is stated to give a value of $\mu = 0.28$, while a bare cast-iron pulley at first gave a value of 0.27, but afterwards was stated to become polished and gave a lower value. This polishing effect has not yet been found by the author in any of his tests to lower the value of μ .

While the Bloesser drive appeared to give in suitable cases very good results as regards capacity and efficiency, it seems to have failed in the matter of durability, being handicapped by a mechanical joint, which is bound to introduce local bending stress in the region of the joint where fracture will eventually occur. The only patentable part of this drive seems to be the joint, so it is obvious why the promoters of

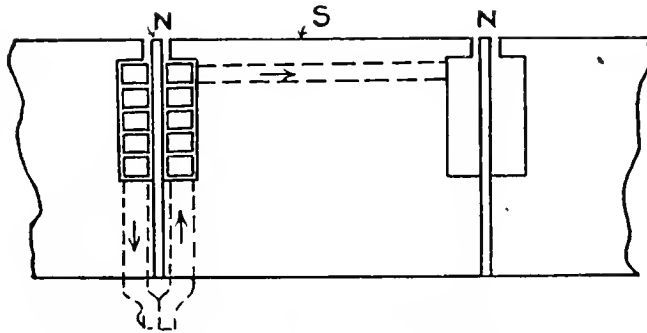


FIG. 3.—SECTION OF LARGER PULLEY.

this drive did not discard a mechanical joint in favour of the well-tried band-saw joint, which has the great merit of preserving the uniform section of the band.

While the magnetic drive appears to have a very large scope of application, it is particularly suited to deal with a difficult class of heavy drives in which a fluctuating load has to be transmitted with a large reduction ratio. A typical example would be a large ammonia compressor, driven by a gas engine or electric motor. Take, for example, a 250-H.P. drive of this nature, for which, at present, rope driving would be the most frequent practice. Using 1½-in. ropes, the usual rule of 30 diameters for the minimum size of pulley makes the smaller pulley not less than 45 in. Now, on a 45-in. magnetic pulley an 18 gauge band, 2 in. wide, will comfortably transmit the load at a linear speed of 5,000 ft. per minute. For the same speed and pulley diameters four 1½-in. ropes, or a 21-in. double leather belt, would be required. The band would effect a saving on the length of drive of about 18 ft., and about 13 H.P. of losses as compared with the belt, and about 26 H.P. as compared with the rope drive.

In general, the large capacity, high efficiency, adaptability to high speeds and short centres, low first cost, and small slip of the band drive will suggest numerous applications of this form of transmission.

A number of problems in connection with this drive require investigation, and further tests are in progress. One interesting development is that by means of a simple attachment for measuring the creep of the band the power transmitted can be accurately ascertained.

Magneto v. Battery Ignition for Petrol Motor Vehicles.—It is interesting to learn from New York that, following a period in which battery ignition in conjunction with electric lighting and engine-starting sets has been so popular in motor-car manufacturing circles in the United States, there is now apparently a reversal of technical opinion on the subject, and present tendencies indicate a return to greater popularity of a separate magneto for ignition purposes.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

FRANCE AND ALGERIA.—In pursuance of an agreement between the British and the French Governments, licences will be issued by the French Customs Office in London, upon application by the exporter in this country, for the importation into France and Algeria of goods of British production or manufacture which are included in the list of articles prohibited to be imported into those countries, with the exception of (a) goods included in List 3, published with the Decree of April 13th, and subsequently amended by the Decree of May 12th (c.f. the ELECTRICAL REVIEW of June 1st), which are placed under the control of the Inter-Departmental Commission on Metals and Munitions of War; and (b) certain specified goods (textiles, soap, oils, &c.).

In the case of goods falling under (a) and (b), applications for import licences must be made by the importers in France and Algeria to the competent French authorities, and information on the subject can be obtained by British exporters from the Board of Trade Office in Paris, No. 10, Place Edouard VII.

The following procedure has been laid down for the issue of French import licences in London for "prohibited" goods not of the excepted classes:—

The application for a licence must be drawn up strictly in accordance with the prescribed form, and be forwarded in triplicate *direct* to the French Customs Office, Bank Buildings, Kingsway, London, W.C. 2. To one of the three copies must be attached a separate certificate, signed on behalf of the Chamber of Commerce of the district or town in which the merchant concerned carries on his business, and attesting that the goods are the produce or manufacture of the United Kingdom.

[A copy of the prescribed form of application, and a suggested form of certificate of origin, were published in the *Board of Trade Journal* for September 13th. It should be borne in mind that the arrangements referred to above in no way affect the necessity of obtaining a British export licence in respect of such articles as are prohibited to be exported to those countries.]

A new Decree has been issued, which contains a re-classification of goods for the purposes of import prohibitions. Goods are now divided into seven categories, called respectively Lists A, B, C, D, E, F, and G. List A consists of those goods which are admitted without licence. In Lists B to G the goods are classified according to the authorities which are to advise as to the issue of import licences. The text of the various Lists may be consulted at the Department of Commercial Intelligence, 73, Basinghall Street, E.C. 2.

UNITED STATES OF AMERICA.—According to a Treasury Circular, trade samples intended solely for use in soliciting orders for goods may now be imported by ordinary mail in unsealed parcels, which, however, must be plainly marked abroad with the words "Trade samples of," subject to examination by United States Customs Officers. Samples sent on approval may not be sent in this way.

The exportation (except under licence) of various classes of goods has been prohibited by Proclamation. The list of goods includes wireless apparatus, electrical equipment, copper, lead, tin, nickel, aluminium, zinc, plumbago, and platinum.

ITALY.—The Italian Government has recently taken steps to terminate at the end of this year the various Treaties with foreign countries which fix rates of duty on certain classes of goods, thus leaving the Government free to revise the Tariff as may be found desirable. This revision has been under consideration by a Royal Commission, which is to present its report very shortly. The Commission has already issued important recommendations, which include the adoption of a double Customs Tariff, one with heavy duties on the goods of countries not granting favourable treatment to Italy, and the other with more moderate duties for goods of other countries. Anti-dumping legislation is recommended, and it is also suggested that the Customs *regime* of the Italian Colonies should be determined by special regulations.

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

- 14,105. "Mine signalling apparatus." W. MILLAR. October 1st.
- 14,107. "Locking electrical spigot-and-socket unions." W. STEWART. October 1st. (Australia, November 10th, 1916.)
- 14,120. "Insulators for telephone, &c., wires." T. TAYLOR. October 1st.
- 14,165. "Audion or lamp relay or amplifying apparatus for wireless telegraphy, &c." M. LATOUR. October 1st. (France, September 30th, 1916.)
- 14,169. "Apparatus for preventing dead lines at line crossing or junctions on electric tramways." W. J. FENGE. October 1st.
- 14,171. "Thermostatic circuit closers." A. M. D. S. GREAVES. October 1st.
- 14,181. "Apparatus for use with searchlights." P. COWDREY. October 2nd.
- 14,187. "Electric hand-lamps." M. J. RAILING & T. TAYLOR. October 2nd.

- 14,194. "Electrolytic process to recover metal from scraps." E. POPPER. October 2nd.
- 14,197. "Electrical apparatus for internal-combustion engines." J. BIJCK. October 2nd. (U.S.A., November 24th, 1915.)
- 14,201. "Electric welding apparatus." R. F. WOODBURN. October 2nd.
- 14,210. "Automatic control of electrically-operated feed-reel brakes." H. V. JAMES. October 2nd.
- 14,215. "Electric furnace control apparatus." BRITISH THOMSON-HOUSTON Co. (General Electric Co., U.S.A.) October 2nd.
- 14,254. "Telegraph, &c., signalling systems." T. B. DIXON. October 2nd.
- 14,286. "Process for electro-deposition of metals." A. A. LOCKWOOD. October 3rd.
- 14,309. "Electric storage batteries or accumulators." FULLER ACCUMULATOR Co. & J. C. WOOD. October 3rd.
- 14,335. "Method of depositing chromium electrolytically from its chemical salts single or compound." E. E. BURNETT. October 4th.
- 14,341. "Fusible metal, &c., cores or mandrels for electro-deposited metal tubes, &c." C. H. PARKER. October 4th.
- 14,348. "Magnetic separation of metals or magnetic bodies from oil flowing through oil circuits." D. BROWN & SONS AND W. H. CHILLO. October 4th.
- 14,350. "Electric transforming and converting apparatus." BRITISH THOMSON-HOUSTON Co. (General Electric Co., U.S.A.) October 4th.
- 14,360. "High-frequency spark gap." A. C. GUNSTONE & G. PEARCE. October 4th.
- 14,361. "Rectifier for mercury interrupters." A. C. GUNSTONE & G. PEARCE. October 4th.
- 14,369. "Electric motors." H. L. TANNER. October 4th. (U.S.A., July 19th, 1916.)
- 14,373. "Pocket flashlamps." C. S. CLOAKE & H. J. CLOAKE. October 4th.
- 14,392. "Fusible mandrels for copper, &c., electro-deposited tubes." LAMP-LOUGH RADIATOR & ENGINEERING Co. October 5th.
- 14,393. "Incandescent electric lampholders." M. H. GOLDSTONE. October 5th.
- 14,399. "Electric torch apparatus." R. CUSHION. October 5th.
- 14,400. "Method of operating self-starters for motors propelled by internal-combustion engines." E. E. MORRIS. October 5th.
- 14,402. "Spark plugs." H. L. BODREAU & J. A. DE VILBISS. October 5th. (U.S.A., June 2nd.)
- 14,411. "Electrical transformers, &c." SIEMENS SCHUCKERTWERKE. October 5th. (Germany, December 2nd, 1916.)
- 14,412. "Localisation of faults in electrical conductors." J. E. TAYLOR. October 5th.
- 14,424. "Apparatus for detecting variations in magnetic fields." D. K. MORRIS. October 5th.
- 14,430. "Magneto-electric ignition apparatus." AKT. GES. BROWN, BOVERI & Cie. October 5th. (Germany, October 31st, 1916.)
- 14,437. "Electric primary cells." R. PEARSON. October 5th.
- 14,446. "Electric motors." C. W. DURNFORD, AND SUBMERSIBLE & J. L. MOTORS, LTD. October 5th.
- 14,451. "Dynamo-electric machines." C. W. DURNFORD, AND SUBMERSIBLE AND J. L. MOTORS, LTD. October 5th.
- 14,455. "Electric pulley blocks." ELECTRIC PULLEY BLOCK Co. & H. R. SMITH. October 6th.
- 14,458. "Electromedical coils." M. H. GOLDSTONE. October 6th.
- 14,481. "Spark plug." J. COURTIER & P. COURTIER. October 6th. (France, October 7th, 1916.)
- 14,484. "Material for electric resistances, &c., and method of preparing same." J. INGER. October 6th.
- 14,493. "Incandescent electric lamps and lampholders." A. J. H. GURNEY. October 6th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

1914.

- 14,439. PHONOGRAPHIC RESPONDING AND RECORDING DEVICES FOR USE WITH TELEPHONES. F. Seclau. June 30th, 1913.

1916.

- 8,473. MACHINE SWITCHING TELEPHONE EXCHANGE SYSTEMS. Western Electric Co. & L. Polinkowsky. June 15th, 1916. (109,456.)
- 12,505. RADIO TRANSMITTER SYSTEMS. L. de Forest. September 4th, 1915. (101,415.)
- 12,687. ELECTRIC FURNACES. J. O. Boving. September 7th, 1916. Cognate application, 2,807/17. (109,465.)
- 12,906. AUTOMATIC FORGING APPARATUS. A. W. Morris. September 12th, 1916. (109,475.)
- 13,121. CHARGING SYSTEMS FOR STORAGE BATTERIES. British Thomson-Houston Co. (General Electric Co., U.S.A.) September 15th, 1916. (109,485.)
- 13,181. SELENIUM AND LIKE SENSITIVE CELLS. M. Martinez. September 16th, 1916. (109,486.)
- 13,443. DYNAMO-ELECTRIC MACHINES. Anschütz & Co. September 22nd, 1915. (101,554.)
- 13,664. COMBINED ELECTRIC STOVES AND TOASTERS. H. A. Rice. September 22nd, 1915. (101,634.)
- 13,746. ELECTRIC SIGNALLING SYSTEMS. R. Lambourne. September 27th, 1916. (Cognate application, 1,233/17.) (109,325.)
- 14,698. MARINE PROPULSION. R. S. Fortham. October 16th, 1916. (109,513.)
- 15,350. SPARK PLUG. M. C. E. Bundy. November 2nd, 1915. (102,054.)
- 16,008. METHOD OF AND PROCESS FOR MAKING MAGNETIC MATERIAL. British Thomson-Houston Co. (General Electric Co., U.S.A.) November 8th, 1916. (109,528.)
- 16,855. METHOD OF AND MEANS FOR COOLING THE SPARKING PLUGS OF INTERNAL-COMBUSTION ENGINES. A. E. Lamkin. November 24th, 1916. (109,345.)
- 17,034. APPARATUS FOR AUTOMATICALLY SIGNALING AND STOPPING RAILWAY TRAINS FOR THE PREVENTION OF COLLISIONS. A. Mancini. July 22nd, 1916. (108,299.)
- 17,464. GLASS-BLOWING APPARATUS. British Thomson-Houston Co. (General Electric Co., U.S.A.) December 5th, 1916. (109,544.)
- 17,983. PRODUCTION AND MAINTENANCE OF HIGH VACUA AND THE PURIFICATION OF NOBLE GASES. British Thomson-Houston Co. (General Electric Co., U.S.A.) December 14th, 1916. (109,358.)
- 18,005. MACHINES FOR MAKING BATTERY CUPS, AND THE METHOD OF MANUFACTURE. S. L. Casella. December 23rd, 1915. (102,952.)
- 18,341. DRIVING ARRANGEMENTS OF ELECTRIC MOTORS. G. Jones. December 21st, 1916. (109,367.)

1917.

- 237. SELF-STARTERS FOR INTERNAL-COMBUSTION ENGINES. C. F. L. King. January 5th, 1917. (109,372.)
- 238. SELF-STARTERS FOR INTERNAL-COMBUSTION ENGINES. C. F. L. King. January 5th, 1917. (109,373.)
- 414. ELECTRIC STARTING DEVICES FOR INTERNAL-COMBUSTION ENGINES. V. A. Trier. January 9th, 1917. (109,376.)
- 3,976. SPARKING PLUG FOR INTERNAL-COMBUSTION ENGINES. W. C. Matthews. March 19th, 1917. (109,403.)
- 4,554. ENGINE STARTER. V. Benedix. March 29th, 1917. (109,583.)
- 4,560. ENGINE STARTER. V. Benedix. March 29th, 1917. (109,407.)
- 6,255. CONTROLLERS FOR ELECTRIC MOTOR CIRCUITS. Igran Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.) May 2nd, 1917. (Addition to 103,441.) (109,418.)
- 7,409. CONTROL DEVICE OR GOVERNOR FOR ROTARY PUMPS. G. & J. Weir and J. G. Weir. May 23rd, 1917. (109,421.)

THE ELECTRICAL REVIEW.

VOL. LXXXI.

OCTOBER 26, 1917.

No. 2,083.

ELECTRICAL REVIEW.

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AN INSTITUTE FOR DISCOVERIES AND INVENTIONS.

"The ideas of inventors," says *E.T.Z.*, "represent not the least interest on the capital formed by a people's spirit of enterprise, and an Institute for Discoveries and Inventions is an economic necessity." During the war, all the principal countries concerned have arranged to make full use of ideas submitted to a central committee, and to analyse and develop these, however unpromising they may appear in their original forms. What is needed is a permanent organisation to render similar service to the nation after the war. The raw materials section of the German War Ministry has been established as a permanent authority, and therein *E.T.Z.* sees the modest beginnings of an "Economic General Staff," which will organise and control a comprehensive scheme of economic mobilisation.

The Kaiser Wilhelm Gesellschaft, the Material-prüfungsamt (for testing materials), and the research departments of colleges and large firms are milestones on the path of technical progress. The Jubilee Foundation of German industry and the Bach Foundation for technical and scientific research are only a couple of examples of the rich resources available. The standing committee of the German Union for developing foreign trade, and securing the interests of industry and commerce in the central administration of Germany, deals with concurrent problems. A promising commencement in the utilisation of experience, ideas, and observations is to be seen in the fact that the staff of the War Department is acting as an exchange, and that the chairman of the German Union of Technical and Scientific Associations has arranged for interchange of views and requirements between industrial technical interests, and the scientific laboratories of the colleges.

The basis of the proposed *Erfindungsinstitut* includes statutory organisation and the support of the principal professional institutions. Ideas and proposals submitted to the new Institute would be examined carefully, developed as far as possible in laboratories (new or existing), and then distributed to and utilised by the industries concerned. A due proportion of net profit would be reserved to the original inventor. The end in view is intelligent fusion on a broad social basis of the functions of private concerns for developing patents, and the ideals of a State department serving the common weal.

What has already been done along these lines in this country is known to our readers so far as it is wise to publish details during the war. There is still room for further advance and improvement, but we have already done much in the way of Imperialising raw materials and developing industrial research and manufacture. Such movements have been prosecuted at least as vigorously in our Oversea Dominions as at home. The achievements of peaceful industrial research in the U.S.A. have been worthily continued and extended in the war organisation of that country. Committees for war industry did sterling service in sifting and developing inventions in Petrograd and Moscow before the revolution, and it is to be hoped that their activities will be extended further during the war, and continued thereafter to the benefit of Russian industrial and economic development.

A Commission of the Académie des Sciences is agitating for the immediate establishment of a

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national laboratory of physics and mechanics to serve home industries by research work and by developing inventions. Finland, Sweden, and Switzerland are displaying similar activity and enterprise; and for the same general purposes Japan has founded the Rikagaku Kenkyusho Institute with £196,000 capital and an annual State subsidy of £2,450. In Vienna the Technical Research Department is working with good results, and there are "a number of new, specifically Austrian organisations" as well.

Germany reckons upon "the sort of Chinese Wall, which has been placed round all the great Powers by the war, being dissolved by the resumption of international traffic after peace is declared. Wise domestic transition policy will prepare for this change. Commercial treaties, patent laws, and economic measures will need reconstructing, and the spirit of invention must be kept mobile." An institute for discoveries and inventions should certainly be regarded as an economic necessity by every great Power from now onwards, but, as for the rest, the deeds and lessons of the war cannot lightly be forgotten, and Germany is likely to find that the Allies' Wall is long, high, and durable.

The Gas-driven Car. THE recent demonstration, in London, of motor vehicles equipped for operation on coal gas is a striking tribute to the efficacy of a little vigorous pushing of even an undesirable thing. There were present, according to the *Westminster Gazette*, "motor cycles with canopy-like tops filled with domestic gas, a lorry for heavy haulage whose overhead envelope took the form of a miniature Zeppelin, and a private motor car whose seven-shillings' worth of gas was carried separately in a bulky container on a special trailer hooked on to the rear of the vehicle; a converted eight-seater Ford carried its charge of gas compressed in cylinders on the side running boards, while to a lordly landaulet was tacked on a single-wheel auto-trailer with a nest of gas cylinders." Needless to add, these excrescences have come about solely owing to the shortage of motor spirit and the dire necessity for finding some substitute fuel for internal-combustion engined cars. But, though we regard the coal-gas driven car and its attendant paraphernalia as a makeshift, it is evident that some motoring circles attach considerable importance to future possibilities in this direction, no doubt having in mind a probable shortage of liquid fuel for some years to come, and it is, therefore, of interest to examine the present possibilities of this development, which has received the blessing of certain motoring contemporaries, who, incidentally, have in the past extended a none too friendly hand to the battery-driven vehicle.

From published data it would appear that a gas-bag capacity of 450 to 500 cu. ft. is the practical limit for vehicles of the 'bus type, and this represents about 14 miles running, while a taxi-cab is assumed to carry 120 cu. ft. and travel 10 miles, so that liberal gas-charging facilities would be a *sine qua non*. There is the alternative of using compressed gas, though the stability of coal-gas under considerable pressure has to be considered, and steel containers are both weighty and expensive, even if obtainable, while an experimental rubber container measuring 4 ft. 6 in. by 1 ft. 3 in., for 1,800 lb. pressure, contains only a normal 500 cu. ft. of gas, equivalent to, say, from 14 to 40 miles' running on the basis already mentioned. Moreover, unless the car engine can be adapted to work a compressor, independent charging apparatus would be required, considerable expense being involved either way.

We have laid stress on the limited mileages which attach to the use of coal gas for vehicle propulsion, because it is precisely on this point that our motor-

ing contemporaries have in the past condemned the electric vehicle—which, whatever its limitations, has never suffered from such a severe mileage handicap as the coal-gas driven vehicle apparently will. The electric vehicle with a normal commercial range of 40 to 60 miles on one charge, and the proved capability of increasing this distance to 100 miles without introducing abnormal constructional features, not to mention its use of still cheaper fuel—roughly one-third cheaper, is obviously far ahead of the new "hybrid" which our motoring friends are so assiduously cultivating.

Mechanical traction is an indispensable factor of the present day, but, under existing conditions, the petrol engine is a millstone round the necks of those who depend on spirituous fuel, and if they use gas in its stead it is a case of "needs must when the devil drives."

ALTHOUGH the term "Lumen" has been adopted by the leading manufacturers of Great Britain—as well as of the United States and Canada—for rating the luminous output of a lamp, in place of the candle-power (which, in point of fact, in no way measures the output), like all such innovations, it may present some difficulties to those who are not familiar with its nature and origin. It may be helpful to electrical readers to point out the analogy which exists between it and the flux from a magnetic pole.

The intensity of the magnetic field near the pole of a long straight magnet of given strength varies in magnitude inversely as the square of the distance from the pole, and the direction of the magnetic force varies from point to point; similarly, the intensity of illumination due to a lamp of given candle-power varies inversely as the square of the distance from the lamp, and the direction of the light-rays varies from point to point. But in most practical applications of magnets, it is not the intensity of the field or the direction of the force that is of importance—the quantity which it is usually necessary to know is the total magnetic flux proceeding from the pole in whatever direction, and this is equal to the strength of pole multiplied by 4π . In the same way, the important quantity in the case of a lamp is not its candle-power in a given direction, but the total amount of light which it produces; and this is similarly obtained by multiplying the mean value of the candle-power in all directions (*i.e.*, the mean spherical candle-power) by 4π . The result in the former case is the number of lines of force proceeding from the magnet pole; in the latter, the number of lumens generated by the lamp. The dynamo designer has no use for the "strength of pole" in his machines; he never gives it a thought—and, similarly, the illuminating engineer is not concerned with the candle-power of the lamps that he uses. What he wants to know is *how much light* a lamp gives out; the candle-power is no guide to this quantity, but the rating in lumens gives it to him at once, and without any calculation or guess-work.

In the same way, the old expression "watts per candle" was an illusory means of expressing the efficiency (or, more correctly, the "inefficiency") of a lamp, depending as it did upon the type of lamp and the mode of measurement; the rating in "lumens per watt," on the other hand, is a true criterion of efficiency, and is independent of the method of measurement. The lumen is the amount of light which will illuminate 1 sq. ft. of surface to the intensity of 1 ft.-candle; knowing the area to be illuminated, and the intensity of illumination desired, the number of lumens required, and hence the number of lamps of a given pattern, is at once obtained in the simplest possible way—namely, by multiplying the two factors together.

A *National Nitrate Industry*.—The preliminary to establishing synthetic manufacture of nitrates on a national scale, is careful, but not prolonged, investigation to ascertain which processes are best adapted to local circumstances of the various plants proposed. What is needed is a preliminary research carried out with the same energy as it is proposed to devote to the later industrial developments, and with an expenditure of money proportioned to the magnitude

* *Scientific American*, pp. 394, *et seq.*, April, 1917.

of the interests at stake. The line of procedure suggested by Norton, though applying primarily to American conditions, is worthy of our consideration. The first step is to decide to what extent we can dispense with hydro-electric power and utilise coal refuse, peat, or even power from our largest central stations of normal type. Where cheap water power is available (as in certain of our Colonies), its possibilities should be investigated. *

Experimental plant should be laid down as follows:—

(1) A 5,000-h.p. unit to test the new Rankin arc process. (2) A unit adequate to determine the acid yield and production costs of the Ostwald process (which was refused a patent in Germany on the ground that all the essential facts were already known). (3) A plant adequate to determine the cost of Haber's synthetic process for the manufacture of ammonia from hydrogen and nitrogen. (4) Norton proposes an experimental Mond plant of 5,000 h.p. operating on cheap or waste coal: another dealing with 500 tons per day of lignites: and a third for utilising peat on a large scale. These experimental plants would hardly be required in this country, the Mond plant and its costs being well known.

Probably in every country it would pay to use more than one process: thus Norton suggests that the arc process might be best in the North-West (U.S.A.), whilst the oxidation of ammonia to nitric acid might be cheaper on the Atlantic seaboard. In a remote district where coal is cheap, the best practice might be to obtain ammonia by the Mond process, use the power gas to fix atmospheric nitrogen by the arc process, and obtain ammonium nitrate as final product, which, owing to its high nitrogen content, is economical for long-distance transport. All the fixation processes at present in industrial use are likely to remain so, and to extend in application according to local circumstances. Further progress will be made, but the general problem of fixing nitrogen from that inexhaustible reservoir, the atmosphere, is already solved, and the supremacy of synthetic manufacture over natural supplies of nitrate is already asserted.

Whatever the details of practice and organisation, we should be able to supply from within our own borders a peace-demand for nitrates far greater than our consumption in the past, and there should be plant available "capable of vastly increasing, at a day's notice, the current output of nitric acid, to meet the nation's needs in case of sudden danger."

Over-population of the world—a contingency which has troubled many people, however unnecessarily—is practically impossible now that unlimited quantities of atmospheric nitrogen can be fixed to meet the needs of intensive agriculture. An abundant supply of synthetic nitrogen compounds, made within our own frontiers, means an assured supply of explosives and security against starvation in war time. Heavier crops may be obtained with less labour where nitrogenous fertilisers are used liberally. Finally, a national nitrate industry provides profitable investment for capital and labour, benefits industry and agriculture by its products, and improves the balance of trade by substituting home production for importation.

INDUCTIVE AND ELECTROSTATIC TROUBLES ARISING FROM A.C. RAILWAYS.

[COMMUNICATED.]

IN one respect at least alternating-current traction systems are more troublesome than direct-current systems. All power circuits are liable to interfere with the proper working of telegraphs and telephones, but experience shows that nothing is more likely to produce trouble of this sort than single-phase railways. Inductive and capacity effects have in some cases led to considerable inconvenience, especially on the Continent of Europe and in America, where single-

phase lines are more numerous than in this country. The inductive effect arises from the current in the power wires, and is proportional to the strength of this current, and, therefore, varies with the number of trains that are running on the system. The current, being alternating, produces a varying magnetic field which, in cutting neighbouring telegraph and telephone wires, induces a voltage in them. Obviously the nearer the communication wires are to the power wires the greater does this voltage become. All inductive effects, however, would be eliminated if it were possible to arrange for the currents in the outgoing and return conductors of the railway system to influence the telegraph and telephone lines equally, for as the directions of the currents are opposite the induced voltages would neutralise one another. It is owing to the outgoing and return conductors of single-phase railways being in widely different positions that the inductive effects are far more troublesome than those set up by ordinary power circuits.

Experience shows that the noises produced in telephone receivers arise almost wholly from the harmonic voltages and currents of the power system. This is due chiefly to the fact that the frequencies of the harmonics generally present in the voltages and currents of power systems cover a considerable portion of the voice frequencies, particularly those frequencies at which telephone instruments and the human ear are of maximum sensibility. Extraneous currents of frequencies approaching the average voice frequency have a more injurious effect upon telephone conversation than currents of lower frequencies. The effect of induction arising from the fundamental frequency is comparatively unimportant so far as telephones are concerned.

Interference on telegraph and other signalling circuits, however, is due principally to the fundamental and lower harmonics. Telegraph receiving instruments are relatively insensitive as compared with the telephone, to the higher harmonics, but are sensitive to disturbances by the lower frequencies, such as the fundamental and lower harmonics, which more nearly approach the normal operating frequency of such circuits. From the point of view of telephonic communication, therefore, it is very desirable that every endeavour should be made to employ generators that give as far as possible pure sine voltage waves. There seems to be little doubt that if generators could be designed to give absolutely pure sine voltage waves and without ripples, the interference with telephone speech would be reduced to an insignificant amount.

Among many other single-phase railways that have interfered considerably with the working of neighbouring telephones is the Rjukan Railway in the South of Norway. The telephone lines are supported on ordinary insulators, and are interlaced. Some of the telephone wires are only 3 metres away from the track, and, owing to the fact that this portion of the line passes through a forest, it was impossible to place them in a more favourable position. When the locomotives were put into service the ringing apparatus was found to be very sensitive to the 15-cycle current, and, notwithstanding that the slots in the motors were skewed, and that the specification stated that the generators were to be designed so that no harmonic should exceed 4 per cent. of the fundamental, serious troubles in connection with the telephones were experienced. The starting of the locomotives produced noises in the telephone receivers, and these noises became more pronounced when the locomotives were running at full speed. In some cases it was impossible to use the telephones at all. Investigation showed that the trouble was caused by tooth pulsations in the generators. The harmonic in the pressure wave, mainly responsible for the trouble, was found to have a frequency of 568 cycles per second, and the difficulty was overcome, or, at any rate, considerably diminished, by connecting a resonance circuit across the generators, the object being to provide a path for the high-frequency current, so that no current at this frequency could exist in the overhead line. Experiments showed that a resonance circuit having a capacity of .2 microfarad and an inductance of .4 henry gave the best results. The current in the resonance circuit was found to be only .36 ampere, indicating that the alternators had high resistance.

Resonance shunts have been employed to eliminate the effects of induced voltage on telegraph circuits. In this

* The cheapest site Norton has located in the States is one capable of yielding 150,000 h.p. at £1 5s. per h.p.-year *cf.* 8s. 4d. in Iceland; 8s. to 20s. in Norway; £2 5s. at Niagara on the Canadian side, and £1 1s. on the American side.

case, however, the shunts are connected to the telegraph circuits themselves, and not to the alternating-current power circuit. The shunt provides a path of low resistance for alternating currents of the frequency for which it is designed, but affords no path for the direct current which operates the circuit. With the aid of these shunts it has been found possible to make certain signalling circuits workable that were previously unworkable; although at high speeds the signals are liable to be distorted as a result of the shunt coming into action, and so providing a path for the working current.

Besides the induced currents, earth currents from the track rails are also liable to lead to trouble, but these currents are more easily dealt with. On the Brighton line somewhat elaborate precautions have been taken to minimise these currents, and also the effects of electromagnetic induction originating from the contact wires. In view of the fact that the electrolytic effects arising from alternating currents are less troublesome than those attributable to direct currents, the Board of Trade fixed the maximum permissible drop in the return circuit at 20 volts instead of 7 volts, as allowed for direct-current systems. Special steps were, therefore, taken to assist the current to return to the generating station. Two conductors have been employed in conjunction with the return circuit. On the lines that were first electrified—those between Victoria and London Bridge—each rail length was connected to one of these conductors; but on later extensions the rails have been bonded together, and connection has been made to the cable at wider intervals. The other return conductor is connected at a few points with the conductor which is connected to the rails. In series with this second cable the secondaries of boosting transformers are connected, the primaries of these transformers carrying a portion of the main current. The effect of these transformers, which have a ratio of 1 to 1, is to cause the current to return by way of the booster cable. Leakage from the rails to earth is, therefore, eliminated. Tests have shown that little of the current returns through the rails or the first-mentioned cable that is connected to them, nearly the whole of the current coming back by way of the booster cable.

What influences to a marked degree the inductive effects arising from the current in overhead conductors is the manner in which the lines are fed. If the lines are energised at one end of the system so that telegraph and telephone lines are exposed to the influence of long lengths of contact wire carrying current in the same direction, then electromagnetic and electrostatic influences are likely to become very troublesome. As on the Brighton Railway, the lines should be sectionalised and fed at various points, so that the current traverses the wires in opposite directions, and so tends to neutralise the induced voltages. A railway on which the telegraph and telephone circuits have been considerably interfered with is the New York, New Haven, and Hartford line. Originally the simplest possible layout was adopted, the current being fed into the contact wire from a single generating station in such a way that telegraph and telephone wires were exposed to the influence of long stretches of high-tension lines carrying currents flowing in the same direction. Some time ago, however, a new method of feeding the line was adopted, with distinctly beneficial results; in fact, it is said that the new arrangement has completely overcome all difficulties. The new feeding system was adopted partly with a view to raising the transmission pressure and partly to eliminate telephone troubles.

Current is supplied from the generating station through transformers at a pressure of 22,000 volts, but the trains are supplied with current at only half this pressure. The middle points of the secondaries of the 22,000-volt transformers are connected to the rails, and one of the outer ends of each transformer to the overhead conductors; hence the pressure between the contact wires and rails is 11,000 volts. The other end of the secondary winding on each transformer is connected to feeders running at the side of the track. About every two miles along the track auto-transformers are connected between the trolley wires and feeders, and the centre points of these auto-transformers are connected to the rails. Hence, when a train is in a section between two auto-transformers, the current will flow in opposite directions

and the division of current on the two sides of the train will depend upon the position in which the train stands. The unbalanced currents flowing in opposite directions greatly minimise inductive influences; and, further, the length of contact line influencing the telegraph and telephone circuits is considerably reduced.

If a train is situated nearer to one auto-transformer than another, it will draw the greater part of its current from the nearer transformer, and the smaller portion from the more distant transformer. But the net result is the same in each case, for the larger current multiplied by the shorter distance is balanced by the smaller current multiplied by the longer distance.

Use has been made in some cases of neutralising transformers as invented in the first place by Mr. Chas. F. Scott, but these transformers do not eliminate the noise set up in telephone receivers resulting from the harmonic frequencies. In its present stage of development the neutralising transformer has multiple primary and secondary windings connected in series with the line wires of the disturbed telephone system. The multiple primary windings are associated with a group of telephone circuits known as "primary wires," which are earthed at or near the geographical limits of the disturbing zone. These earth connections complete a low-impedance circuit for the induced currents in the primary wires, and cause them to magnetise the transformer core. By virtue of the transformer action electromotive forces are induced in the secondary windings, and by proper connection of the secondary windings with the telegraph and telephone wires, which are called "secondary wires," these electromotive forces are made to oppose and reduce the voltages induced in these wires by the disturbing electric system. On account of the choking action of the transformer primaries part of the voltage (90 per cent. or more) induced in the primary wires acts as an exciting electromotive force for the transformer primary winding, so that the difference of potential between the ends of the primary wires is reduced by approximately this amount. The use of these neutralising transformers, however, will not by any means eliminate all noise disturbances, for they only reduce the voltages induced in telegraph and telephone lines, by currents at the fundamental frequency. Moreover, residual voltages are always left in the wires, and if the induction is very severe, these voltages may be great enough to interfere with the telegraph service. Theoretically, the neutralising transformer has possibilities in the direction of reducing some noise troubles, but practical experience seems to indicate that they are not of much use in this connection. Generally speaking, it may be said that, while neutralising transformers provide means for greatly reducing moderate amounts of low-frequency induction, the limitations and disadvantages of such transformers prevent their constituting a primary protection against inductive interferences. Hence it is necessary in the case of alternating-current railways to work out carefully the methods of distributing power to the trains, so that inductive disturbances are prevented as far as possible.

Electrostatic effects have not, on the whole, proved nearly so troublesome as electromagnetic effects; in fact, on some railways the adjacent telegraph and telephone lines have not been charged at all. Much seems to depend upon the construction of the railway. If, for instance, there are many earthed steel structures, as on the Brighton Railway, the telegraph and telephone lines are shielded, and no electrostatic troubles arise. Like electromagnetic induction, electrostatic induction varies with the frequency of the current in the contact wires. Electromagnetic induction, as already stated, varies with the current, whilst electrostatic induction is independent of the current but is dependent on the voltage. Any drop produced by the current will, of course, reduce the electrostatic effect. One method of getting rid of electrostatic voltages, which has been adopted on the Rjukan Railway, for instance, is to employ discharge coils. The coils used on the Rjukan line have a resistance of 750 ohms. They are connected across the double telephone lines at distances of 2 km., and the middle point of each coil is earthed.

No electrostatic disturbances have been met with on the Brighton lines, but on the single-phase section of the Midland Railway (the Lancaster, Morecambe, Heysham

section) both electromagnetic and electrostatic effects have been observed.

On this railway wooden supports are used for carrying the contact wires, and this probably accounts for the electrostatic effects being more pronounced than those experienced on railways using steel structures. Electrostatic effects were considerably reduced by erecting an earth wire between the power wires and the telegraph wires parallel with the track. The telegraph lines have also been earthed through resistances.

No doubt in time to come other methods will be found for dealing with these telegraph and telephone difficulties. On some of the Continental lines the inductive effects have been very troublesome indeed, and have only been overcome after shifting the wires well away from the power circuits. The method of feeding the contact wires is undoubtedly the main point that demands consideration when designing single-phase traction systems, and if proper attention be paid to this matter, a good deal of the trouble associated with telegraph and telephone circuits can be avoided.

MAGNETO FLASH LAMPS.

THE development of metallic filaments has extended enormously the use of small and medium-sized electric lamps, as well as those of higher candle-power. The demand for very small lamps (such as "flash lamps") is reckoned in millions, and to provide current for these there has grown up a distinct and important branch of the electrical industry, manufacturing small primary batteries and storage cells. The latter are capable of yielding a suitable current for a long period, but the cells themselves are heavy, the use of acid in "pocket lamps" is objectionable, and the necessity for periodical recharging involves delay (or duplicate batteries), and limits the use of the lamp to within easy distance of charging facilities. The use of storage cells is best restricted at present to comparatively large semi-portable sets (for bedroom lighting and similar service), and to cases such as that of miners' lamps, for which proper provision can be made for recharging at frequent, regular intervals. For ordinary flash-lamp service dry batteries offer the advantages of light weight and independence of current supply for recharging purposes. There, however, the advantage of the dry battery ends. There have been extraordinary improvements in the manufacture of small dry cells, but nothing can alter the facts:—(1) That a dry cell is most suitable for yielding some thousandths or some hundredths of an ampere, and not at all suitable for yielding $\frac{1}{2}$ ampere or more for any considerable period. (2) Evaporation of moisture gradually increases the resistance of the cell, and, far more serious, "local action" consumes the active materials even when the cell is on open circuit. (3) A stock of batteries cannot be kept for replacements: cells must be used soon after they are made if their performance is to be at all satisfactory. (4) Current provided by small dry cells is disproportionately costly. Only the immense convenience of small electric lamps and the lack of a better means of providing "pocket current" have been responsible for the enormous present-day utilisation of flash-lamp batteries. That there is room for a better method of providing current goes without saying, and one solution to the problem is described by W. Wedding in a recent issue of *E.T.Z.*

Briefly, this method consists in the use of a small magneto-generator driven by a spring in which energy is stored from time to time by the user. Suggestions have been made to use compressed air or gas generated as required to drive a small motor coupled to a dynamo, but such an equipment could hardly be sufficiently light, strong, and cheap. A similar and much more practicable idea is to use muscular energy derived from the person carrying the lamp, to generate current for its incandescence. Several attempts have been made, but Karl von Dreger (Budapest) seems to have been the first to devise a convenient equipment of suitable form and power. A useful output of one to two watts is derived from the thumb or

from the four fingers used together to move to and fro a lever or grip bar which is coupled through a suitable clock-work and spring to the armature of a magneto-generator. In order to keep the gear ratio and losses as low as possible, the dynamo armature is driven at comparatively low speed, and full use is made of the space available in order to obtain high peripheral speed. Obviously, the armature speed must be kept as nearly as possible uniform, but, with so low a total power available, it would be a mistake to adopt any form of braking to control the speed. Dreger's method is to balance the load imposed by the lamp on the dynamo, and the mechanical connection between dynamo, spring, and driving lever, so that when the latter is worked in the ordinary way, the armature speed is practically constant after the lamp reaches normal brilliancy. The spring works practically uniformly between $\frac{1}{3}$ and $\frac{2}{3}$ tension, and the available one or two watts keeps it under this tension during normal working.

By using several springs, which come into action successively, enough energy can be stored to keep the lamp burning for a short time without working the driving lever during that period. Such provision for storage of energy increases the weight and cost of the equipment. Even the simpler form of lamp is rather heavy as compared with battery lamps: for instance, a thumb-driven magneto lamp

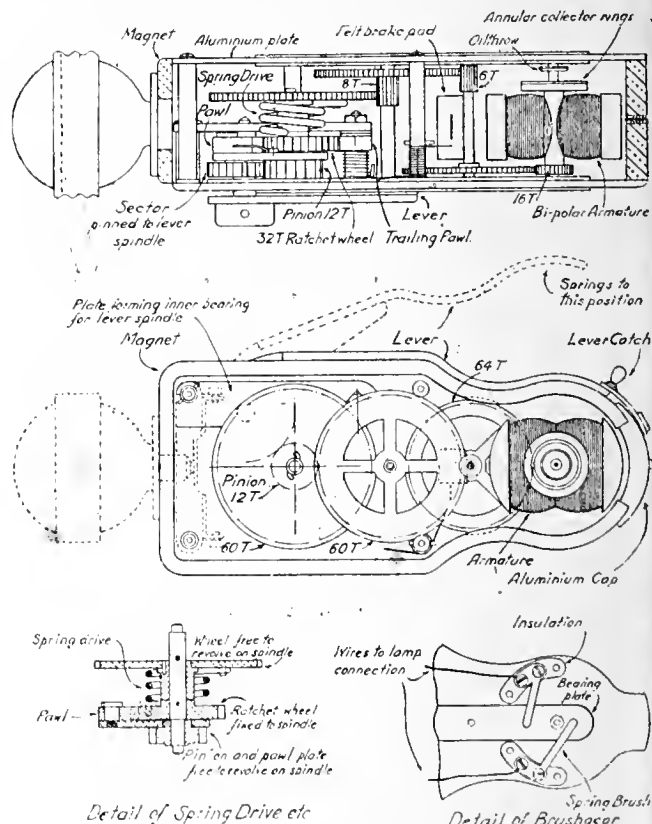


FIG. 1.—DETAILS OF CONSTRUCTION OF HAND-DRIVEN MAGNETO LAMP.

without storage weighs about 1 lb., and if additional mechanism be added to yield 3 minutes' storage, the weight increases to 1 lb. 14 oz., which is sufficiently heavy, for a pocket-lamp. The more powerful hand-lamp, operated by opening and closing a finger grip, weighs 2 lb. 2 oz. without storage, and 5½ lb. if provision be made for 10 minutes' storage. (Presumably the spring grip has to be worked for 10 minutes to provide for 10 minutes' "independent" burning?).

Though a lamp with these general characteristics will undoubtedly be useful in special applications, there is certainly no reason to anticipate that battery lamps will fall into disuse. The higher first cost (not stated) of the magneto lamp is admittedly compensated to some extent (possibly completely) by the elimination of battery renewals, but the weight of the magneto lamp and the necessity for driving it continuously, or nearly so, are serious drawbacks. A light set which could be wound up at intervals like a clock would be more convenient in practice.

a somewhat different type of magneto lamp, due to O. Fischer, utilises a rotating ring magnet running between poles of a double-T armature. Driving is by periodic depression of a small lever, and the stationary armature is connected permanently to the lamp. The rotating magnet is also as fly-wheel, and runs on ball bearings. No springs are used, the driving lever acting simply through a 1:20 gear train. The magnet runs at 1,200 R.P.M., and the weight of the set complete is $\frac{1}{2}$ lb. A heavier set ($1\frac{3}{4}$ lb.) is available for use on bicycles, the drive being then taken on a roller pressing on the front tire. Other applications suggested for this equipment are in ignition apparatus, bells, and door alarms.

Our contemporary, *The Model Engineer and Electrician*, in its issue of March 29th, 1917, published a very detailed description of one of these German lamps, which was picked up on a battlefield in France. The following particulars are obtained from this source.

Fig. 1 shows the details of construction. It will be seen that the permanent magnet forms the case of the machine: it is $1\frac{1}{16}$ in. wide, No. 10 gauge, and weighs 5 oz. Between the poles is a bipolar armature, $1\frac{1}{8}$ in. in diameter, $\frac{3}{16}$ in. across the core, and $\frac{1}{8}$ in. across the end; it is wound with 28 enamelled copper wire, has two concentric slip springs, and weighs $1\frac{1}{2}$ oz. The core is machined out of the solid, and runs on a spindle $\frac{5}{16}$ in. in diameter, with pivots about No. 18 gauge. Two plates of aluminium, No. 18 and No. 22 gauge, form the sides of the case, and carry thin steel bearing plates; they are connected by four $\frac{3}{16}$ in. steel bars. The sector plate connected to the hand lever has 12 teeth, gearing with the first pinion, which carries a wheel on a plate to drive the ratchet wheel.

The hand lever is $\frac{1}{2}$ in. wide, and is stamped out of No. 15 steel plate; it is held closed by a catch, and when released opens to the working position under the action of a spring. All the parts, except the lampholder and the aluminium cap, can be assembled before the permanent magnet is placed in position, the magnet being held in place by screws passing through the cap, and screws which connect the lampholder to the base of the generator. The pinion driven by the lever has 12 teeth, and the ratchet wheel 32 teeth; between the latter and the main driving wheel (60 teeth) is a strong spring of No. 13 steel wire. The train of gearing consists of pinions having 8, 6, and 16 teeth and wheels of 60, 60, and 64 teeth, so that the armature revolves about 300 times for one revolution of the main driving wheel. The full travel of the lever rotates the first wheel $\frac{1}{2}$ revolution, and therefore drives the armature through 75 revolutions: at 40 impulses per minute this gives an average armature speed of 3,000 R.P.M. In the drawing a small felt pad is shown, which is held in a spring in contact with the top spindle. The lamp is suitable for 3.5 volts, 0.2 ampere. The generator, complete with the lampholder, weighs $16\frac{1}{2}$ oz.: it is $4\frac{3}{8}$ in. high, $1\frac{1}{2}$ in. across the side plates, and $1\frac{1}{8}$ in. wide. The author of the article, Mr. F. Westmoreland, who owns the lamp, states that it gives a very good light. Many more details, with photographs, are given in the original account. Obviously, there is practically no storage of energy in the lamp apart from the spring—which is merely a maintaining spring—and the fly-wheel effect of the rotating parts.

As a result, five substances were found to be equal on the average, and in some respects even superior, to ebonite. The actual results are confidential.

The test methods for instrument transformers which had previously been drawn up at the request of the Verband deutscher Elektrotechniker were supplemented so that at any ratio both the correction and the angular error can be read off directly on the arrangement adopted. The sources of error were fully investigated, and it was found that with the arrangement used they could be entirely eliminated. Comparative measurements on potential transformers by the new method and the electrometer method gave values in good agreement.

A method of measuring the phase angles of current-measuring resistances in a double bridge for alternating currents of technical frequency was devised. Phase calibration is effected by displacing suitable condensers mounted with cranked handles. Even with resistances of 0.0005 ohm there is close agreement between the measurement of the time constants to 10^{-7} sec., or of the phase angles to $\frac{1}{10}$ minute at 50 cycles per second.

A new type of vibration galvanometer was constructed which can be calibrated at a distance by electromagnetic excitation. The instrument is a needle galvanometer with crossed magnetic fields similar to the Rubens instrument. The needle is magnetised by an electromagnet and this excitation causes a change in directive force, and, consequently, in the calibration of the needle. The instrument has two internal attachments having needles of different dimensions: the first attachment can be calibrated for frequency ranges from 8 to 70 cycles per second, and the second for ranges of from 30 to 140 cycles per second. The image projected by the mirror remains in the field of view during change of calibration, and can be seen immediately the new internal part of the instrument is inserted. The sensitivity is given as 10^{-7} amp. for 1 mm. deflection at a scale distance of 1 metre.

A series of experiments was carried out on chrome-steel magnets with the result that such magnets, when of right composition and properly treated, can be used as brake-magnets in meters, being practically as good as those of tungsten-steel in respect of invariability and non-dependence on temperature.

THE WORKING COSTS OF THE PRINCIPAL PRIME MOVERS.

By OSWALD WANS, OF LINCOLN, M.I.Mech.E.

(Abstract of paper read before the INSTITUTION OF MECHANICAL ENGINEERS.)

THE object of this paper is to give data that will be of service in estimating capital expenditures and working costs, and in establishing the relative commercial values of the principal prime movers. For this purpose typical examples of the following prime movers will be considered:—

Suction-gas engines and plants burning anthracite, coke, and wood refuse.

Gas engines using town gas.

Oil engines of the solid injection high-compression type.

Diesel engines.

Steam engines.

The scope of the paper includes units up to a working load of 500 B.H.P., a power range embracing the engines for which there is by far the greatest demand.

The items constituting the total working cost are:—

Capital Charges:—	Running Charges:—
Depreciation.	Cost of fuel.
Insurance.	Cost of lubricating oil.
Interest upon capital expenditure.	Cost of water supply.
	Cost of sundry stores.
	Cost of labour.
	Cost of repairs.

Rent and taxes must be considered in addition, but owing to the wide variation in their amounts, it is not possible to make allowance here.

Capital Expenditure.—This should cover the total cost of the completed installation in working order. Buildings and floorings have not been included, as their cost varies widely, being largely dependent upon the taste of the purchaser.

The cost of the buildings for internal-combustion engines would be less than for a steam plant, and this applies equally to suction-gas engines, for the producer and cleaning plant do not require a covering, whereas some form of protection is necessary for a boiler. Cooling towers have been included in all cases, with the exception of the smaller gas and oil engines of about 50 B.H.P., as the more usual practice is to employ cooling tanks suitable for thermo-siphon circulation.

When deciding the size of the engine, it is necessary to consider its overload capacity, for this factor greatly affects the capital expenditure, the reliability, and the fuel economy.

The larger overload carried by a steam engine is a characteristic of considerable value in the handling of fluctuating and peak loads. Moreover, this advantage is attained without impairing the fuel economy at the working load. Unfortunately, this feature is not possessed by an internal-combustion engine.

ELECTRICAL WORK AT THE PHYSIKALISCH-TECHNISCHE REICHSANSTALT, CHARLOTTENBURG, IN 1916.

The *Elektrotechnische Zeitschrift* for September 13th gives some details of the work carried out at the Reichsanstalt during 1916, and the following notes refer to the portions of more general interest.

Exhaustive experiments were carried out on substitutes for ebonite to determine the suitability of such materials as insulators in electrical instruments, &c. The following points were considered in the research:—

1. Surface resistance under various test conditions.
2. Absorption of water.
3. Action of dilute sulphuric acid.
4. Action of heat (hot water, Bunsen flame, electric arc, &c.).
5. Whether easily worked (machined).

Cost of Labour.—The charges under this heading should include not only the attendant's time during running hours, it also that needed to clean, grind in valves, &c., and generally to keep the installation in good condition.

TOTAL WATER LOST. GALLONS PER WORKING LOAD B.H.P.

Steam engine	21.23
S.I. oil engine	0.325
Diesel engine	0.275
Gas engine: Town gas	0.375
Anthracite and coke	2.2
Wood, &c.	5.87

Wages at the rate of 6d. per hour have been allowed for in the cost curves, fig. 4.

The following formulæ give a fair indication of the time that is spent solely upon the prime movers within the scope of this paper:—

Suction-gas (wood fuel) and steam engine plants	$0.8 + 0.0047 \text{ B.H.P.}$
Suction-gas (coal and coke fuel)	$0.6 + 0.0041 \text{ B.H.P.}$
S.I. and Diesel engines	$0.3 + 0.0036 \text{ B.H.P.}$
Town-gas engines	$0.2 + 0.0017 \text{ B.H.P.}$

These expressions give the labour in hours per rated working load per hour. Thus for a 100-B.H.P. suction-gas plant using wood fuel, and a 100-B.H.P. town-gas engine, the labour would be respectively 1.27 and 0.37 hours per hour's run.

Cost of Repairs.—The annual charge should provide amply for wear and tear, and such breakages as are not covered by insurance.

The following are the repair charges allowed for in the working cost curves, fig. 4:—

Diesel and S.I. oil engines.	
town-gas engines	3 per cent. of engine cost.
Suction-gas installations	3 per cent. of engine and producer costs.
Steam installations	2½ per cent. of engine, boiler, and auxiliary costs.

From the foregoing data it is possible to estimate with reasonable accuracy the annual working costs of the engines under consideration. Water and fuel are the ruling factors:

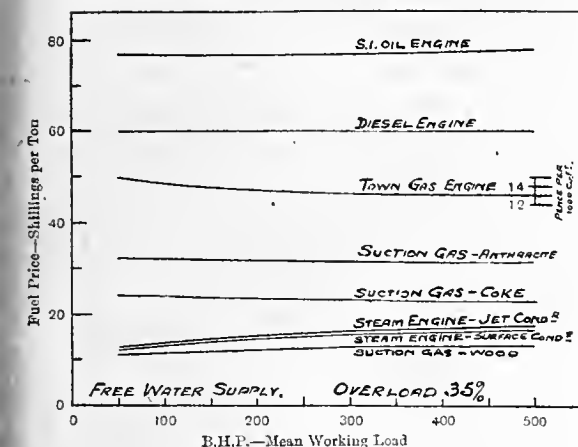


FIG. 5.—FUEL PRICE CURVES.

Curves are given with water at 9d. per 1,000 gals., and with water free, the latter of which is reproduced in fig. 4. None of the curves A to F include the cost of fuel, but curve G represents the total annual working cost of a Diesel engine using fuel-oil at £3 per ton. It follows, therefore, that the total amount that may be spent annually upon fuel to give equal running charges for any one of the remaining installations is represented by the length of the ordinate between the curve G and the cost curve of the particular engine considered. From the total fuel cost thus obtained, the maximum prices that may be paid can be easily computed, and have been plotted in curves fig. 5, whilst the fuel prices given by those curves for plants of 250 B.H.P. mean working load are given below:—

	Price of fuel. Curve, fig. 5.	Price ratio.
Diesel engine	60s. 0d. per ton.	0.785
Solid injection oil engine	76s. 6d. per ton.	1.0
Suction-gas: Anthracite	21s. 6d. per ton.	0.41
Coke	23s. 0d. per ton.	0.3
Wood	12s. 0d. per ton.	0.157
Steam engine:		
Jet condenser	16s. 0d. per ton.	0.21
Surface condenser	15s. 0d. per ton.	0.195
Town-gas engine	1s. 1d. per 1,000 cu. ft.	0.014

In the curves, the engine possessing the highest thermal efficiency, namely, the Diesel engine, has been taken as a convenient basis using fuel oil at £3 per ton. Reference to these curves shows that the relative fuel prices for the several installations are fairly uniform for the range of powers under consideration.

As the power increases a higher price may be paid for coal, and the steam engine becomes a more serious rival of the suction-gas plant; nevertheless, for installations up to 500-B.H.P. working load the latter well holds its own, for it is possible to obtain even running costs with fuel ranging in price, according to the power, from two to three times that permissible for a steam plant. The price allowable for town gas is practically constant at 1s. 1d. per 1,000 cu. ft., and consequently confines the use of the town-gas engine to cities in which gas is procurable at this low rate.

Calorific Values Assumed.

Anthracite	14,500 B.T.H.U. per lb.
Coal (boiler)	13,500 B.T.H.U. per lb.
Fuel oil	18,000 B.T.H.U. per lb.
Wood refuse	5,800 B.T.H.U. per lb.
Town gas	540 B.T.H.U. per cu. ft.

Turning now to the high-compression solid-injection oil engine, a high price may be paid for fuel oil, namely, £3 16s. per ton, as compared with £3 for the Diesel engine, notwithstanding the higher thermal efficiency of the latter engine. The lower capital expenditure and other running charges of the solid-injection engine are responsible for this result.

Before the war fuel oil could be obtained at an average price of £3 a ton. An adequate supply is of the utmost importance to manufacturers. With fuel oil at £3 a ton, the price of coal must not exceed on the average 25s. and 12s. per ton respectively for suction-gas and the larger steam plants over 250 B.H.P. in order that the total annual running charges shall not exceed those of an oil-engine of the solid-injection type. Considering the refuse suction-gas plant, the price of fuel, ranging from 11s. to 13s. a ton, even with a free water supply, limits its use to industries in which the refuse is a waste product of the industry.

It has been shown that the cost of fuel has a deciding influence upon the working cost, although that due to the necessary water supply may be serious in some districts. The maximum permissible prices that may be paid in any locality are indicated by the curves, fig. 5. The practical application of these price ratios shows that each type of engine has its particular field of action in which it can be used with commercial advantage, provided due regard is paid to the local conditions, or, in other words, an exclusive claim to minimum working costs cannot be rightly made on behalf of any one of the prime movers under consideration.

However thermally efficient an engine may be, the ultimate test is a commercial one involving the market price of fuel, which must always depend upon the facilities for distribution from the source of supply. In practice, therefore, railway and shipping freights have a marked and direct influence upon the type of engine giving the most favourable performance from the commercial standpoint.

FEDERATION OF BRITISH INDUSTRIES.

MR. F. DUDLEY DOCKER, C.B., the retiring president of this Federation, delivered an address at the annual meeting, held at the Connaught Rooms, on Friday last. Having referred to the growth of the Federation and to their prospect of being able to prove themselves a power for good in the welfare of the Empire, he said that the grave danger which faced all associations was stagnation. They must progress if they were to be useful. The first regular step towards stagnation was to have a perpetual president, therefore he declined, though with much personal regret, to be nominated for a second term. No better man could be found for the office than Sir Richard Vassar Smith, whom the Executive Committee suggested. Mr. Docker alluded to the complaint that subjects in which they were specially interested had not been taken up by the Federation, or the pronouncements had not been made on questions exciting popular interest. In many instances, while the Executive Committee did not appear to have taken any action, they had, in fact, been making careful inquiries and doing quiet useful sate work, and had only decided, after careful consideration, to avoid or sometimes to postpone taking action. It had not been lack of interest or want of energy, but a sense of responsibility that had induced the Executive to refrain from public reference to these matters. The position which the Federation had gradually built up was that of being the representative organisation of British manufacturers, and it was obviously wise to refrain from embarking lightly on any project, and to avoid subjects of secondary importance.

A question that must be considered by the Federation was the policy of protecting our trade against foreign aggression. This was a subject of absorbing interest to them as manufacturers, and it was not one that could be disposed of in a rough and ready way. There was no summary solution. They must consider and determine if any duty should be imposed, and on what goods, and whether or not preference was to be extended to our Oversea Dominions, or to any and which of our Allies. Again they must consult with the Government as to the method by which any tariff, when constructed, could

be used as a power to bargain with foreign nations. Personally, he was absolutely certain that they must have a power to bargain, but he strongly objected to this procedure being called Protection or Tariff Reform. This matter must have their earnest consideration, and he attached supreme importance to it, but there was a grave difficulty in the way. This Federation was an industrial association, and he would be sorry to see it in alliance with any political party. It would be detrimental to their interests to be labelled Liberal or Tory, or with any other political designation, and unfortunately the questions of Free Trade and Protection had become party measures, and one or other was included in the respective programmes of the two great political parties. Should it become necessary in the judgment of the Federation to advocate the imposition of a duty on any article in the interests of the manufacturers of this country, he would not object to such action, for it would be done definitely in the interests of British trade, and not at the request or instigation of any politician. If such a duty were imposed, in his judgment it should be used deliberately as a means of bargaining with foreign Governments to obtain facilities and preference for British trade. He was quite ready to support action by the manufacturers, but he deprecated that this Federation should be called a Free Trader or a Tariff Reformer. These terms belonged to politics, from which this Federation should keep itself absolutely free. Another important question of pressing concern was the relation which education must bear to industry. A sub-committee had been considering the proposals formulated by the President of the Board of Education, and they had invited the members of this Association to express opinions on certain subjects for the guidance of the Committee. This question of education lay at the root of a great many of their difficulties. If they were to be successful in competition, they must provide for the better education of themselves and their workpeople. One of the causes, in his opinion, of industrial unrest was the lack of knowledge; it was a fruitful agent for the generation of suspicion, and he therefore urged that the Federation should concern itself particularly in fostering in no niggardly spirit the spread of education. Allied with education was the sense of discipline. There was no doubt that the lack of discipline created an irresponsible condition which was detrimental to all well-being. One and all, they should do their utmost to help on such movements as the formation of cadet corps, which while improving the physique of their young people, at the same time inculcated a respect for authority, and a desire to play for the side, rather than encourage selfish tendencies. During the past year the Association had done well; their foundations were solidly laid, and they had obtained recognition from the Government. *The Prime Minister had authorised him to say that he would welcome any federation of industry, and expressed an opinion that such an association would be of assistance to any Government.* They must go on, and it should be their object to obtain some recognition and status in the eye of the law that would place them in as favourable a position as the Trade Unions now occupied. Mr. Docker said he desired to publicly tender to Sir William Peat, Mr. Oldham, and Mr. Nugent and Major Caillard in particular, and in general to the chairman of the various sub-committees, and the office staff, his very hearty thanks for the efforts they had made to carry on the work and to create a sound and efficient organisation.

Sir WILLIAM B. PEAT, in proposing a vote of thanks to Mr. Dudley Docker, said that Mr. Dudley Docker was the pioneer not of trade combinations, which had existed for 20 years, but of a combination which should embrace all trades—a far larger and far grander idea—a combination which embraced, or ought to embrace, not alone the capitalist interests of the country, but the labour without which that capital could not succeed.

In responding, Mr. DOCKER said that the Federation was the idea of his life. He had always thought, and always hoped, that manufacturers would all come together to help this great country. "We were the greatest manufacturers in the world if we only knew it." Their influence was greater than they had the least idea of. Individually it was nothing, collectively it was everything. He hoped the membership of the Federation would largely increase. He was also hoping that they would have a home of their own where they would meet together and discuss the great subjects of the day, and that their weight would be so great that the Government would consider them and talk to them.

Sir VINCENT CAILLARD (Messrs. Vickers, Ltd.) proposed the election of Sir Richard Vassar Smith as President of the Federation for the ensuing year. He joined in the expressions of regret that Mr. Docker should vacate the presidential chair. This great Federation had immense problems to face and solve. To accomplish successfully its objects, which were not confined to that country, or even to the Empire, but were world-wide, would require on the part of all the members of the Federation breadth of view, untiring energy, unflinching courage, conciliation, and determination. Sir Richard Vassar Smith was known personally to a great many of them, and by reputation was known to them all. In him they had all the necessary qualities enumerated in a very high degree.

The resolution was carried unanimously.

The following gentlemen were elected vice-president of the Federation for the ensuing year: Mr. Dudley Docker, Lord Aberconway, Sir Vincent Caillard, Mr. A. H. Dixon, Sir

Algernon Firth, Sir Robert Hadfield, and Mr. W. Pe Rylands.

On the motion of Mr. Docker, seconded by Mr. H. B. Ryland (County of London Electric Supply Co., Ltd.), the following annual report was unanimously received and adopted.

Mr. W. PETER RYLANDS (The Iron and Steel Wire Manufacturers' Association of Great Britain and The Wire Net Association) said that the appointment of an Executive Council was probably the most important business with which their Federation had to deal. A committee was appointed to consider the whole matter, and had made recommendations. The lines upon which those recommendations had been framed had been those of endeavouring to construct an executive which should be representative of industry by group so that each group of industries whose interests were more or less analogous should themselves directly elect their representatives to the executive. When they came to consider the question of groups they found considerable difficulty. There were the big main groups of industries, and there were smaller groups. They also got overlapping in many of the groups, such as that between engineering and the iron and steel manufacturers. Accordingly, the view they took was that the plan would be to take the big groups of industry as the basis, letting each group decide for itself the sub-division particularly appropriate to the group. They were proceeding upon those lines. The scheme was very nearly complete, and letters were about to be sent out to the secretaries of associations asking for certain material information necessary to construct a constitution upon the lines indicated.

WAR ITEMS.

Ministry of Munitions.—The Minister of Munitions made the following appointments within the Ministry:—

Major J. W. Hills, M.P., to act temporarily as a member of the Munitions Council in charge of the Labour group during the absence of Sir Stephen Kent, K.C.B.

Vice-Admiral Sir A. G. H. W. Moore, K.C.B., C.V.O., to be Controller of the Mechanical Warfare Department.

Major-General H. F. Thudler, C.B., C.M.G., to be Controller of the Chemical Warfare Department.

Brigadier-General A. C. Currie, C.M.G., to be Controller of Munition Design.

Mr. E. V. Haigh, to be Controller of the Trench Warfare Supply Department.

Mr. H. C. B. Underdown, to be Director of the Agricultural Machine Department.

Major H. Newton, D.S.O., to be Assistant Director of the Trench Warfare Department.

Mrs. H. J. Tennant, C.H., to be Chief Adviser (Women's Welfare) in Labour Regulation Department.

Women's Work in Engineering.—The Ministry of Munitions' Exhibition of official photographs and other war industries to be opened at the City Art Gallery, Birmingham, on Monday afternoon next. It will remain open until November 10th from 11 a.m. to 8 p.m. daily.

German Coal Shortage.—The special correspondent of the *Times* at Amsterdam states that speaking in the Frank Municipal Council concerning the coal situation, one member said that the civilian population of the city received only instead of 40 per cent. of the coal promised. The municipal industries were receiving much more than their share, and a coal famine would be worse than anything experienced hitherto during the war.

Fuel Shortage in Athens.—In Athens fuel scarcity is acute, although the electric current for public use has already been reduced to a minimum and traffic on several tram lines suspended. The electric works recently had fuel for one day only, and it is proposed to requisition uncut timber.—*Times*.

The Aron Meter Co.—The German newspapers state that the liquidation has been concluded of the interests in the Aron Electricity Meter, Ltd., of London, particularly the latter's participation in the firm of H. Aron, Elektrizitäts Zähler Fabrik, G.m.b.H., of Charlottenburg.

Engineers' Bonus.—The Ministry of Munitions has issued the Skilled Timeworkers (Engineers and Moulders) War Order, 1917, dated October 13th, 1917 (with a view to ensuring the maintenance of the output of munitions), relating to the remuneration to be paid to fully qualified skilled engineers and moulders of the class specified in the Order, work being munitions work or work in connection therewith, which at the time when these directions are given is paid time rates.

Workmen to whom these directions apply shall receive a bonus of 2½ per cent. on their earnings, which shall either alter or become part of their time rates, the bonus to accrue from the beginning of the first full pay following October 12th, 1917, and the first payment thereof is to be made as soon as possible, and not later than the first full pay day, November, 1917. The directions apply, subject to the following provisions, only to fully qualified skilled engineers and moulders rated at or above the current district time rates, turners or fitters while employed on or in connection with munitions work and paid at plain time rates without addition of any bonus other than (a) a bonus dependent

timekeeping, (b) a bonus (not being a bonus on output) less favourable to such workmen than the bonus payable under these directions, in which case the existing bonus shall merge in the bonus payable under these directions, (c) a war advance given to meet the cost of living as the result of or in conformity with arbitration under Part I of the Munitions of War Act, 1915.

These directions shall not apply to workmen of the class specified above whose wages it has been the practice to regulate by the movements in the wages of men employed in trades other than the engineering and foundry trades. An application may be made to the Minister of Munitions for special directions in cases where the existing basis of remuneration for such workmen is less favourable than that of workmen of the same class to whom these directions apply.

These directions will not apply to workmen paid an up-standing wage or salary which covers overtime or other allowances. Nothing in the foregoing provisions shall affect the present basis of determining piece rates or premium bonus times or any other system of payment by results.

Exemption Applications.—Lewes Tribunal has withdrawn conditional exemption held by A. J. Cox (31, garrison duty abroad), jointer and shift engineer at the Lewes electric light works, and substituted three months' temporary exemption.

According to a Swansea newspaper, a special meeting of the Neath Rural District Council has been held to consider the question of military appeals against certain employees of the Council's electric lighting station. Mr. Thomson, electrical engineer, said that if the military appeals were successful the Council would be compelled to close down one or two shifts, and it would be impossible to carry on the power station without suitable men. It was decided to notify the Council's consumers of the position, and to emphasise the fact that no action would be taken without giving them reasonable notice.

On the recommendation of the Advisory Committee, Rochdale Tribunal has granted conditional exemption to E. Hornby (29, B 2), motorman, appealed for by the Corporation tramway department.

Surrey Appeal Court has granted a final month's exemption to G. T. Church (31, B 1), electrical engineer, of Chertsey.

Lancashire Appeal Court has granted three months' exemption to five electrical men engaged at the works of Messrs. Pilkington Bros., Ltd., St. Helens.

At Walthamstow, the tramway manager (Mr. W. Murray) appealed for 12 tramdrivers, and said that they were in great straits for want of men, and those appealed for could not be replaced. Nine of the men were granted six months, and the others three months each.

At Dawlish, the Electric Light Co. renewed an appeal for C. C. Hodges (31), manager and secretary, who was stated to be doing all the work of the concern, with the aid of two pupils. The Military suggested temporary exemption until a substitute was obtained, but conditional exemption was granted so long as Mr. Hodges remains in his present employment.

Renewed temporary exemption until January 1st has been granted to G. Dring (28), electrical engineer, appealed for by the Ilfracombe Electric Light Co.

Berks. Appeal Court has dismissed a military appeal against exemption granted to J. H. Ferguson (36, C 3), managing director and secretary of the Whitechurch and Pangbourne Electric Supply Co., Ltd.

High Wycombe Tribunal has granted six months' exemption to R. Pugh (40, B 2), electrical engineer.

At Congleton, an appeal was made for the man in charge of the electric light plant at Moreton Hall, placed in Class C 3 after three rejections. He was given conditional exemption until March 31st.

Before the Brailes Rural Tribunal, a review was made of the case of G. F. Hall (33, Class A), electric light attendant to Mr. J. R. King, at Honington Hall. It was stated that an efficient substitute had been offered and refused, and Mr. King said that in addition to working for him, Hall was the only practical man he had to carry on the electric light plant at Shipston. If he went there would probably be no light at Shipston, and the capital of the company owning the undertaking would be in danger of being lost. The substitute offered knew nothing about meters or wiring, and when he found that he would have to do this work he refused to stay. Another substitute sent was only a gardener and painter. The appeal was dismissed, and exemption continued.

The same Tribunal dismissed a military appeal against exemption held by A. W. Whitehead (40, C 2), electrician to Sir Grey Skipwith.

Six months' exemption has been granted to A. F. Pinson (19, C 2), Swanscombe, driver on the local tramways.

At Greenwich, an appeal was made by J. H. Hardwicke (26, C 2), electrician at a Woolwich music hall, and a month only allowed.

At Broadstairs, the Isle of Thanet Tramway & Lighting Co. appealed for five tramway employees as being indispensable until efficient substitutes are found. The manager (Mr. Forde) said that owing to the drain upon their staff it was necessary to reorganise the service. Each man was allowed a month, with the privilege of a personal appeal later.

Before the East Sussex Appeal Court, a Brighton electrician appealed for extended exemption, and the employer said that

since the last appeal two improvers had joined up, and he had been unable to replace them. The work was of national importance, and consisted entirely of maintenance work at military hospitals, &c. He himself was a Regimental Quartermaster-Sergeant in the Territorials, was just completing 30 years' military service, and was quite willing to enter into an agreement whereby the Army kept him and released the man. The decision of the Court was a final three months.

On the appeal of the Corporation tramway department, Rochdale Tribunal has exempted until February 28th, F. Walton (29, C 2), overhead linesman, who has been discharged from the Army.

G. Cooper (35, B 1), electrician, applied at Mansfield for his certificate of exemption to be varied. He was granted four months last June, and given the option of going into munition works. He did so, but his health was affected, he being subject to gas poisoning, and he asked to be allowed to return to electrical work on his own account. The request was acceded to, and exemption until January 31st was granted.

At Mansfield, temporary exemption until a substitute is found was applied for by Mr. E. H. Hewlett, borough electrical engineer, for H. Topley (18, Class A), switchboard attendant, whose protection certificate has been withdrawn. Mr. Hewlett stated that the supply of power was very important indeed, and the man's work was skilled. He should like exemption until Christmas in order to get a 16-year-old learner a little more experienced. The appeal was refused.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The E.T.U. and the A.E.S.E.

"Shift Engineer," in his remarks published in the ELECTRICAL REVIEW, makes use of the motto, "United we stand, divided we fall"; but in the case mentioned—i.e., the amalgamation of the A.E.S.E. with the E.T.U.—this motto would be wrongly applied, for the simple reason that there would be a division among the members of the A.E.S.E., the greater number of whom would immediately resign. Apply this motto to the A.E.S.E. only; let all qualified station engineers become united in the A.E.S.E., and make it a strong and creditable Association that engineers will be proud of and that chiefs will look to for assistance.

The suggestion of amalgamation is absurd; no man who is an electrical station engineer in the full sense of the word can at the present time, nor until a very great change has taken place in the social state, meet with the workmen who work under him to discuss their respective salaries and wages, or the general conditions under which they work. The engineer has, in the majority of cases, to act as deputy for either the chief, or president, or mains engineer during his hours of business, and cannot become, or make, a confidant of the workmen.

"C. W. B." is quite correct when he says that "station engineers have a live organisation," but it is the A.E.S.E., not the E.T.U.

The A.E.S.E. is the only organisation that at present represents station engineers. For patriotic motives, also due to a very large percentage of its members being on war service, this Association considered it advisable to discontinue its meetings for the period of hostilities, unless some very urgent business came forward. Unlike certain other societies, the A.E.S.E. does not wish to hamper or delay the progress of the war by causing discontent in generating stations. That has never been the policy of the A.E.S.E. Where there has been discontent it has generally been remedied by the case being clearly stated to those in authority.

I quite agree with "Engineer-in-Charge" in his leading remarks, and he fully explains the unique position of the shift engineer by saying it is "absolutely anomalous."

The apparent results of the A.E.S.E. have been few, but it has done some very good work, in spite of the war and the efforts of the E.T.U. to cripple it. I think it probable that a number of the members of the A.E.S.E. who have been drawn into the fold of the E.T.U. are the agitators who, at the commencement of the A.E.S.E., caused it so much trouble by attempting to force a policy of agitation and disaffection; if so, we must be grateful to the E.T.U. for relieving the A.E.S.E. of a very unpleasant burden.

W. E. R., *Serjeant, R.E.T.*

The Association Movement.

I have only this afternoon had my attention called to the letter in the ELECTRICAL REVIEW, written by Mr. Llewelyn B. Atkinson, Secretary of the Cable-Makers' Association, with reference to the above matter. If Mr. Atkinson has only been closely associated with the Cable-Makers' Association for something over 14 years, he will, perhaps, be more easily pardoned for giving expression to several inaccuracies with regard to facts which occurred some years earlier. It is, however, regrettable that he did not obtain further corroboration for his statements in those quarters where, no doubt, official records could be traced to verify my earlier statements.

I have no "axe to grind" in cable circles, and I have no particular wish or need to stand in the limelight in this matter,

especially if the times have already been casting their brilliancy elsewhere. Were it otherwise Mr. Atkinson might have heard of me before.

I must now, however, as I am directly challenged, give further specific details of the actual indisputable facts, as they occurred in their exact sequence.

I stated that after a preliminary conversation with Mr. J. J. Easton, my first interview was with Mr. Alexander Siemens. I will now add that my second interview was actually with Mr. Taylor at his factory at Helsby, upon the only occasion on which I have ever visited those works in my life.

It is many years since I met Mr. J. S. Paterson, and I believe he has left the cable industry, but I trust this letter will come before him. Mr. Paterson gave me his active support, and will be able to give an unbiased record of those events.

In my communication, I reported that I only had difficulty in one quarter. I did not expect to find it necessary to refer to that again; but as the necessity arises, I beg to state that it was the late Mr. Robert Gray who, in his own office, informed me that he did not believe it possible for such an Association to exist for any length of time, and he believed in the "survival of the fittest."

My last interview of all (how surprised Mr. Atkinson will be!) was with Mr. Henry Edmunds, then chairman of Messrs. W. T. Glover & Co., Ltd. I did not disclose to him my conversation with Mr. Alexander Siemens, but I did state that I had met with almost complete success. Mr. Edmunds's reply to me was that he would see Mr. Robert Gray himself, and that he believed his influence would be effective. Up to that time, I beg to state most definitely and emphatically that Mr. Henry Edmunds had not seen or spoken to any one of the parties interested in this subject, from the time I started the campaign until then, nor had he any knowledge of my earlier movements until I communicated them to him. Almost immediately afterwards, the first preliminary meeting took place, and the subsequent events are no doubt correctly related by Mr. Atkinson.

Mr. Atkinson will, however, perhaps be interested to learn that Mr. Henry Edmunds had some time before, if I am correctly advised (to requote Mr. Atkinson's method of expression), "had the idea to found, or be associated with, a trade organisation." This, however, had a short life, if a merry one, and broke down. I referred to this event in my original communication.

I would mention that the whole of these facts can be corroborated by Mr. J. J. Easton, if his memory serves; if that fails, by the official records of Messrs. Siemens, to whom all progress was reported.

In conclusion, I would like to add that, by placing the genesis of the Cable-Makers' Association on record, I am not wishing to detract from the later efforts of those who have brought this Association to so successful a conclusion, and I am particularly sorry that Mr. Atkinson did not extend his inquiries into wider channels before seeking publicity.

Herbert H. Berry.

London, W. 1, October 23rd, 1917.

"A EUROPEAN CONCERT."—A correspondent at the Front points out that a misprint occurred in the letter under this heading in our issue of September 28th; the supply voltage is not 2,000, but 220 volts. Reference to the original shows that the error on the part of the compositor was not inexcusable.—EDS. ELEC. REV.

The Niche and Its Occupant.

The war is the biggest moral earthquake which has taken place in the memory of man. It is responsible for the overthrow of institutions and customs, generations in the making, which had become as harbours of refuge against the grasping hand of self individual gain. We know that things can never bear the same relationship in the years ahead as they did in the far-away summer days of 1914.

One of the outcomes of the upheaval is the closer relationship between Capital and Labour. It took a European war to enable each to discover the true worth of the other, to find the true meaning of the motto, "Unity is strength," and to sow the seeds for true co-operation in the happy days to come "*après la guerre*." And if half the schemes which have seen the light of day obtain realisation, the world will indeed be a better place.

Unfortunately, the boundary line of labour is tending to become too sharply defined. It is increasingly evident when labour is mentioned that "productive" labour only is referred to. The producer—the man who weaves the article, who produces the tangible result with the toil of his hands and the sweat of his brow—he is the man who will benefit by the utopian schemes held out like sugar plums to a fractions child. But what of the man whose brain created the vision from which the tangible thing was evolved? He is still left where he has, perforce, been compelled to rest in a little niche in the wall—out of harm's way, yes, and quite as easily forgotten as a sculptured saint in a cathedral portal. He is a member of the "staff," and as such is outside the labour qualification. His wage has become a salary, his time-sheet a mere set of numerals on the roll of the clock recorder, his hands are idle from the result of daily contact with the crude components of his dream-child. He is a man above, a being apart, but alas! in such a minority that he ceases to be worth consideration when the betterment of the individual lot is on foot.

Co-operation for the producer is in the air. Cannot the flashes which are illuminating the darkness produced by the present chaos shed a little light on the niche in the wall and awaken the capitalist to a realisation of the untapped source of national energy lying dormant there?

The loyalty of the staff to its chief is beyond reproach. When will he discover their true value, and respond to the mute appeals for recognition, even if it be but the acknowledgment of trust well-placed and well-proved? Its loyalty can become something more than a mere expression of willingness to serve. It can become a real dynamic force urging the manufacturer and producer, and, through them, the nation at large, into new channels of enterprise, and opening vistas of a world-wide expansion at present unattained.

Abolish the niche, give its occupants freedom to expand, eradicate by careful attention all that belittles it, encourage all that expands and ennobles it, as you would your producer, and the day will not be far distant when you will be repaid not thirty, not sixty, but a hundredfold.

F. E. S.

LEGAL.

THE BOSCH MAGNETO PATENTS.

THE supremacy of the Bosch magneto was discussed in the Patents Courts on Thursday, last week, when the British Lighting and Ignition Co., Ltd., of 204, Tottenham Court Road, London, W.C., applied for licence to use 21 German-owned patents for these magnetos.

The application was heard by the Controller, Mr Temple Franks, and Sir Cornelius Dalton.

MR. HUNTER GRAY appeared for the applicants, who were, he said, a firm formed in May of this year to acquire the plant, machinery, and factory of the Bosch Magneto Co., Ltd., which was practically entirely owned by German capital. This Bosch Magneto Co. had 120 patents or applications. The purchasers direct were Messrs. Vickers, Ltd., who formed the present applicant company to work the plant bought from the Controller. They paid a large sum of money. The works, however, were not manufacturing works. There was merely a repairing shop. The magnetos before the war were not even assembled here. They came over actually completed and assembled, and all the firm did in England was to effect repairs to damaged magnetos. Undoubtedly the Bosch was at that time the best magneto that could be obtained for motor-cars, and a great deal of work had been spent on its evolution. Mr. Gray went on to say that he did not want the licence to be made out for the term of the war only. A company of this size, with a large capital and under the guidance of Vickers, was not going back from the position it must take up, seeing the great amount of money that must be spent to get this industry into this country. A very large sum was paid for the fixed plant, machinery, and factories. The applicant company was formed with a capital of £200,000. Very substantial sums had been spent by the applicants since the purchase was made, and there was no question of the future rate of manufacture. These magnetos were now being made in large numbers. A licence had already been given to the Chesham Supply Co., Ltd., to manufacture (ELECTRICAL REVIEW, May 25th); the sum fixed as payable by way of royalty was then arranged at 5s. per magneto. That, under the circumstances, was very generous, and if the Court could see its way to fix a smaller royalty in the case of the present applicants, no doubt that would react, and the Chesham Supply Co. would get the benefit of it.

SIR CORNELIUS DALTON: I understand that for a motor bicycle before the war the cost of the magneto would be £1 retail, and for a four-cylinder car it would be up to about £12. There must have been a considerable number made.

MR. GRAY: I am told by the manager that the biggest output, which occurred about the year before the war, was 100,000 in the United Kingdom and the Colonies, excepting Canada.

THE CONTROLLER: If you can give us any reason or consideration why the royalty should be lowered we will hear you.

MR. GRAY: When you consider the great expenses to be incurred, I think you will see there is a reason why a small royalty should be imposed. There are special considerations in this case which do not apply to all applications. He went on to say that the applicant firm were turning out for war work a very large number per week. They hoped to go on increasing that number during the war, and after, but they would not be able to do it unless they got a big market. They could only get that and beat the Germans if they had highly developed works and equipment which would enable them to compete with Germany after the war. The Chesham Supply Co. applied only for nine patents, and only two of those were in the present list. He apprehended they might find it necessary to come to the Court again. The whole of the 26, with the exception, perhaps, of three or four, were embodied in the magneto actually made by the applicants.

IF MR. GRAY said, the Germans were to be allowed to compete without legislative restriction, and to manufacture in this country, and English makers had to pay them a big royalty, they would try to get all the trade back after the war.

Applicants' general manager, MR. A. BENNETT, said he was in the service of the Bosch Magneto Co. from 1907 until it was wound up by order of the Board of Trade. The colonial business grew latterly, but he should say 80 per cent. of the output was for this country, or 80,000. The prices before the war would range from £6 to £50, the last figure for the big stationary gas engines; but for motor cars and bicycles the prices would be from £6 to £12. He calculated that they were doing 90 per cent. of the total magneto business of this country. The plant would have to be multiplied several times to render it equal to producing the quantity the Bosch Co. formerly imported. Mr. Bosch's own explanation of his success was that his works were situated in a part of Germany which was very far away from the natural sources

of supply, and he could only succeed and make money in that part by doing excellent work.

THE CONTROLLER: You say the success of the Bosch magneto was due to admirable workmanship?

WITNESS: Yes; and we can secure good workmanship here. We are making magnetos for most of the aircraft at the present time. It is only a matter of experience to get the material up to the excellency that the Germans attained.

MR. GRAY: Did Bosch's ever make machines in this country?

MR. BENNETT: No; we only made machines in London for the purpose of competition where it was laid down that the whole engine had to be of British manufacture. Mr. Bennett added that he would like the royalty to be as small as possible, because he was responsible. He would be quite pleased if it could be fixed at 5s.

An officer from the Admiralty, **COMMANDER BRISTOW**, giving evidence, said he had been particularly concerned at the Admiralty with magnetos and their use for public purposes.

He agreed that the sum of 5s. for royalty was excessive, and that the offer of the Chesham Supply Co. should not be allowed to weigh on anybody's mind to any degree. They were not magneto manufacturers, but cab proprietors and hirers. The Government have been in consultation with patent experts in this country, and their view was that upon the validity of these patents they could put up a very decent fight. They would challenge the validity of all these patents, except, perhaps, two—one dealing with the central terminal and the lagging pin, and the other a patent on the hole in the contact-breaker cam, which was fitted with a wick taking the oil to the surface of the cam. The number of magnetos imported to this country before the war, as far as they could make out, of all sorts, from America, Germany, and oddments, amounted to 280,000 a year. So that if the trade was struggling under a royalty of 5s. a magneto, it would be paying to Bosch in Germany £70,000 per annum. A licence went on for several years, so that a very big amount at that rate would be paid to the Germans for a number of patents of which it was said that they were not valid. Moreover, it was perfectly true, as Mr. Gray said, that the superior quality of the Bosch magneto did not lie in the patents, but in the workmanship and material, and it had been found quite possible for magnetos superior to the Bosch to be turned out, not embracing any device for which Bosch could claim a patent. Mr. Bennett was perfectly correct when he said their works would have to be very much extended before they could cope with the whole requirements of the country; but he did not think he need be afraid of the German on that particular account. The following companies were also manufacturing: The British Thomson-Houston Co., the British Westinghouse Co., Siemens, Ericsson, Peel-Comer, Thomson Bennett, the M-L Magneto Syndicate, the Watford Speedometer Co., the Fellowes Magneto, and others. The total capital of these companies must run into millions of pounds. For the first five alone the capital was very considerable. All these proposed to continue after the war. All these firms were members of the British Magneto Manufacturers' Association, and they were unanimously agreed that they would fight the Bosch Co. if necessary. He believed that they had established some sinking fund or reserve to enable them to engage in litigation with the Bosch Co. if the Bosch Co. wanted it. The upshot of all these consultations had been that, whatever others might do, they had definitely made up their minds that they would not apply for a licence, and they were anxious that nothing should be done by anybody else to prejudice the position which they had taken up with regard to the validity of the patents. Although the Government saw no objection to Messrs. Vickers having a licence, the Government would not regard with equanimity any clause inserted in that licence which made them appear to be sole licensees. It would not be satisfactory if the Court granted a licence which in any way would enable the Bosch Co. to say at the end of the war that anybody legally acknowledged the validity of the patents for which licence was granted.

THE CONTROLLER: The licence would only be between the applicants and the Board of Trade, and no licence for war use could ever be taken to be a general guarantee of the validity of the patent rights.

COMMANDER BRISTOW: Say, for instance, that the British Thomson-Houston Co. were using a certain patent, we should not like it to be possible for the Bosch Co. to say: "It does not matter what you think about its validity. A licence has already been granted in respect of it, and the Patents Court has recognised it." Take the patent for the central terminals and lagging pin. If Messrs. Vickers had taken out a licence for that, we should not like them to be in a position to turn round and say: "We have taken out a licence for this patent, and you cannot now challenge it."

MR. GRAY: They cannot do that.

SIR CORNELIUS DALTON asked Commander Bristow: Do you think it wiser for the present applicants to join the other companies?

COMMANDER BRISTOW: That is a matter I have no opinion to express upon.

THE CONTROLLER: What will be the demand for the output of magnetos after the war?

COMMANDER BRISTOW: With 280,000 a year required before the war, it is highly probable that that number will be greatly exceeded after the war. There is a great movement for reforming the motor trade, and by standardisation to place this country in a much better position to fight the importation of these foreign cars.

In reply to the CONTROLLER, **COMMANDER BRISTOW** said the demand for magnetos for aircraft was likely to increase, as well as for pumps, agricultural machines, and all sorts of things.

MR. GRAY: Now that I have Commander Bristow's support, I am going to ask you, Sir, to give us the licence at a lower royalty.

SIR CORNELIUS DALTON: You still want a licence after hearing him?

MR. GRAY: Yes; if we find that we don't, we can notify you to that effect afterwards. In considering this application, I should like you to bear in mind that this is a key industry.

THE CONTROLLER: We shall recommend that a licence be granted. It can be borne in mind that the Chesham Supply Co. were only applying, when they were before us, for licence to use for their own particular purpose, and it may be now that we shall be quite prepared to reconsider the whole question of royalty, and to recommend the Board that all people who come for a licence now—and possibly even the Chesham Supply Co.—should have the royalty based on these new considerations. We have in this Court to take into account a variety of considerations: first, how far the patents enter into the process of manufacture, then what is the public interest, and finally the development of the industry. The applicants will be duly notified by the Board of Trade as to their licence, and the conditions on which it is issued.

NEW ZEALAND COMPENSATION CASE.

A DISPATCH in an Auckland paper states that at Wellington £2,000 damages were awarded by a Christchurch jury to Mrs. Minnie Jones, whose husband was killed by electric shock while working on the North Canterbury Hospital roof; £1,000 for herself, and £250 for each of four children. The claim was for £2,500 against the North Canterbury Hospital Board.

BUSINESS NOTES.

City Business Men and Government Control of Trade.—

Yesterday afternoon there was to be held at Cannon Street Hotel a public meeting of merchants, manufacturers and traders concerned in the production, importation, and distribution of commodities of national necessity. The object was to consider the effect of the present system of Government control of trade upon legitimate commercial interests. The following resolutions approving of the recommendations of the London Chamber of Commerce Merchants' Committee, which we reproduce from the *Financier*, were to be submitted:—

(a) That Government should cease to act as trading intermediary between producers and consumers, but should utilise to the fullest extent the services of the business community.

(b) That to this end merchants should be encouraged to continue to carry or import stocks of commodities essential to this country.

(c) That, so far as any control of imports and exports is concerned, the quantities allowed should as far as possible be based upon a fair allocation of quantities amongst merchants dealing in particular articles, after consultation with representative trade organisations. Permits should only be granted to British and Allied subjects who are legitimate merchants and importers to the trade involved.

(d) That the various control departments should be co-ordinated so far as to secure a uniform system on questions of principle and to obviate present delays in dealings with licences and permits.

(e) That control departments should in all cases be assisted by representative business men nominated by their respective trades.

(f) That steps be taken to represent to the Government, to Members of Parliament and the public generally the views set out in the report of this committee.

Basic Pig-Iron from Midland Ore.—

The Right Hon. George Roberts, M.P., P.C., lit up on Saturday last the last remaining idle furnace at the Stanton Ironworks, which has been placed in commission for the purpose of making basic pig-iron out of local iron ore for steel making. The manufacture of basic pig-iron out of local ore is a new industry in the Midlands; and not until the shortage of raw materials for steel-making purposes had made itself felt were the Midlands called upon to divert their blast furnaces to the manufacture of basic iron. It is of interest to note that under normal conditions these furnaces remain in continuous operation for some 15 years before requiring relining. The Stanton Co. now have in commission nine furnaces, and supply their own iron ore and coal, &c.

Catalogues and Lists.—

MESSRS. TREDEGARS, LTD., 9, Diana Place, Euston Road, London, N.W.1.—Leaflet giving prices, &c., of the "One Part" holder.

BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—List No. 4,155, giving description, dimensions and shipping particulars of oil-break switches, type O. Form E, also No. 4,153, giving similar information respecting Form C.

THE SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, London, W.C.—Thirty-six-page illustrated pamphlet giving prices and essential catalogue details of "Sunlite P.E.", "Diffusa," Holophane, and other reflectors, and fittings for use with half-watt lamps, for lighting all departments of works and general offices, stores and tool-rooms, &c., also for yard, cinema and public building lighting.

MESSRS. COLE, MARCHANT & MORLEY, LTD., Bradford.—Twenty-four-page publication showing a large number of illustrations of condensing plants specialised in and installed by them.

MESSRS. SCHOLEY & CO., LTD., 56, Victoria Street, London, S.W.1.—Leaflet fully describing the Copps feed-water regulators, for which the firm has recently booked a large number of orders. These include contracts with Sheffield (repeat order), Manchester and Birmingham Electricity Departments, the Yorkshire Electric Power Co. (repeat), Messrs. Babcock & Wilcox, and many industrial firms.

ELECTRICAL APPARATUS CO., LTD., Vauxhall Works, South Lambeth Road, London, S.W.—No. 4 of the E.A.C. "Quarterly Review," just issued, contains a good deal of illustrated material

relating to E.A.C. work in war time, and to the company's manufactures, such as an A.C. no-volt release, air compressors, springing figure type cyclometer counters for E.A.C. meters, controller regulators, testing rheostats, and automatic protection for slipping motors.

Liquidation.—BRITISH CONTINENTAL ELECTRICITY CO., LTD. Creditors must send particulars of their debts, &c., to the Liquidator, Mr. C. E. Barker, 21, Finsbury Pavement, E.C., by November 30th.

Stoker Contracts.—THE UNDERFEED STOKER CO. has effected sales of its stokers to the following electricity authorities:—

Wolverhampton Electricity Works	10 A
Brighton Electricity Works	6 A
Swansea Corporation Electricity Works	2 E
St. Helens Electricity Works	1 E
St. Albans Electricity Works	1 E
Carlisle Electricity Works	1 A
Bath Electricity Works	1 E

The latest list of customers for these stokers also includes the War Office, Messrs. Armstrong, Whitworth & Co., and a number of collieries, ironworks, &c.

Book Notices.—Science Abstracts, A and B. Vol. XX. Part 9. September 29th, 1917. London: E. & F. N. Spon, Ltd. Price 1s. 6d. each.

"Letters concerning the War: Between an American and a relative in Germany." Privately printed, New York.

"Beuma Journal." Vol. III. No. 4. October, 1917. London: Oakley House, Bloomsbury, W.C. Price 1s. net.

"Post Office Electrical Engineers' Journal." Vol. X. Part 3. October, 1917. London: H. Alabaster, Gatehouse, and Kempe. Price 1s. net.

LIGHTING AND POWER NOTES.

Acton.—The Council has received a cheque for £2,500 from the Metropolitan Electric Supply Co., in accordance with the terms arrived at when the Council disposed of its powers to the company.

The profit on the Acton undertaking was stated to be 10·26 per cent.; and having regard to this, the Council expressed the opinion that the company was not justified in increasing the charges for current by 10 per cent.

Australia.—Members of the Melbourne Council recently visited the Spencer Street power house, where a water-tube boiler has been equipped with a furnace for burning brown coal. The experiment is stated to be quite satisfactory, the full boiler output being maintained. It has been found that brown slack coal also gave good results; at present there is no market for this coal.

Blackpool.—WAGES.—The War Bonus Sub-Committee has considered the application on behalf of the employés in the electricity works for a war bonus of 15s. week, and has decided to offer the same sum as was recently awarded workers in other departments—12s. a week. In the event of non-acceptance, the matter will go to arbitration.

The past six months' working of the Corporation electricity department shows an aggregate output of 2,649,261 units, an increase of 221,329 units on the similar period of last year.

Bolton.—PRICE INCREASE.—The Electricity Committee has approved a report submitted by the electrical engineer on the question of increasing the price of current owing to the increased cost of coal, and has decided that the following advance over the prevailing prices should take effect as from the commencement of the current quarter:—Ordinary power consumers, 1d. per unit; lighting supply consumers, 1d. per unit; and traction supply, subject to the approval of the B. of T., 10d. per unit.

Bradford.—The latest establishments to adopt electricity for driving purposes are a new mill just completed for Messrs. Jeremiah Ambler & Sons, one of the pioneer woollen firms, and Dockfield Mills, Shipley, for the completion of which Government licence has been secured.

The Chamber of Trade has decided to support the National Chamber's petition to the Government (originated by the Leeds Chamber) for the fixing of definite uniform times of shop lighting restriction to cover the period of a month, during each month of the winter, based on the sunset conditions of the various parts of the country, instead of the present confusing system of a change of time every evening.

Bristol.—YEAR'S WORKING.—The report of the year's working of the electricity department to March 31st last shows gross receipts amounting to £143,923, an expenditure of £98,318, and a gross profit of £45,571, which, with the amount transferred from redemption and sinking fund (No. 2) account, makes a total of £16,111. After repayment of loans and interest, £18,373, there was a net loss on the year's working of £2,232. The credit balance brought forward from last year's account was £9,292, which, with adjustment of income-tax (1915-16), £1288, made a surplus of £10,580, which has been appropriated as follows:—Loss on year's working, £2,232; allowance to employés on active service, £3,398; and £4,968 on work not chargeable to loan account, leaving a balance of £72 to carry forward to next account. The outstanding debt amounts to £517,566. The total number of consumers was

5,736, a net increase of 128 during the year. The number of units sold was 23,579,139, an increase of 1,913,171. The general manager, Mr. H. Faraday Proctor, in his report states that the 3,000-kw. turbo-generator, sanctioned by the L.G.B. last year, had been delivered, and was expected to be in full running order during the autumn; but the load had so increased, that further plant was absolutely necessary. On the initiation of the Government scheme at Henbury, arrangements were made for co-operative working between the electric generating stations of the respective departments, with a view to the works of the Government being taken over by the Corporation after the termination of the war; the Government purchased a further 6,000-kw. generator in addition to those already on order for its own requirements for the more particular use of the Bristol Corporation Electricity Department to meet the growing demands. The stoppage of the works at Henbury had placed the Corporation electricity undertaking in a difficult position as regards meeting future requirements, as the Feeder Road station had its full complement of plant, and the Henbury scheme was being relied on. The engineer further states that arrangements for either the extension of the existing station at Feeder Road, or the construction of a new station on a large scale is therefore difficult, pending the advancement of the general scheme of organised electricity supply being considered by the Government, and it is particularly regrettable that the purchase of the 6,000-kw. generator sanctioned by the Council in May, 1915, was not approved by the L.G.B., the added load having already almost taken up the capacity of the smaller set to which the Corporation was then limited by the Board. Of the £23,056 increase in working costs, £16,011 represented the additional cost of coal.

Ealing.—The T.C. has received a letter from the Commissioner of Police requesting the resignation of members of the electricity staff who had enrolled as special constables. The Town Clerk explained that this was the outcome of the Council's reply to a letter from the Commissioner respecting the payment of compensation for injury sustained in the course of duty by special constables enrolled for the purpose of protecting their employer's premises. The borough electrical engineer had applied for long-service badges for these men, but the request was refused. It was decided that the Town Clerk should point out that the men were enrolled three years ago, and that during that period the liability of the police authorities regarding the payment of compensation had not been questioned. It was also resolved to say that it would be an ungracious act to ask the men to resign at this juncture because the Council declined to accede to a demand which did not appear to be justified.

Greenock.—PROPOSED LOANS.—The Corporation last week decided to apply to the Secretary for Scotland for sanction for power to borrow £53,000 for the electricity undertaking. It was stated that £6,000 was required to complete old contracts, £13,000 for additional mains and services in Greenock and £8,000 in Port Glasgow, £10,000 for land and property extensions at Dallingburn power station, and £16,000 for transforming plant and switchgear. The total of £53,000 will cover the immediate requirements, but in the near future further expenditure will be necessary.—*Glasgow Herald*.

Liverpool.—OUTPUT FIGURES.—The Corporation Electricity Department has made considerable progress during the past 12 months. There are now about 12,400 consumers, an increase of 400 in the year. Close upon 61,000,000 units were supplied for lighting, power and traction purposes, an increase of nearly 7 million units. During the first eight months of the present year there was an increase of 5 million units, or 13 per cent., as compared with a similar period last year.

London.—P.L.A. REPORT.—The report on the work of the Port of London Authority for the year to March last mentions that at the Royal Albert Dock 43 new electric cranes and a new crane track and conduit have been completed, and progress has been made with the provision of electric pumping plant for the dry docks.

At Tilbury three transit sheds, with 12 electric cranes, have been completed.

Loughrea.—The Town Commissioners decided to approach the Electric Lighting Co. with a view to the utilisation of electricity for the purpose of a new milling industry. Mr. Cahill said that after providing the town with light, something like 1,500 h.p. was being wasted, and might be turned to profitable account in the direction indicated. The L.G.B. has declined to sanction an increase from 6d. to 8d. per unit on electricity supplied by the company to the workhouse, stating that it does not consider the Guardians have power to increase the price agreed upon with the company in 1914.

Nuneaton.—LOAN APPLICATION.—The T.C. has applied to the L.G.B. for sanction to a loan of £575 for money overspent on machinery, £785 for excess expenditure on mains and services, and £2,140 for new mains and services and costs of raising the loan.

Oldham.—HOUSING SCHEMES AND ELECTRIC LIGHTING.—Acting on the request of the L.G.B. which has promised substantial financial assistance, local authorities in Lancashire, as elsewhere, are busy preparing big housing schemes to meet the great shortage which will exist in most districts after the war. This should mean a considerable extension of electric lighting. At Oldham there is a proposal to erect 500 houses, and at the meeting of the local Electricity Committee, Mr. Chamberlain, one of the joint engineers, stated that he had written to the borough surveyor, expressing the hope that the claims of the electricity department would not be overlooked when the question of the

means of lighting the proposed houses came to be considered. In the letter he pointed out that at present there were about 100 small houses, rented at about 5s. 6d. a week clear, which were electrically lighted. Mr. Chamberlain told the Committee that the old fetish that electric lighting was a matter for the big house only ought to have been dead long ago, and the present scheme, if carried out, would provide a splendid opportunity for that department.

Rochdale.—As a result of the extra cost of coal, the question of an increase in the charges for electricity is under consideration. There is now a coal clause in connection with the main contracts with consumers.

Southend.—INQUIRY.—A L.G.B. inquiry was held on Tuesday, last week, regarding the proposal to borrow £45,520 for the provision of additional generating plant at the electricity works, and for £1,150 for electric vehicles for the collection of horse refuse.

Tipperary.—The B. of G. proposes expending £100 on the renovation and improvement of the workhouse electric lighting plant.

TRAMWAY AND RAILWAY NOTES.

Australia.—ELECTRIFICATION OF THE VICTORIAN SUBURBAN RAILWAYS.—The Railway Commissioners have announced that, to enable the electric trains to be run during the first half of next year, special arrangements had been made to secure from America some of the gear necessary to inaugurate the service. The scheme had reached a stage where the installation of a small quantity of additional plant would allow trains to run on the Sandringham-Essendon line, and a relatively small portion of the rotary converting plant, transformers, and switchgear essential to the commencement of electric traction has been ordered from the General Electric Co. (U.S.A.), which is the contractor for the electrical equipment of the suburban rolling stock, and the original orders placed in Great Britain for the gear have been cancelled, so that no extra expense will be incurred by the transfer.—*Melbourne Age*.

Bingley (Yorks.)—The Council has decided to apply to the B. of T. for prolongation of the time by two years for the completion of the tramway at Crossflats. This step does not materially affect the proposed (after-war) linking-up of the Bradford, Bingley, and Keighley tramways between Crossflats and Stockbridge. It is an additional extension on the war-time extension already granted.

Birmingham.—ARTERIAL ROADS.—The City Council has adjourned consideration of the recommendation of the Public Works Committee favouring the widening of the chief arterial roads and the construction of a separate track system for tramways. The subject is to be discussed by the chief Committees of the Council, and there is good reason to believe that the scheme will again be submitted for adoption within the next three or four months.

Blackpool.—YEAR'S WORKING.—The annual report of the Corporation tramways for the year ended March 31st last, shows a total revenue of £94,367, working expenses amounting to £53,229, and a gross profit of £41,138; interest and sinking fund charges absorbed £19,956, leaving a net profit of £21,182, which has been disposed of as follows:—For the relief of rates, £10,000; permanent way renewal fund, £9,000; to reserve fund, £2,182. The total amount at the credit of the reserve fund is now £9,142, and of the renewals fund £30,542. The passengers carried numbered 17,810,538; the car-mileage was 1,131,728, showing an increase of 3,224,687 passengers and 62,201 miles during the year. The average total revenue per car-mile was 20.01d.; the average working expenses per car-mile, including power, were 11.29d.

At a meeting of the Tramways Committee, Mr. Charles Furness, general manager, reported that when conditions allowed he should apply for permission to purchase about 16 additional cars, bringing the total up to about 100. At the same time he recommended, in view of depletion of staff, that application be made to the B. of T. for permission to use trailer cars. This would increase the carrying capacity from 50 to 80 per cent., and only an additional conductor would be required. The Committee approved the recommendation, and application is to be made as suggested.

A recommendation by the Watch Committee that a double set of lines should be placed at the Dickson Road terminus of the Blackpool and Fleetwood Tramroad Co., was deferred until the present lease expires in July, 1919.

Bradford.—WAGES.—The Corporation tramway workers, numbering about 1,000, through the local branch of their Union, are applying for a wages advance of equal to £1 per week on pre-war rates. They are already in possession of advances up to 12s. per week in addition to receiving time and a-half pay for overtime. The new demand would cost the department £42,000 a year. The Tramways Committee states that the advance is impossible without a material increase in fares. The Committee has recommended to the War Wages Committee that the application be not granted, but it is willing to go to arbitration.

TRAFFIC RETURNS.—The city's tramway receipts for the half-year ending September 30th were £203,590, an increase of £19,000 on the corresponding period last year. The total expenditure includes £22,000 in war wages and bonuses, an increase of £14,000, in addition to which £10,000 (an increase of £1,000) has

been paid in war allowances. The car-mileage was 3,052,000, a decrease of 107,000. The passengers carried numbered 42,893,000, an increase of 745,000, averaging 127 journeys for the whole population, an increase of 16 journeys.

Continental.—SWITZERLAND.—The Swiss Locomotive and Machinery Works Co., of Winterthur, which has just declared a dividend of 7 per cent. for 1916-17, as in the previous year, reports that the Federal Railway Administration has definitely allocated to the company an order for the mechanical parts of the four experimental electric locomotives for the St. Gothard Railway.

Edge Hill Light Railways.—An application was recently made to the Light Railway Commissioners for an order authorising various lines in the district between Stratford-on-Avon and Banbury, covering about 11 miles. The railways are to deal with minerals, though passenger-carrying powers are included; it is apparently intended to adopt electric traction, as powers are sought for the erection of a generating station.

Huddersfield.—WAGES.—The existing war bonus of 10s. per week paid to adult male tramway employees is increased to 11s. per week; those of the female employees (1s. 6d.) and boys (5s.) are increased by 2s. each, with certain conditions as to overtime work. The increased bonuses are retrospective to September 19th.

Lancashire.—TRAMWAY WAGES AWARD.—The recent award to the tramway workers of Lancashire is now being regarded as even more favourable to the employees than was at first apparent. The arbitrator, on a point of appeal, has decided that the award of 12s. for men and 9s. for women applies to a six-day working week, and that if an employee works seven days he is entitled to an extra amount. As, owing to the reduction in staffs, the seven-day week is fairly general, this will mean an increase of 11s. a week. In Bolton, where a 13-day fortnight arrangement has been in vogue, the general manager has been authorised to prepare a scheme for a six-days' week.

Liverpool.—The Corporation Tramways have carried nearly ten million more passengers during the past nine months as compared with 1916, and although there was a decrease in the mileage run of 90,303 miles, the receipts, which were £603,317, showed an increase of £53,417 upon those of the corresponding period of last year. The earnings per car-mile were 1s. 3.43d., as against 1s. 88d. Some 2,200 employees have joined the Forces, and this fact, with the difficulty of obtaining supplies, has involved strenuous conditions.

London.—The Lewisham B.C., having regard to the improving receipts of the L.C.C. tramways, has directed that they should be included in a provisional valuation list for reassessment.

Londonderry.—A member of the Corporation having declined to negotiate with that body for the use of land in connection with the proposed city electric tramway service, the Corporation decided to acquire the land compulsorily.

Warrington.—The T.C., in sanctioning increased fares on the tramways, was told by Alderman Wilkinson that war bonuses were costing the Corporation £3,600 a year. Prior to the war, in 1914, the working cost per car-mile was 8d., and they could make money on that basis, but the cost had now risen to 11½d. per car-mile.

TELEGRAPH AND TELEPHONE NOTES.

Argentina.—The high-power wireless station which, with the consent of the Argentine Government, has been erected, under the supervision of Messrs. Siemens-Schuckert, in the vicinity of the station of Plomer is designed to communicate with the high-power station at Nauern, near Berlin, the distance between the two stations being about 13,000 kilometres. Signals from Germany have already been received, but the prevalence of strong atmospherics has so far prevented them from being intelligible.—*Review of the River Plate*.

Australia.—Orders aggregating 1,000 lines of automatic central-office equipment and 1,000 telephones equipped with the dial have just been placed, to be used as additions to the automatic exchanges in Australia. This is the second set of orders placed since the beginning of 1917, the first one—for 1,800 lines—being received in February.—*T. and T. Age*.

The Minister for the Navy recently stated that £55,000 had been spent in the purchase of wireless workshops and plant at Randwick, Sydney, and there were now 81 men employed there.—*Melbourne Age*.

Holland.—In confirmation of the report that there is wireless communication between Holland and foreign countries, via Berlin, the Amsterdam *Telegraaf* states that commercial telegrams are arriving in Holland by this route.—*The Times*.

Telephoning During Air Raids.—The Postmaster-General earnestly appeals to the public to refrain from using the telephone during and immediately after an air raid. Private calls must necessarily give way at such times to urgent calls of public and national importance.

CONTRACTS OPEN AND CLOSED.

OPEN.

Dublin.—November 1st. G.N. Railway Co. (Ireland). Six or twelve months' supply of general stores (including several electrical items). See "Official Notices" October 5th.

Grimsby.—October 29th. Corporation. House service boxes and house fuse-boxes and fittings. See "Official Notices" October 12th.

Spain.—The municipal authorities of Uruena (Province of Valladolid) have just invited tenders for the concession for the electric lighting of the town during a period of 15 years. Tenders have also lately been invited by the municipal authorities of Villadefrades, in the same province, for the concession for the electric lighting of the town during a similar period.

York.—November 2nd. N.E. Railway. Telegraph stores for six and twelve months. See "Official Notices" to-day.

CLOSED.

Government Contracts.—List of new contracts placed during September, 1917:—

WAR OFFICE.

Generating sets.—R. A. Lister & Co., Ltd.
Motors.—Electric Construction Co., Ltd.; F. Parkinson & Co.; Rhodes Motors, Ltd.
Transformers.—Harland Engineering Co.
Iron wire.—Dorman, Long & Co., Ltd.; Firth & Co., Ltd.; Guest, Keen and Nettlefolds, Ltd.

INDIA OFFICE STORE DEPARTMENT.

Alternators.—Crompton & Co.
Cells.—Siemens Bros. & Co.
Cells and dynamos.—J. Stone & Co.
Copper plates.—Williams, Foster & Co.; Pascoe, Grenfell & Son.
Gutta-percha sheet.—Siemens Bros. & Co.
Wire.—Whitecross Co.; Shropshire Iron Co.; R. Johnson & Nephew.

H.M. OFFICE OF WORKS.

Engineering services.—Electric wiring, &c., new Court House, Newington Causeway; Lund Bros. & Co.
Ordnance Survey Office, overseas.—Electric generating plant: Harland Engineering Co.

POST OFFICE.

Telegraph apparatus.—Automatic Telephone Mfg. Co., Ltd.; General Electric Co., Ltd.; I.R., G.P. & Telegraph Works Co., Ltd.; Telegraph Condenser Co., Ltd.; H. White & Co.
Telephone apparatus.—British L. M. Ericsson Mfg. Co., Ltd.; General Electric Co., Ltd.; Western Electric Co., Ltd.
Submarine cable.—Telegraph Construction and Maintenance Co., Ltd.
Telegraph cable.—Connolly Bros., Ltd.
Telephone cable.—B.I. & Helsby Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; W. T. Glover & Co., Ltd.; Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; C. Macintosh & Co., Ltd.; Peel-Conner Telephone Works, Ltd.; Siemens Bros. & Co., Ltd.; Union Cable Co., Ltd.; Western Electric Co., Ltd.
Leclanché cells.—Siemens Bros. & Co., Ltd.
Insulators.—Bullers, Ltd.
Stay-rods.—Bayliss, Jones & Bayliss, Ltd.
Zinc rods.—Eyre Smelting Co., Ltd.
Bronze wire.—B.I. & Helsby Cables, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co. (incorporated in the London Electric Wire Co. and Smiths, Ltd.).
Copper binding wire.—B.I. & Helsby Cables, Ltd.
Covered copper wire.—Concordia Electric Wire Co., Ltd.
Copper line wire.—T. Bolton & Sons, Ltd.; B.I. & Helsby Cables, Ltd.; Elliott's Metal Co., Ltd.; Johnson & Nephew, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co. (incorporated in the London Electric Wire Co. & Smiths, Ltd.); Wilkes, Sons & Mapplebeck, Ltd.
Voids.—Brunner, Mond & Co., Ltd.

London.—**ST. PANCRAS.**—The Borough Council has accepted an offer of Messrs. Bruce Peebles & Co. to supply an additional 1,000-KW. motor-converter for £4,000.

HAMMERSMITH.—The Electricity Committee recommends that the offer of Messrs. W. B. Dick & Co., Ltd., be accepted for the supply of cylinder oil for 18 months from September 25th, 1917, at 3s. 6d. per gallon.

Taunton.—**T.C.** 2,500 tons of Russell's Black Vein washed bean coal for the electric light works: Cory Bros. & Co., Ltd., at £1 9s. 9d. per ton, an advance on the last contract of 7½d.

Transformer and Meter Contracts.—Messrs. Ferranti, Ltd., have received the following contracts:

Yorkshire Electric Power Co.—One 150-K.V.A. and one 200-K.V.A. 3-phase transformer.
British Cellulose & Chemical Mfg. Co., Ltd.—Three 10,000-K.V.A. 3-phase transformers for furnace work (secondary current 50,000 amps.).
Stockton-on-Tees Corporation.—Annual contract for c.c. meters.
Redditch Urban District Council.—Annual contract for a.c. meters.

FORTHCOMING EVENTS.

Physical Society of London.—Friday, October 26th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Papers on "A Class of Multiple Thin Objects," by Mr. T. Smith, and on "The Radius of the Electron and the Nuclear Structure of Atoms," by Prof. J. W. Nicholson.

Association of Supervising Electricians.—Tuesday, October 30th. At 7.15 p.m. At St. Bride's Institute, Bride Lane, E.C. Paper on "Switchboard Telephone Equipments," by Mr. T. P. Lee.

Salford Technical and Engineering Association.—Saturday, November 3rd. At 7 p.m. At the Royal Technical Institute, Peel Park. Members' short papers for gold medal given by Mr. W. O. Larmouth.

NOTES.

Volunteer Notes.—**COUNTY OF LONDON VOLUNTEER ENGINEERS (FIELD COMPANIES).**—Headquarters, Balderton Street, Oxford Street, W. 1.

Orders for the week, by Lieut.-Colonel Clay, V.D., commanding:—
Officer for the Week.—Lieut. W. J. A. Watkins.
Drills.—Week ending Sunday, November 4th, 1917:—
Monday.—No. 3 Company, Left Half. Recruits, signalling, 6.30.
Tuesday.—Physical drill and bayonet exercise, 7.30.
Wednesday.—No. 1 Company, 6.30.
Thursday.—No. 2 Company, 6; signalling, ambulance, 6.30.
Friday.—No. 3 Company, Right Half. Recruits, 6.30.
Sunday.—Commandant's Parade. Parade Waterloo Station, opposite No. 10 Platform, 8.45 a.m., for work at Esher. Uniform. Mid-day rations to be carried. Compulsory for A and B men.
Musketry.—Belvedere Road. Tuesday, Wednesday, and Thursday, 5.30 to 7.
Note.—The Medical Officer will attend for examination of recruits, &c., on Thursday, at 6.
All enamelled cap badges must be returned to the Quartermaster-Sergeant without delay.
The Regimental Tailor will attend on Tuesday, October 30th, at Headquarters, at 6.30, to measure for uniforms.
Unless otherwise indicated, all drills will take place at Headquarters.
(By order) MACLEOD YEARSLEY, Capt. and Adjutant.

Metropolitan Association of Electric Tramway Managers.

—A meeting of the members of this Association was held at the Municipal and County Club, Whitehall, on Friday last, when there were present:—Messrs. Ullmann (East Ham), Harvey (Ilford), Hammond (Met. Electric), Williams (Erith), Stokes (Bexley), Mason (South Met.), Mackinnon (L.U.T.), and Goodyer (Croydon). Messrs. Ullmann, Hammond and Goodyer were respectively re-elected chairman, vice-chairman and secretary. A number of items on the agenda had to be left over for discussion at a subsequent meeting.

Municipal Trading: Our Obligations to Posterity.

The following is an extract from the report of the chairman of the Christchurch (New Zealand) Municipal Tramway Board for the year ending March 31st, 1917:—"Some day the New Zealand Legislature may recognise the advisability in view of the rapid increase in municipal trading concerns, of setting up a standard, as the result of the fullest investigation, for the guidance of those municipalities which desire to strike a true balance between the rival interests of the present generation, which wants to get as many benefits as possible from its municipal trading concerns, and the coming generation, which, while undertaking its own new burdens, should not receive, by way of legacy, obligations which should have been met by its forefathers."

Appointments Vacant.—Chief assistant engineer, for the Fleetwood U.D.C. electricity works, £150; mains engineer (£3) for the Lowestoft Corporation electricity and tramways departments; shift engineer (£220) for the Manchester Corporation electricity department; assistant electrical engineer for the Bnxtion Corporation electricity undertaking; charge engineer (50s.) for the L.C.C. Tramways Department; meter repairer (45s.) for the Luton Borough Electricity Works. See our advertising pages to-day.

Central Station Employes: St. Pancras Proposals.

In view of the general increase of wages throughout the country to employes engaged in electrical undertakings, the St. Pancras Borough Council has secured information regarding the rates paid by other municipal undertakings, and, as a result, the Electricity Committee makes the following recommendations:—

	Present maximum weekly wages.	Revised maximum weekly wages as recommended.
Station superintendent (King's Road)	£208 + 25 + 17 = £250 per annum; present salary £233 per annum	To receive maximum salary of £250 forthwith, instead of on Dec. 16th next, when it becomes due. £200 to £225 per annum, paid monthly.
Chief assistant (Regent's Park)	£3 10s. per week	
Shift engineers (King's Road)	£3 0 0	£3 15 0
Shift engineers (Regent's Park)	2 10 0	3 5 0
Sub-station electrician	2 0 0	2 12 6
Switchboard attendants	1 10 0	2 0 0
Engine drivers	2 0 0	2 7 6
Condenser hands	1 12 6	2 0 0
Cleaners	1 10 0	1 15 0
Boiler foreman	3 5 0	3 10 0
Stokers (per shift)	5s. 3d. per shift	6s. 6d. per shift.
Trimmers	4s. 4d. per shift	5s. per shift.
Storekeeper (King's Road)	£1 17 6	£2 0 0
Storekeeper (Regent's Park)	1 15 0	1 17 6
Mains superintendent (out-doors)	4 10 0	No alteration.
Mains superintendent (in-doors)	4 0 0	No alteration.
Meter and installation superintendent (Vacant)		
Meter and installation assistant	£2 5 0	£2 10 0
Meter repairer	2 0 0	2 5 0
Meter inspector and repairer	1 17 6	2 2 6
Meter exchangers	1 12 6	1 17 6
Boys, 14—16 years of age	0 10 0	10s. to 15s.
Youths, 17 years and upwards	1 5 0	£1 to £1 5s.
Improver	1 7 6	£1 to £1 7s. 6d.
Carpenter	2 5 0	£2 10 0
Storekeeper (mains department)	1 15 0	1 17 6
Arc lamp foreman	2 2 6	2 10 0
Assistant arc lamp foreman	2 0 0	2 5 0
Arc lamp trimmer	1 15 0	1 17 6
Arc lamp repairer	1 15 0	1 17 6
Cable jointer (sen.)	2 5 0	2 10 0
Cable jointer	2 2 6	2 7 6
Cable mates	1 12 6	1 17 6
Ganger	1 17 6	2 2 6
Manhole inspector	1 12 6	1 17 6
Wireman, first	2 0 0	2 5 0
Wireman, second	1 15 0	2 0 0

Inquiries.—Makers of machines for the manufacture of litharge perforated lead sheet and moulding lead grids for accumulators are asked for.

Institution and Lecture Notes.—**Belfast Association of Engineers.**—The new session opened last night (Thursday) with the presidential address of Mr. A. M. I. Cleland on "The Relations between Employer and Worker." Other events in the programme are:—

December 20th.—"Electro-Metallurgy," G. L. Roslyn.
January 17th, 1918.—"Past, Present, and Future of the Internal-combustion Engine," Prof. J. H. Smith, D.Sc.
February 21st.—"Decimal System," Dr. W. J. Crawford.
March 21st.—"The Panama Canal," J. Milne Barbour, D.L.

Institution of Engineers and Shipbuilders in Scotland.—The report of the Council for the year ending on September 30th, 1917, shows that the membership was 1,573, a decrease of 20 members. The income was £3,536, and the expenditure £3,413, leaving a surplus of £123.

Greenock Electrical Society.—The opening meeting of the session took the form of a whist drive in aid of Red Cross funds on October 18th. The honorary president, Mr. Hugh Ferrier, gave a short address on "Technical Education."

Manchester Association of Engineers.—At the first meeting of the session, on October 13th, the president, Mr. J. P. Bedson, delivered an address in which he referred to the mineral riches of Alsace-Lorraine, Belgium, and the North of France, which Germany desired to secure; and afterwards dealt with the importance of unified control of all transport facilities in this country. As an instance of what the British manufacturer was up against in the matter of transport cost, he said that before the war Belgian nail-makers, buying their rods in Germany, 400 miles from their own works, could get them delivered for 1s. 6d. per ton by water, and could deliver into the Thames for 5s. per ton, a total of 6s. 6d. per ton, whereas delivery from Manchester would have cost at least 15s. per ton. The cost of railroad transport in this country was 1'192d. per ton per mile, as compared with France 0'726d., Germany 0'637d., Holland 0'590d., Norway 0'867d., and Denmark 0'956d., the main reason for the high cost of transport in this country being our neglect of water transport. Canal and river transport on the Continent had been developed to a remarkable extent. The ton-mile traffic on the Rhine alone was 4,025,660,000, that on the Elbe 2,222,080,000, on the Seine 610,000,000, on the St. Quentin 291,075,000, and on the Scheldt 177,673,000. To reach that level in this country he imagined State aid would be necessary, and should a Ministry of Commerce be appointed, the State might be led to realise that our canals should be improved, utilised, and nationalised at the very earliest moment: in fact, they should be made free, on the same principle as highways.—*Colliery Guardian.*

Institution of Electrical Engineers.—The opening meeting of the 1917-18 session will be held on Thursday, November 8th, at 6 p.m., preceded by light refreshments at 5.30 p.m. Mr. C. H. Wordingham will deliver his inaugural address, and the premiums will be presented. By kind permission, the meeting will be held at the Institution of Civil Engineers, Great George Street, S.W.

Lancashire and Cheshire Linking-up Scheme.—The question of the linking-up of Lancashire and Cheshire electricity undertakings is to be further discussed at a conference which is to be held in Manchester next month. The second report of the Inter-connection Committee will be considered, and opposition will then be forthcoming from several of the authorities interested in the suggestion contained in the report, that the Joint Board shall be invested with powers to acquire, when and where necessary, the ownership and control of existing power stations.

A meeting of "Group C" has been held at Stalybridge, at which there were present representatives from the boroughs of Ashton-under-Lyne, Oldham, and Stockport, the Stalybridge Joint Electricity Board, and the Glossop Electric Lighting Co. After full discussion of the report, it was unanimously decided to express agreement generally with the proposals for linking-up the electricity undertakings in the Lancashire and Cheshire area, but stating disagreement with that portion of the report which refers to the conferment of additional powers upon the proposed Joint Board in regard to the establishment and control of all future and existing power stations and high-pressure transmission lines. The view was expressed that the idea of supplying the whole of the district concerned with current produced from one central generating station would probably mean an increase in the price for lighting, and certainly an increase in the price of current for power purposes.

Reference to the matter was made at a recent meeting of the Oldham Corporation Electricity Committee. Coun. Jackson said that the price at which it was proposed to supply current under the scheme was in excess of the figure at which Oldham were able to supply at present; in fact, the proposed price was a farthing per unit higher than Oldham's charge. The idea of linking-up electricity stations was all right, but he took exception to that part of the scheme which might simply reduce the Oldham works to the level of a distributing station. Coun. Frith said that the biggest difficulty they had was the fact that they could not buy machinery. When the war was over, and they could get the requisite plant, they would be able to supply current cheaper than at present, and at a rate that would be far less than that proposed under the centralised scheme, which he thought was altogether too big to be workable.

British Dyes, Ltd.—In the annual report it is stated that the electrical installation has been completed, and both the old and new works are now entirely operated by the company's own plant. A power gas plant has been completed, and is in

operation. A pipe system for the distribution of gas, steam, and compressed air throughout the works is approaching completion.

The Association of Electrical Station Engineers of London.—The following letter has been received by this Association from the Chief Industrial Commissioner's Department, Ministry of Labour, Whitehall, S.W., by the Association:—

"With reference to your letters of the 19th and 20th inst., I am directed by Sir George Askwith to say that, so far, no agreed conference has taken place. Such a conference is only being arranged between the parties, and he would suggest that you should communicate with Mr. Edward Calvert, Hon. Sec., Associated Municipal Electrical Engineers, Electricity Works, Squire's Lane, Finchley, with a view to being represented at the conference."

Accordingly, the hon. secretary of the Association, Mr. W. A. Jones, A.M.I.E.E., wrote to Mr. Calvert as follows, on October 22nd:—

"re Conference between the A.M.E.E., E.T.U., and Representatives of London Borough Councils.

I beg to enclose herewith a copy of a letter from the Chief Industrial Commissioner with respect to a claim made by this Association to represent power station engineers-in-charge and technical assistants at the above conference.

I enclose a list of the London power stations, the staffs of which are represented by this Association. Such further information as you may require to substantiate the claims made by this Association I shall be pleased to supply.

In view of the close proximity of the commencing date of the conference, I shall be glad to receive your assurance, at the earliest possible moment, that facilities will be granted for this Association to be represented."

We are informed that a circular is being addressed to the London power stations in the terms given below:—

A representative Committee with executive powers has been formed to deal with the following matters:—

1. All questions arising out of and in connection with the conference between the A.M.E.E. and E.T.U. under the presidency of Sir Geo. Askwith.

2. To plan the reconstruction of the London division of the above Association.

The constitution of the Committee is as under:—

Chairman: Mr. H. W. Healy (Battersea).

Hon. Sec.: Mr. Arthur Jones, A.M.I.E.E. (Leyton).

Committee: Mr. E. N. Christmas (Islington); Mr. C. Cox (L.N.W. Railway, Stonebridge Park); Mr. W. Wilcocks (Hammer-smith); Mr. A. J. Giffin (West Ham).

Pending the full development of the reconstruction, of which you will receive notification in due course, three geographical divisions have been created, viz.:—West; North Central; East.

The appended tabulation will clearly indicate this sub-division, together with the officers acting for each division.

WEST.	NORTH CENTRAL.	EAST.
Mr. H. W. Healy (Battersea).	Mr. J. Cox (L.N.W.R., Stonebridge Park).	Mr. A. Giffin (West Ham).
Mr. Wilcocks (Hammer-smith).	Mr. E. N. Christmas (Islington).	Mr. W. A. Jones (Leyton).

STATIONS.		
Acton.	City of London.	Barking.
Battersea.	County of London (City Road).	Beckenham.
Barnes.	Central Elec.	Bermondsey.
Brompton and Kensington.	Finchley.	Blackheath S. Met.
Chelsea.	Hackney.	Bow (C.X. and City).
Chiswick.	Hampstead.	Dartford.
Croydon.	Hornsey.	Deptford.
Ealing.	Islington.	Erith.
Fulham.	Lambeth (South London).	East Ham.
Heston and Isleworth.	Neasden (Met. Rail.).	Ilford.
Kingston.	St. Pancras.	Leyton.
Kensington and Knightsbridge.	St. Marylebone.	Poplar.
Lots Road.	St. James' and Pall Mall.	Stepney.
Twickenham.	Westminster Elec. S.	Southwark.
Wandsworth.	Watford.	Shoreditch.
Wimbledon.		Walthamstow.
Wimbledon (L.S.W. Railway).		West Ham.
Willesden (North Met.).		Woolwich.

All inquiries concerning the Association should be directed to the officers in control of your division.

Membership of the Association embraces the following grades of engineering assistants:—

Engineer-in-charge.	Meter superintendents.
Assistant engineer-in-charge.	Draughtsmen.
Junior in-charge.	Testing engineers.
Mains assistants.	Publicity engineers.

The Association at present includes in its membership a number of senior technical or administrative officers. Engineers holding this rank are invited to communicate direct with the Hon. Sec., Mr. W. Arthur Jones, A.M.I.E.E.

Applications for membership will only be considered from fully qualified engineers, and should be made direct to the officers in control of your division.

H. W. HEALY (Chairman of Committee).
W. A. JONES, A.M.I.E.E. (Hon. Sec.).

Engineering Training.—Yesterday afternoon a meeting was to be held at the Institution of Civil Engineers, to form a Central Organisation for improvement in and better co-ordination of engineering training, and to appoint a representative committee of engineering and educational interests to initiate action in the matter. The proposal arises out of an informal conference of engineers and educationalists, which held several meetings at the Board of Education early this year.

The conference presented a memorandum to the Board suggesting that a bureau might be established within the Department, and the suggestion received strong support from professional men, accompanied, however, by an expression of opinion that an independent organisation would be preferable. Mr. Fisher, President of the Board, agreed with this view, and the meeting was accordingly convened. A report will appear in our next issue.

Engineering in China.—At the Engineers' Club, Manchester, on Tuesday evening, Mr. S. W. B. McGregor, who for some years represented a group of British manufacturing engineers in Shanghai, opened a debate on "The Commercial Aspect of Engineering in China."

Late Legal.—OSRAM LAMP WORKS v. POPE'S ELECTRIC LAMP Co.—Yesterday, by a majority of three to two, the House of Lords decided the above case in favour of the Osram-Robertson Lamp Works, Ltd., with costs.

OUR PERSONAL COLUMN.

Central Station and Tramway Officials.—The Preston Corporation Tramways Committee recommends the appointment of Mr. HENRY CLAYTON as assistant engineer and manager at £200 a year.

The Electricity Committee of St. Pancras Borough Council recommends that the salary of Mr. T. W. MERRY, superintendent at the King's Road Station, be increased from £233 per annum to the maximum of £250 per annum forthwith.

Blackpool Electricity Committee has appointed Mr. GEORGE YATES electrical fittings superintendent at £200 per annum, rising by annual increments of £25 to £250; Mr. HERBERT MAKIN to be salesman and chief clerk, at £180, rising by £10 to £200; Mr. WALTER UNSWORTH to be invoice and ledger clerk, at £150, rising to £160 at the end of 12 months; and Mr. F. W. LEATHERBARROW to be stores clerk in the electricity department at £135, rising to £150.

Barnes U.D.C. has increased the salary of Mr. CORNET, shift engineer at the electric light works, from £160 to £180 a year, and his war bonus from £16 to £18 per annum.

General.—Mr. E. W. FLOWER has resigned the office of president of the Federated Electrical Trades Union of Australia (N.S.W. Branch). In his letter to the Union, which is prominently published in the Australian Press, he says:—

"The obligations which I have taken, and which are numerous, are of such a character that I feel I cannot allow myself to be associated any longer with this strike. I have endeavoured to remain loyal to my Union at all times, and I trust I have proved so, but the conditions of my country compel me at this hour to go, and which is I think and right. I cannot consider my co-operation here longer; and I thank you, and would ask you to do so, for this forthwith."

Mr. Flower has resumed duty in the railway department.

On October 22nd a presentation was made to Mr. MALCOLM BREINGAN, manager of the Glasgow branch of the Western Electric Co., Ltd., by friends in the electrical trade on the occasion of his approaching marriage. The presentation took the form of a handsome salver, uniquely decorated with facsimile initials of the donors.

Mr. G. W. TEMPEST, chief engineer for the Lancashire and Yorkshire Private Telephone Co., Manchester, has been married at Heptonstall (Yorks.) to Miss Ethel Sutcliffe. From his employers, Mr. Tempest received a cheque and dinner service.

At Manchester, on Saturday last, the wedding was solemnised of Miss VERA FERRANTI, daughter of Dr. S. Z. de Ferranti, of The Hall, Baslow, and Lieutenant ERLING ORD, Canadian R.A.M.C., who holds the Croix de Guerre. Lieutenant ORD attended the bride's brother, Major Ferranti, who died of wounds in July, while he was in hospital, and he was entrusted with the late Major's last message home. It was in this way that he first met the lady who is now his wife.

At Brantford, Ontario, according to the *Times*, the Duke of Devonshire unveiled a monument to Dr. ALEXANDER GRAHAM BELL, inventor of the telephone. Dr. Bell and Mrs. Bell were present. Dr. Bell's first successful experiment was made in Brantford in 1871, and the Bell Homestead of 13 acres has been acquired by the Bell Memorial Association.

Roll of Honour.—Captain DESMOND GARDINER TROTTON, R.F.A., who, according to the *Times*, was killed on October 15th, took a degree in electrical engineering at University College, London.

Sergeant D. LIVINGSTON, R.F.A., who has fallen in action, was with Messrs. Richardson, Wetherth & Co., of Hartlepool.

Private D. L. JELST, Durham L.I., who was on the staff of Messrs. Richardson, Wetherth & Co., Ltd., Hartlepool, has been wounded in action.

Corporal R. A. KNIGHT, R.E., who has fallen in action, was on the staff of Mr. W. Rigden, electrical engineer, of Ramsgate.

Lance-Corporal F. ANDERSON, of the Croydon Corporation tramway staff, has died whilst on active service.

Corporal A. C. PEARCE, R.E., an overhead linesman on the Corporation tramways at Croydon, has been awarded the Military Medal.

Sapper J. F. BAGNALL, R.E., awarded the Military Medal for bravery in maintaining telephonic communication under heavy shell fire, was on the staff at Siemens Bros. Dynamo Works, Stafford.

Private W. F. WEBB, City of London Regiment (P.O. Rifles), killed in action, was a meter inspector in the Winchester Corporation electricity department.

Second-Lieutenant W. G. MANSELL, 3rd East Surrey Regiment, attached to the R.E.C., reported missing, and feared killed, was, on the outbreak of war, an electrical engineering student at the Battersea Polytechnic.

The Military Medal has been gained by Company Sergeant-Major UNDERWOOD, Royal Welsh Fusiliers, an inspector on the Mansfield & District Light Railways. On September 13th last he led a raid on the enemy trenches, and was instrumental in getting in all the wounded.

Private W. BRUFORD, who has died from wounds, was employed by Messrs. Dick, Kerr & Co., Ltd., Preston.

Private S. HENSHALL, of the Coldstream Guards, who has been killed in action, was employed by the Lancashire Electric Power Co.

Private E. HALL, Manchester Regiment, who died of wounds on October 10th, was employed by the British Westinghouse Co., Ltd., Trafford Park.

Sapper F. SMITH, R.E., who was wounded in France a fortnight ago, was employed in the Accrington Corporation electricity department.

Private E. SUMNER, severely wounded, was head clerk for the Alderley & Wilmslow Electric Supply Co.

Lance-Corporal J. WALMSLEY, L.N.L. Regiment, and Sapper R. C. BOND, R.E., both employees of Messrs. Dick, Kerr and Co., Ltd., Preston, have been killed in action.

Sergeant W. PALFRAMAN, holder of the D.C.M. and two Certificates of Merit for bravery in action, who was a former employee of the Bradford tramways department, was presented to the Tramways Committee last week whilst on leave. A resolution of hearty congratulation was accorded him.

Gunner R. BOXWORTH, R.F.A., who has died of wounds in France, aged 43, was employed by Messrs. Whipp & Bourne, electrical engineers, Castleton.

Private T. COOK, King's (Liverpool) Regiment, killed in action, was employed by Messrs. Dick, Kerr & Co., Ltd., Preston.

Sergeant J. DOYLE, recently awarded the Military Medal, has since died of wounds. He was for many years before enlistment a motorman on the Liverpool Corporation tramways.

Corporal P. WHITESIDE, R.F.C., who has been wounded, was an apprentice electrician with the Lancashire & Yorkshire Railway Co.

Private A. E. GOOD, Oxford and Bucks. L.I., who has fallen in action, was employed by the Electric & Ordnance Accessories Co., Aston.

Corporal E. P. MOORE, Machine Gun Section, formerly employed in the electrical laboratory of the B.T.H. Co., Rugby, has been killed.

Second-Lieutenant H. V. SCHOFIELD, who received his early training as an electrical engineer at the Whithy U.D.C. electricity works, has been appointed Adjutant of his Brigade, and will assume the acting rank of Captain.

Sapper J. MUGHAN, a Leeds electrical engineer, has been admitted to hospital suffering from trench fever.

Lance-Corporal W. KILLAN, Seaforth Highlanders, killed in action on October 12th, was employed by Messrs. C. Macintosh & Co., Ltd.

Sergeant J. SEAZEL, R.A.M.C., who has fallen in action, was formerly in the employ of Messrs. Messengers & Sons, electric lamp manufacturers, Birmingham. He had been recommended for the Military Medal.

The *Times* reports that Lieutenant (late Acting Captain) J. H. CARDEW, M.C., R.F.A., died of wounds on October 5th. He graduated with honours, specialising in electrical science, at the McGill University, Montreal. He was trained as an electrical engineer at the British Westinghouse Works, where he was captain of the Westinghouse Football Club. He entered the Indian Government service in 1909, and at the outbreak of war held the appointment of electrical engineer of the Oudh and Rohilkund and North-Western State Railways.

Obituary.—Mr. H. A. WROTTESELEY FANSHAW.—The death occurred in London, on October 18th, of Mr. H. A. Wrottesley Fanshawe, late of the Indian Government Telegraphs, at the age of 70 years.

Mrs. M. LONGRIDGE.—We regret to learn from the *Times* "Deaths" columns that Mrs. Michael Longridge has passed away in South Devon, at the age of 70 years. We desire to tender an expression of sympathy to Mr. Michael Longridge, President of the Institution of Mechanical Engineers, in which expression, we believe, we shall carry with us the feeling of a wide circle of friends and admirers.

Mr. J. J. KIRKHAM.—The death took place on October 15th of Mr. Joseph John Kirkham, manager of the works of the Deal and Walmer Gas & Electricity Co. He had held this position for 21 years.

CITY NOTES.**Dick, Kerr
and Co., Ltd.**

The report for the year ended June, 1917, states that the profits earned were £95,465, to which is added £20,397 brought forward. After paying debenture interest, trustees' fees, and premium on debenture stock redemption, the balance is £105,374. Six per cent. has been paid on the preference shares, 10 per cent. is recommended on the ordinary shares, £25,000 has been put to supplement special reserve for contingencies, and £56,074 is to be carried forward. The amount of excess profits levy has not been finally settled; the reserves are sufficient for extra depreciation, special taxation, &c. The work carried out by all departments on behalf of the Government has been of even greater magnitude than in the preceding year. The national factory mentioned in last year's report has been completed and organised, and was handed over to the Government as a going concern in July, thus releasing a number of members of the staff of the company for new development work in other directions. The company has acquired the control of the United Electric Car Co., Ltd., by the purchase of the greater part of the issued preference and ordinary shares of that company. Steps have since been taken to amend the Articles of the Car Co. so as to enable Dick, Kerr & Co. to retain control of that company so long as it continues to hold the ordinary shares, and the directors, therefore, intend to dispose of the preference shares so as to replace the capital of the company temporarily invested therein. Before offering the shares for sale elsewhere, the directors are inviting applications for them at par from share and debenture holders of D.K. & Co. The output of the Car Co. will be sold through D.K. & Co.'s selling organisation, and it is anticipated that a considerable increase in business and reduction in general and administrative expenses will result. Annual meeting: London, Oct. 31st.

The second annual meeting was held in **Erinoid, Ltd.** London on October 18th. The chairman,

Mr. ANDREW BINNIE, moved the adoption of the report, which recommended a dividend equal to 16½ per cent. per annum. For 1915 the trading profits were £5,825, for 1916 £9,472, for 1917 £22,191. They could not hope to continue to progress at that rate, but it was significant that the sales showed a continuous increase. The increased profits were not due to profiteering, but to natural growth of a new industry. The results had been achieved despite all the restrictions with which business was hampered to-day. The workers in the Stroud Valley were of a fine type, and their relations with them had always been of the most excellent nature, due in a large measure to the wise and sympathetic management of Mr. Cleeve and the local managers. They were creating a strong financial position. Mr. Binnie referred to the vexed question of excess profits duty and its application to new industries. New industries would be seriously handicapped. They must either work with inadequate working capital or be considerably over-capitalised by comparison with older industries. In view of the embargo on new capital, many of them might be driven to borrowing. A duty of 50 per cent., or even 60 per cent., was tolerable, but 80 per cent. stifled new industries and penalised thrifty management. The increase was a serious mistake. Although their company was not at present seriously affected by the excess profits legislation it was desirable that directors of new industries should take every opportunity of stating their case, and he hoped that discrimination might be exercised in applying new and untried legislation to our new industries.

The A.E.G.—The prospectus has just been published in Berlin in connection with the admission to quotation on the Berlin Stock Exchange of new shares of the nominal value of £1,450,000, which were decided to be issued in December, 1915, so as to permit of an interchange of shares with the company's subsidiary, the Berlin Electricity Works Co. Since then (July, 1917), a further emission of nominally £800,000 has been made by the A.E.G., and been taken over by the same company, which in exchange transferred shares in the Electro Works Co. to the A.E.G., which, in turn, as previously reported, has assigned these and other interests in the Electro Works Co. to the Imperial Government. At present the share capital of the A.E.G. stands at £10,000,000, the reserve funds are stated to amount to £4,650,000, and the loans of the 4, 4½, and 5 per cent. types which are still unredeemed total £5,300,000. The investment portfolio is represented by £2,819,000, and includes £980,000 in war loans and Government bonds, £265,000 in shares of branch companies, £625,000 in shares in A.E.G. sale companies, £477,000 in book value of 14,510,000 fcs. of shares in the Zurich Bank for Electrical Undertakings, and £362,000 in shares of the Felten & Guilleaume Co. The number of workers employed by the A.E.G. on July 1st, 1917, is stated to have been 79,293.

North Metropolitan Electric Power Supply Co.—An extraordinary general meeting of this company was held last week, when, according to the *Morning Post*, a resolution was passed to the effect that the amount which the company were autho-

risied to borrow on debenture or mortgage of the undertaking, a sum not exceeding the nominal amount (inclusive of bonus) of £13,333 be raised by the issue at such price, and to such persons, as the directors might determine of further mortgages in the like form and on the like terms and conditions as, and ranking *pari passu* with, the existing mortgages. Mr. E. GARCKE, who presided, explained that the object of the resolution was to enable the directors to provide security to be deposited with the Treasury in respect of loans obtained with the concurrence of the Ministry of Munitions for the purpose of carrying out extensions of cables and for other works to enable supplies of energy to be given for munition manufactures and other war purposes. The resolution was carried.

Claud Hamilton, Ltd.—The report for the year ended April 30th last states that the balance at credit of profit and loss account, after writing off the usual depreciation, is £10,669. Deducting from this the preference dividend, there is left for disposal a balance of £9,919. The directors recommend a dividend of 7½ per cent. and a bonus of 2½ per cent., less tax, on the ordinary shares; writing down investments, £500; placing to credit of a dividend equalisation account £2,000; and carrying forward the balance of £5,169.—*Financial Times*.

Stock Exchange Notice.—Application has been made to the Committee to allow the following to be quoted in the official list:—

Dick, Kerr & Co., Ltd.—Further issue of 40,000 ordinary shares of £1 each, fully paid, Nos. 260,001 to 300,000; and 45,000 six per cent. cumulative preference shares of £1 each, fully paid, Nos. 305,001 to 350,000.

Anglo-American Telegraph Co., Ltd.—Interim dividend for the quarter ended September 30th, 15s. per cent. on the ordinary stock, and £1 10s. per cent. on the preferred stock, less income-tax.

West India & Panama Telegraph Co., Ltd.—Interim dividends for half-year ended June, 1917:—6s. on the first and second preference shares, 6d. per share on the ordinary, free of tax.

Western Telegraph Co., Ltd.—Dividend, 3s. per share, and a bonus of 4s. per share, both free of tax, making the total for the year ended at June, 1917, 8 per cent.

Babcock & Wilcox, Ltd.—Interim dividend, 6 per cent.

STOCKS AND SHARES.

TUESDAY EVENING.

THE strength which has prevailed amongst gilt-edged stocks gives no indication of abatement, and the inauguration of another thrift campaign will have the effect of giving a fillip to the issue of National War Bonds. This has an effect upon other gilt-edged stocks, and the Consol market is good throughout, reflecting firmness on such issues as industrial debenture stocks, and the best class preference shares. The discussion that has arisen with regard to the possibility of a levy on capital is not affecting Stock Exchange markets in any way, but the prospects which are opened in this direction are arousing a good deal of attention. They make, at any rate, an interesting, not to say poignant, subject for consideration.

The home railway market is but fairly well maintained. Once more the amount of public support necessary to keep things going in this section has dwindled away, and business is of a very irregular order. The Undergrounds, however, keep tolerably steady, and the advertisement which they received through moonlight nights is regarded as a somewhat grim bull point for the stocks. Underground Electric Income bonds are maintained at 84, but Metropolitan shed ¼ and Districts declined to 16. There is not much doing in the other stocks.

Activity in Marconi shares is wavering a little. One day there will be a very animated market, while on the next, business falls away to a shadow. Attention centres a good deal upon the American Marconi shares, possibly because there is more speculation in these; possibly because those who follow the market seem to think there is wider scope for capital appreciation here than there is in the other Marconi shares. The parent Marconis are 1/16 lower at 3 7/16. Americans rose to 23s. 3d., but came back again to 22s. 9d. Canadians are 11s. 9d., and Marines, which have a useful investment following, are a good spot at 2 21/32, both old and new shares. There has been a little interest taken just lately in shares of the Spanish Marconi Co., the price being about 11s. 6d.

The appetite for cable stocks is keen as ever. Easterns, Westerns, Eastern Extensions, and Globes are the four popular investments, this, of course, being due to the fact that the dividends on the quartette are paid free of income-tax. Prices are better, and once again it has to be remarked that stock is a good deal more easy to place than it is to buy. The recent reports are excellent, and have given reassurance to those who were inclined to apprehend a possible deduction of income-tax from dividend payments. At present, anyway, there seems to be little fear of such an alteration being made.

South Londons are 5s. better at 3; Bromptons reacted $\frac{1}{2}$ to 6 $\frac{1}{2}$. These are the only changes amongst the Home electricity shares, where the list as a whole keeps very hard. General Electric ordinary have risen to 18. British Westinghouse preference eased off to 2 15/16. Recent buyers of these shares are wanting to take their profits in the absence of any further developments—even rumour being quiet—in connection with the American interests that were recently credited with intentions to bring about some kind of working arrangement between the manufacturers in this and their own country. Edison Swan shares, however, are better. The fully-paid have gained 5s. at £2; the £3 shares rose to 21s., though at the moment they are obtainable at this price. The company's 1 per cent. debenture stock is a point up.

In the colonial and foreign group, Kalgoolie preference have hardened to 5s. 3d., but Kalgoolie Tramways debenture at 12 $\frac{1}{2}$ is lower, the price being still more or less nominal. One feature of the last few days is a persistent demand for Manila Electric Railway capital stock, on which the price has risen 4 to 70. Anglo-Argentine Trams First preference receded to 3, and Brazil Traction remain depressed at 45. The Mexican stocks are also dull and heavy, small falls occurring in the bonds of the Tramways Co. British Columbia 4 $\frac{1}{2}$ per cent. debenture at 51 shows a slight recovery.

Rubber shares are steady and command a good deal of support. There is a further advance amongst copper issues. The armament shares have been inactive, but iron and steel descriptions keep on rising. On the whole, the Stock Exchange gets a good deal of business these days, in spite of air raids and other impediments.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend	Price	Rise or fall	Yield
	1915. 1916.	Oct. 23, 1917.	this week.	p.o.
Brompton Ordinary	10 9	6 $\frac{1}{2}$	— $\frac{1}{2}$	£6 18 6
Charing Cross Ordinary ..	5 5	8 $\frac{1}{2}$	—	6 9 0
do. do. do. 4 $\frac{1}{2}$ Pref. ..	4 $\frac{1}{2}$ 4 $\frac{1}{2}$	8 $\frac{1}{2}$	—	6 18 4
Chelsea	4 8	2 $\frac{1}{2}$	—	5 9 1
City of London	8 8	18	—	6 8 1
do. do. 6 per cent. Pref. ..	8 6	10 $\frac{1}{2}$	—	5 18 6
County of London	7 7	11	—	6 7 3
do. do. 8 per cent. Pref. ..	8 8	10	—	6 0 0
Kensington Ordinary	7 6	6 $\frac{1}{2}$	—	5 14 3
London Electric	8 8	1	—	Nil
do. do. 6 per cent. Pref. ..	6 4	8 $\frac{1}{2}$	—	5 6 8
Metropolitan	8 8	8 $\frac{1}{2}$	—	4 12 4
do. do. 4 $\frac{1}{2}$ per cent. Pref. ..	4 $\frac{1}{2}$ 4 $\frac{1}{2}$	8 $\frac{1}{2}$	—	7 4 0
St. James' and Pall Mall ..	8 8	7	—	5 14 6
South London	5 5	3	+ $\frac{1}{2}$	6 13 4
South Metropolitan Pref. ..	7 7	31/6	—	6 10 6
Westminster Ordinary	7 7	6 $\frac{1}{2}$	—	5 3 3

TELEGRAPHS AND TELEPHONES.

	Dividend	Price	Rise or fall	Yield
	1915. 1916.	Oct. 23, 1917.	this week.	p.o.
Anglo-Am. Tel. Pref.	6 8	99	—	8 1 0
do. do. Def.	68/6 1 $\frac{1}{2}$	28 $\frac{1}{2}$	—	8 9 0
Chile Telephone	8 8	7 $\frac{1}{2}$	—	5 11 4
Cuba Sub. Ord.	5 6	8 $\frac{1}{2}$	—	5 14 9
Eastern Extension	8 8	14 $\frac{1}{2}$	+ $\frac{1}{2}$	5 7 7
Eastern Tel. Ord.	8 8	149 $\frac{1}{2}$	+1	5 7 0
Globe Tel. and T. Ord. ..	7 7	18 $\frac{1}{2}$	+ $\frac{1}{2}$	5 6 8
do. do. Pref.	6 6	10 $\frac{1}{2}$	—	5 15 8
Great Northern Tel.	22 24	89	—	6 8 1
Indo-European	18 18	53 $\frac{1}{2}$	—	6 1 6
Marconi	10 16	3 $\frac{1}{2}$	+ $\frac{1}{4}$	4 7 8
Oriental Telephone Ord. ..	10 10	8 $\frac{1}{2}$	—	3 2 6
United R. Plate Tel.	8 8	6 $\frac{1}{2}$	—	5 16 4
West India and Pan.	8d. 6d.	1 $\frac{1}{2}$	—	3 6 8
Western Telegraph	8 8	15	+ $\frac{1}{2}$	5 6 8

HOME RAILS.

	Dividend	Price	Rise or fall	Yield
	1915. 1916.	Oct. 23, 1917.	this week.	p.o.
Central London, Ord. Assented	4 4	60 $\frac{1}{2}$	—	6 12 3
Metropolitan	1 1	24 $\frac{1}{2}$	— $\frac{1}{2}$	4 2 8
do. do. District	Nil Nil	16	— $\frac{1}{2}$	Nil
Underground Electric Ordinary	Nil Nil	1 $\frac{1}{2}$	—	Nil
do. do. "A"	Nil Nil	6/3	—	Nil
do. do. Income	6 4	8 $\frac{1}{2}$	—	5 15 3

FOREIGN TRAMS, &c.

	Dividend	Price	Rise or fall	Yield
	1915. 1916.	Oct. 23, 1917.	this week.	p.o.
Adelaide Sup. 8 per cent. Pref.	6 6	4 $\frac{1}{2}$	—	6 3 1
Anglo-Arg. Trams, First Pref. ..	5 $\frac{1}{2}$ 5 $\frac{1}{2}$	8	— $\frac{1}{2}$	9 3 4
do. do. 2nd Pref.	5 $\frac{1}{2}$ —	2 $\frac{1}{2}$	—	—
do. do. 5 Deb.	5 6	67 $\frac{1}{2}$	—	7 8 3
Brazil Traction	4 4	45	—	—
Bombay Electric Pref.	6 6	92	—	6 4 8
British Columbia Elec. Rly. Pfc. ..	6 5	40 $\frac{1}{2}$	—	12 8 10
do. do. Preferred Nil Nil	30	—	—	Nil
do. do. Deferred Nil Nil	27 $\frac{1}{2}$	—	—	Nil
do. do. Deb.	4 $\frac{1}{2}$ 4 $\frac{1}{2}$	51	+1	8 6 8
Mexico Trams 5 per cent. Bonds ..	Nil Nil	45 $\frac{1}{2}$	—	Nil
do. do. 6 per cent. Bonds ..	Nil Nil	39	—	Nil
Mexican Light Common	Nil Nil	22 $\frac{1}{2}$	—	Nil
do. do. Pref.	Nil Nil	35	—	Nil
do. do. 1st Bonds	Nil Nil	45 $\frac{1}{2}$	—	—

MANUFACTURING COMPANIES.

	Dividend	Price	Rise or fall	Yield
	1915. 1916.	Oct. 23, 1917.	this week.	p.o.
Babcock & Wilcox	15 15	3 $\frac{1}{2}$	—	4 12 4
British Aluminium Ord.	7 10	1 $\frac{1}{2}$	—	6 8 1
British Insulated Ord.	17 $\frac{1}{2}$ 20	14 $\frac{1}{2}$	—	6 15 7
British Westinghouse Pref. ..	7 $\frac{1}{2}$ 7 $\frac{1}{2}$	2 $\frac{1}{2}$	— $\frac{1}{2}$	5 2 0
Callenders	20 20	14 $\frac{1}{2}$	—	6 18 0
do. do. 5 Prof.	5 5	4 $\frac{1}{2}$	—	6 1 8
Castner-Kellner	22 22	8 $\frac{1}{2}$	—	6 8 0
Edison Swan, fully paid	— —	2	+ $\frac{1}{2}$	Nil
do. do. 4 per cent. Deb. ..	4 4	73 $\frac{1}{2}$	+1	5 8 10
Electric Construction	7 $\frac{1}{2}$ 7 $\frac{1}{2}$	1	—	7 10 0
Gen. Elec. Pref.	8 8	10 $\frac{1}{2}$	—	5 14 3
do. do. Ord.	10 10	18	+1	5 11 0
Henry	25 25	1 $\frac{1}{2}$	—	7 18 2
do. do. 1 $\frac{1}{2}$ Pref.	4 $\frac{1}{2}$ 4 $\frac{1}{2}$	1	—	5 12 6
India-Rubber	10 10	14	—	7 2 10
Telegraph Co.	20 20	40	—	5 0 6

*Dividends paid free of income-tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, October 24th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb. 1/6	..
a Ammoniac Sal	per ton £75	..
a Ammonia, Murate (large crystal)	" £54	..
a Bisulphide of Carbon	" £23	..
a Borax	" £28	..
a Copper Sulphate	" £63	£1 dec.
a Potash, Chlorate	per lb. 2/6	..
a " Perchlorate	" 2/-	..
a Shellac	per owt. £12 10	..
a Sulphate of Magnesia	per ton £16	..
a Sulphur, Sublimed Flowers ..	" £35	..
a " Lump	" £25	..
a Soda, Chlorate	per lb. 10 $\frac{1}{2}$ d.	..
a " Crystals	per ton 120/-	..
a Sodium Bichromate, casks ..	per lb. ..	..
METALS, &c.		
c Brass (rolled metal 2" to 12" basis)	per lb. ..	..
c " Tubes (solid drawn) .. ..	" ..	..
c " Wire, basis .. ..	" ..	..
c Copper Tubes (solid drawn) ..	per ton 1/6 $\frac{1}{2}$ to 1/7	..
g " Bars (best selected)	" £150	£1 dec.
g " Sheet	" £150	£1 dec.
g " Rod	" £150	£1 dec.
d " (Electrolytic) Bars	" £125	..
d " " Sheets	" £152	..
d " " Wire Rods	" £133	..
d " " H.C. Wire	per lb. 1/8 $\frac{1}{2}$	..
f Ebonite Rod	" 3/-	..
f " Sheet	" 2/6	..
n German Silver Wire	" 2/8	..
h Gutta-percha, fine	" 6/10	..
h India-rubber, Para fine	" 3/5 $\frac{1}{2}$	ad. inc.
i Iron Pig (Cleveland warrants) ..	per ton Nom.	..
l " Wire, galv. No. 8, P.O. qual.	" £32	..
g Lead, English Pig .. ..	" ..	..
g Mercury	per bot. Nom.	..
e Mica (in original cases) small ..	per lb. 8d. to 8/-	..
e " " " medium	" 6/6 to 6/-	..
e " " " large	" 7/6 to 14/- & np.	..
d Silicon Bronze Wire	per lb. 1/8 $\frac{1}{2}$	..
r Steel, Magnet, in bars	per ton ..	..
g Tin, Block (English) .. ..	" ..	..
n " Wire, Nos. 1 to 16	per lb. 8/6	..

Quotations supplied by—

a G. Boor & Co.	g James & Shakespeare.
c Thos. Bolton & Sons, Ltd.	h Edward Tilt & Co.
d Frederick Smith & Co.	i Bolling & Lowe.
e F. Wiggins & Sons.	j Richard Johnson & Nephew, Ltd.
f India-Rubber, Gutta-Percha and	k P. Ormiston & Sons.
Telegraph Works Co., Ltd.	l W. F. Dennis & Co.

Supplies for German Central Stations.—According to E.T.Z., the amount of copper allowed quarterly by the German Metal Controller for the purpose of maintenance and repairs in electricity undertakings is at present from 2 to 3 kg. (4 $\frac{1}{2}$ to 6 $\frac{1}{2}$ lb.) per 100 kw. installed. The allowance to stations which serve only lighting networks is subject to special control. All metal thus released must be replaced by old metal or, if there is a loss in the repair job, this must be made good by metal taken from some source not already requisitioned. The central station may not claim in respect of repairs, &c., to be made in consumers' works; the latter must make their own claim. Iron and steel supplies are subject to strict control, but iron parts held in stock by central stations for running repairs and the like, may be used without a special permit. Electricity stations stand third on the "urgency list" prepared by the military authorities for the control and disposal of railway trucks. The first three items on the list are: (1) Coal, coke and briquettes. (2) Timber of every description, wood carbonisation products. (3) Constructional and working materials, tools and machinery for mines, gas and electricity works. Electricity stations have had to put up with inferior or unsuitable coal supplies and they will remain under this disadvantage. In order that they may keep their boilers in good order and obtain full rated output from them, it is recommended that they adopt forced draught, cooled grates and coal breakers. These improvements should be made forthwith in order that they may be completely available for future peak-load periods. The Electricity Administration (Elektrizitätswirtschaftsstelle) is willing to do everything in its power to assist in rapid delivery and installation of the equipment concerned.

Charge of Stealing Lamps.—According to the *Daily Chronicle*, a charge of stealing 868,000 electric bulbs, valued at £1,800, was brought at the Guildhall on Saturday against Simon Deitch, a Spitalfields electrical engineer. Accused's explanation was that he bought the lamps, but in a box under his bed the police found 5,300 bulbs, which bore the initials of the prosecutor's factory. A remand was ordered, bail in £200 being allowed.

First Aid in Factories.—The order of the Home Secretary in regard to ambulance and first aid arrangements at blast furnaces, copper mills, iron mills, foundries and metal works, comes into force on December 1st, and copies may be purchased at H.M. Stationery Office.

THE HIGH-TENSION MAGNETO.

(Continued from page 382.)

THE INSTALLATION AND CARE OF A MAGNETO.

1. *Installation.*—Satisfactory operation of a magneto can only result if the alignment between the driving shaft and the magneto shaft be perfect. It is necessary to drive the magneto through some form of flexible coupling, and in a coupling that is used very extensively on aeroplane engines the drive is transmitted through a steel leaf spring having a total cross-section of 11 mm. \times 15 mm. Provision is made for obtaining an angular adjustment of the part which grips the leaf spring, with respect to the part secured to the magneto spindle, for the purpose of timing.

This particular design of coupling is not ideal, because whilst being sufficiently flexible in a plane at right angles to the axis of rotation, to take care of rapid and cyclic variations in the driving torque, it does not allow for the alignment of the two shafts being slightly in error. Obviously, any error of this nature will bring into play large stresses which may eventually cause the magneto to function imperfectly. A large percentage of the troubles that have arisen in practice with aeroplane magnetos have been due to imperfect alignment.

The magneto manufacturer is very careful in machining the base to ensure that the distance between the bottom of the base and the axis of the spindle conforms with extremely fine limits of accuracy. For example, this distance in the type A.S.S. magneto is nominally 50 mm., the limits being plus 0 mm. and minus 0.05 mm., giving a tolerance of 0.05 mm.

The author doubts whether engine builders are working to such fine limits as these in milling the platform to which the magneto is secured, and, in fact, it is a very difficult matter for them to do so. Some improvement is therefore to be looked for in the direction of devising some method of fixing that will simplify the machining problem. The use of a curved base plate on the magneto is a possible solution, because this enables the engine builder to machine the surfaces requiring alignment at a single boring operation, instead of having to perform two distinct boring and milling operations.

The curved form of base is used by the S.E.V. Co., of Paris, on one of their rotating armature type six-cylinder magnetos. With this arrangement dowel pins are used in the base for location purposes, the magneto itself being secured by some form of clamping device. This would seem to be an eminently sound arrangement.

Even when fixing screws are used in the base, it is customary to employ a strap which completely embraces the magnets. These straps are usually made of steel, and tests carried out on a type A.S.S. magneto have shown that the shunting of the magnet flux resulting therefrom amounts to about 6 per cent. This means approximately a 12 per cent. loss in the energy output of the magneto—an amount not to be overlooked. It is, therefore, recommended that the straps be made of phosphor bronze, and steps are now being taken to make this change.

2. *Timing.*—It is, of course, essential that when installing a magneto the adjustment of the coupling should be carefully made to give what is termed the correct "timing." In other words, when the contacts are just on the point of separating—as determined by the indication of a battery and bell connected in parallel with them—the relation of the driving shaft to the magneto shaft must be such that the piston in the cylinder to be fired is some definite distance from the top of its stroke. When the magneto is provided with variable ignition, this adjustment is made with the timing lever fully advanced. Usually, an aeroplane magneto is timed so that each cylinder is fired when the crank is about 30 deg. behind the dead-centre position.

In the type A.S.S. magneto the operation of timing is facilitated by the introduction of locking holes in the distributor brush gear wheel and distributor end plate, so that a pin inserted in the gear wheel can lock the sleeve inductor in the correct position. The pin can only be inserted after the distributor is removed, and likewise the pin must be withdrawn before the distributor can be replaced. This ensures that the magneto is not run with the locking pin inadvertently left in place.

3. *Setting of Distributor Brush.*—When the contacts are on the point of separating and the high-tension discharge is about to begin, the carbon brush (or metal brush in the type A.S.S. magneto) should overlap the distributor segment to the extent of about two-thirds of its contact surface. In the rotating armature type magneto the desired relation between brush and segment can be easily achieved by altering the meshing of the distributor brush gear wheel with the full-speed wheel on the armature shaft. Generally speaking, the correct meshing is indicated by the magneto manufacturer, who spot-marks two teeth on the brush gear wheel and one tooth on the other wheel. When the armature is in some definite position the latter tooth should mesh between the two former teeth.

In the type A.S.S. magneto the relation of brush to segment can only be altered by displacing the brush holder mounting with respect to the gear wheel to which it is secured. A change in the meshing of the two gear wheels is not permissible.

4. *Care of Distributor and Brush.*—The distributor and brush are vital parts of any magneto, and in overhauling they should be subjected to very careful treatment. The brush track of the distributor should be kept clean and polished. Any appreciable carbon deposit can be removed by cleaning the track with a cloth soaked in petrol, but if the segments protrude even by the smallest amount, it is necessary to have the track machined. If the distributor is made of an entirely satisfactory insulating material, trouble of this nature will not be experienced, because there will be no tendency for the insulation to shrink away from the metal during the life of the distributor.

For the best results to be secured, it is necessary to use a very hard grade of carbon brush, which should be properly bedded and polished. The spring tension should not be excessive, and both brush and spring should be perfectly free to move in a radial direction. There should be no signs of binding in the brush holder. In certain quarters a carbon brush having a highly-polished contact face is looked upon with suspicion, and in consequence it is the practice to remove the polished surface by the careful application of a file! This is a most pernicious habit, and cannot be condemned too strongly.

Experience has shown that to secure freedom from what is called "tracking" of the distributor it is very necessary to use a carbon brush that will readily take a high polish. The polished skin on the face of the brush is a desirable thing, and, when working in conjunction with a distributor made of suitable material, and having a polished brush track, there is no likelihood of "tracking."

5. *Contact Breaker.*—The satisfactory operation of any magneto is to a very large extent dependent upon the platinum contact breaker points being correctly adjusted. In the type A.S.S. magneto the maximum gap between the contact points, which are made slightly convex, should be .012 in. In rotating armature type magnetos the gap usually worked to is .015 in., and, generally speaking, a magneto that has to operate at very high speeds—that is, one which has to give a large number of sparks per minute, as in the case of a 12-cylinder magneto—should work with a smaller gap than one that has not to perform such strenuous duties. Great care should be exercised to prevent oil getting on to the contacts, because this will set up sparking, in consequence of the large resistance interposed between the contact faces, and carbonisation of the oil will result, which will greatly interfere with the satisfactory running of the machine. The contacts should therefore be kept perfectly clean, and this can be readily done by using a fine emery cloth. A file should not be employed under any circumstances whatever.

6. *Lubrication.*—As it is standard practice to use ball bearings in every type of high-tension magneto, very little lubrication is necessary, and special attention should be given to this point by all those who are entrusted with the care of magnetos fitted to aeroplanes or used for other purposes. Over-lubrication is, in fact, more likely to produce injurious results than too little lubrication, because the oil wells are likely to become flooded, and oil will possibly find its way into the distributor and contact breaker housing. Taking the type A.S.S. magneto, for example, six drops of oil in each oil well every 12 hours of running will be quite sufficient.

THE PROBLEM OF ENGINE STARTING.

The starting characteristics of the petrol motor are inherently bad. With other prime movers, such as the steam engine or turbine, motion results as soon as steam is allowed to enter the machine, whilst the ordinary electric motor can be started by the simple closing of a switch.

There are, fundamentally, only three methods of starting a petrol motor, neither of which is ideal:—

(a) To rotate the crank shaft slowly by applying a driving torque, until the cylinders are filled with an explosive mixture and the magneto is running at a sufficiently high speed to ensure satisfactory ignition. The driving torque may be produced either by hand rotation or by driving the crank shaft through gearing with an electric motor fed from a battery.

(b) To introduce compressed air into the cylinders so that the necessary driving torque is transmitted to the crank shaft through the medium of the pistons and cylinders. Starting is then effected as under (a).

(c) To fill one particular cylinder with an explosive mixture by hand rotation, or in some other way, and, whilst the crank shaft is stationary, cause an igniting spark to occur in this cylinder, using for this specific purpose a hand-operated auxiliary magneto co-operating with the main magneto. The main magneto may itself be adapted for producing this spark, while stationary, if suitable auxiliary apparatus be provided.

Method (a), using an electric motor, is generally adopted in America at the present time for motor-cars. It is also employed very considerably in this country for the same purpose. The method is far from perfect, chiefly for the reason that the torque required to start the engine is enormous for the size of motor that is generally installed.

The consequence is that at the instant when the switch is closed, the momentary rush of current reaches an extraordinarily high value—about 200 amps. for a 12-volt battery—when considered in relation to the capacity of the battery that has to supply it. Such treatment means that the battery very rapidly wears out and becomes useless.

This method has been tried on aeroplanes, but with what success the author cannot say. Fundamentally, it does not seem to be a method particularly suited to the requirements of the case, unless by very special attention to the design of the electric motor it is possible to reduce the weight to an extremely small figure.

Method (b) has also been tried on aeroplanes, but here, again, possibly on account of the increased weight of the compressed-air bottles which have to be carried, the method does not seem to have come into general use.

Method (c) appears to have met with the greatest success, and it is the method generally used at the present time on aeroplanes. So that this method can be applied, it is necessary to slightly modify the distributor brush holder, by adding what is termed a "trailing point." This is merely a nickel point which is moulded in the insulator so that the angle between it and the axis of the distributor brush is something of the order of 30 deg. This point is connected to a brass ring on the front of the brush holder moulding, and an extra terminal on the distributor is connected to an additional carbon brush which is in contact with the ring.

The hand-starting magneto—which is a small rotating armature type machine driven through gearing by hand—is connected to the extra distributor terminal, so that when it is operated the trailing point is maintained at a high potential. This means that when the trailing point comes in close proximity to the trailing edge of the distributor segment current will flow from the point to the segment through the air, and thence to the electrodes of the spark plug in the cylinder that is filled with an explosive mixture.

Owing to the angular displacement between the trailing point and the main brush, the piston in the cylinder under consideration will always be near the dead-centre position when the conditions as previously described obtain. The piston should, therefore, receive a forward impulse when the spark occurs, and this should be followed by other impulses in proper sequence, until a speed is reached at which the ordinary magneto is capable of performing its proper functions.

The hand-starting magnetos that have been developed in this country differ from the standard Bosch machine in that no high-tension switch is provided for the purpose of breaking the connections to the main magneto so long as the starting magneto is being operated. It is true that the introduction of such a device complicates the wiring, because it means that the high-tension lead from the armature of the main magneto has to be brought to a distributor terminal on the starting magneto, and another lead run between some other terminal on this distributor to the rotating brush on the main magneto.

Against all this we have to consider that the use of a high-tension switch absolutely prevents the main magneto coming into action until the starting magneto is stopped. Without the high-tension switch the main magneto will come into action at extremely low speeds, so that to prevent backfires it is necessary to retard the ignition during the starting period. The other scheme eliminates this necessity, because with fixed ignition on the main magneto it should be possible to take the engine up to a sufficiently high speed with the hand starter to ensure that when the main magneto comes into operation the timing of the spark will not be too far advanced.

It is perhaps not out of place to refer to the method of starting adopted on the 200-h.p. Maybach engine fitted to German airships brought down in this country, as described in *The Autocar* for December 16th, 1916. This type of engine has six cylinders, two-point ignition being provided. Two Bosch Z.H.6 magnetos—a new type of rotating armature magneto evidently developed since the outbreak of war—one of which is fitted with a trailing point, are provided. The hand starter is coupled up to the magneto with trailing point in the ordinary way.

A special method is adopted for filling the cylinder with an explosive mixture. By means of a lever and cam shaft all the valve tappets, inlet and exhaust, are lifted off their cams. At the same time the lever actuates other levers which close the exhaust passage to the silencer, by partially rotating the water-cooled barrel valve in the exhaust manifold. The exhaust ports and the outlet in the exhaust manifold are thus put in communication with a secondary outlet pipe that leads to a large suction hand pump, by means of which gas is sucked into the cylinders from the two carburettors through all the inlet valves. When this has been done the lever arm previously referred to is returned to its normal position. This operation opens the exhaust outlet to the silencer in the normal running position and closes the pipe leading to the suction pump. The hand starter is finally turned and the engine begins to rotate.

It is interesting to note that the angle between the trailing point and the centre of the distributor brush on the Bosch Z.H.6 magneto is 42 deg. On the type A.S.S. magneto fitted with trailing point this angle is, as already stated, 30 deg.

(To be continued.)

BRITISH AND AMERICAN ELECTRICAL TRADE WITH AUSTRALIA.

A FORTNIGHT ago we published (ELEC. REV., p. 348), under the title "Supertax" on British Trade with Australia," a criticism offered by the *Australian Statesman* of the action of the Australian Customs Authorities in adding 10 per cent. to British machinery invoice figures. We have now received the following copy of a letter written to the *Melbourne Age* by Mr. R. F. BUTLER, the local secretary of the B.E.A.M.A., which, in view of its interest, we quote in full:—

"The Senate last evening (August 10th) passed a resolution for the appointment of an official representative in Washington. The debate indicates that the function of this official representative will be to increase Australian trade with America, and recent cablegrams show that the appointment will be welcomed by the United States Government. The cordiality with which the proposed appointment has been received in the United States conveys the impression that the United States see, in the appointment, a possibility of increasing very materially its trade with Australia. It would be interesting to know whether the idea of making this appointment originated in Australia or in the minds of American representatives, either in the United States or in Australia. Anyone who has followed the development of this matter up to date cannot get away from the impression that its ready approval by the United States trade authorities is inspired by the idea that through this channel the trade of the United States with this country will be materially increased. We can hardly think that a producing country like the United States is hankering after the products of Australia to such an extent that it would invite or, at any rate, receive so warmly the appointment of an Australian representative merely for the purpose of promoting the exportation of Australian products to America, but rather that a country producing much the same commodities as Australia is animated more by the desire to use such a special representative as a means of increasing its export trade to Australia.

"For a considerable time this country has been courted in trade matters by America, who, naturally, has been taking advantage of the difficulties which British trade has experienced, due to war conditions, to extend her export trade to Australia. Australia appears now to be on the point of yielding to American persuasion, forgetting, apparently, the enormous debt she owes to Great Britain for her security and existence as a nation and for support in the whole of her financial transactions.

"In the business of exporting goods to Australia, America is a direct competitor of the United Kingdom, and in spite of our obligations to the mother country the Commonwealth Department of Trade and Customs has for some considerable time been increasing Great Britain's difficulties in carrying on her export trade with this country by 'loading' British invoices. Taking advantage of the increase which has taken place in the cost of manufacturing in Great Britain, particularly in dynamo-electric machinery, the Customs authorities have issued a ruling that all invoices for dynamo-electric machinery imported from the United Kingdom shall be loaded 10 per cent., with a net result that British manufacturers have to face a 10 per cent. increase in the duty which they have to pay, and which, in some cases, notably metal-filament lamps, is not imposed on, at least, one neutral country.

"The Customs Department may have legal justification, in view of the wording of the Customs Act, for loading invoices covering the importation of material which was contracted for before the war, but, at the present moment, if a British firm received an order for dynamo-electric machinery the invoice value is, for duty purposes, increased 10 per cent. by the Customs Department, notwithstanding the fact that such an invoice carries on the face of it the declaration required by the Customs as to its fair value, and independent altogether of any inquiries as to whether or not the particular invoice gives the fair market value in Great Britain. In this particular way the present administration of the Customs Act defeats the declared intention of this country to give preference to British material. To quote one instance: A 50-c.v. lamp imported from Holland pays in round figures 2½d. duty, while a similar lamp imported from Great Britain pays 5d. duty. It would be interesting to ascertain from the Customs Department whether, for example, they have in Holland at the present moment officers to ascertain what is a fair selling value of lamps in Holland, or whether they have officers in Sweden to ascertain the fair selling value of electrical material manufactured in Sweden and exported to this country.

"The whole attitude of the Customs Department, and the recent developments with regard to the appointment of a special representative in the United States, leaves a somewhat unpleasant impression in the minds of British manufacturers that Australia cares nothing for the success of British trade with this country, and that her attitude is not only indifferent, but is actually antagonistic to the support of British industry.

"Is it too much to ask that, while Australia enjoys its security, and while Great Britain is absorbed in the present European struggle with all her energy, Australia should not only support British trade in materials which cannot at present be manufactured in Australia, but should refrain from imposing additional burdens on the already hard-pressed

British manufacturer, and should also refrain from taking steps which will make it more difficult after the war for Great Britain to regain that portion of Australian trade to which, in common gratitude, she is entitled?"

The *Melbourne Age* makes the following comment on the matter:—

"Some light was thrown in the House of Representatives on the practice of the Customs Department in 'loading' invoices of dynamo-electric machinery imported into Australia from the United Kingdom. The Minister of Customs, in reply to Mr. Kelly (N.S.W.), said invoices were loaded by varying percentages, which were dependent upon the extent of the difference between the export price charged to the Australian importer and the home-consumption price charged to British buyers, which was the statutory basis of duty. This was done because it was found that manufacturers allowed buyers for export lower prices than were given to buyers for home consumption. These loadings had been imposed upon the invoice values of certain British firms, as far back as 1905, but the loadings now in force had, for the most part, been imposed since 1915. A similar practice had been followed in respect to certain American firms since 1907. The invoice values of metal-filament lamps from the United Kingdom were 'loaded,' but not of similar goods from Holland, because the prices charged for export by the Dutch manufacturer were the same as were charged for home consumption. Dutch lamps were accompanied by a certificate of origin, issued by the British Consul-General."

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

B.T.H. Oil-break Switches.

THE BRITISH THOMSON-HOUSTON CO., of Rugby, has recently issued two new lists, Nos. 4153 and 4155, dealing with oil-break switches, types O, form C, and O, form E, respectively. The former type, illustrated in fig. 1, is suitable for circuits up to 300 amps.

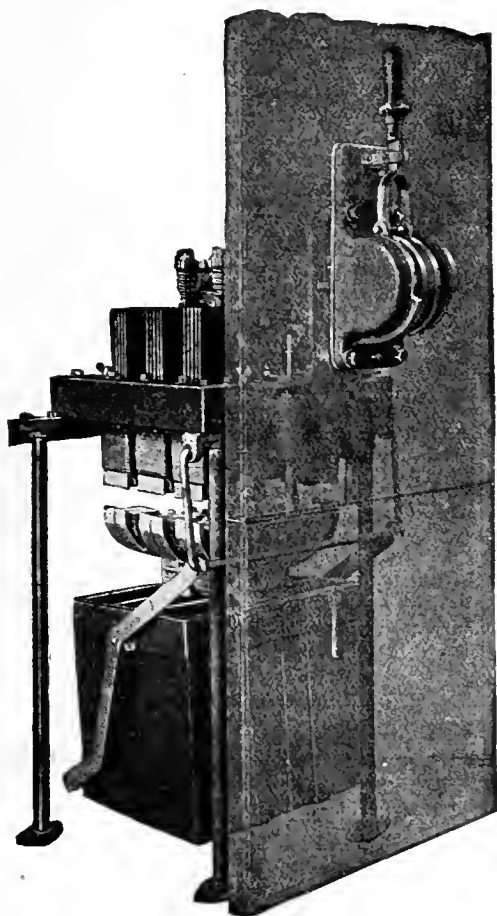


FIG. 2.—B.T.H. OIL-BREAK SWITCH, FORM E.

at 3,300 volts, while the latter type (see fig. 2) is designed for use on heavy A.C. circuits up to 650 volts with ratings of 2,000 and 3,500 amps. at 50 cycles or less.

In the former type, standard switches can be supplied in single, double or triple-pole non-automatic and automatic patterns suitable for switchboard mounting, also in single-pole automatic patterns for wall mounting.

These switches are of the free-handle type, and open by gravity when the tripping device operates; the switch motion is accelerated by the aid of springs, and a double break is obtained.

The oil vessel, trip coils, and operating mechanism are supported by a common frame; the switches can be provided with overload and low-voltage release, and in connection with the former a time-lag device of the oil dash-pot type can be supplied.

The form E switch is of heavier construction; the oil-tank contacts and operating mechanism are mounted on an impregnated

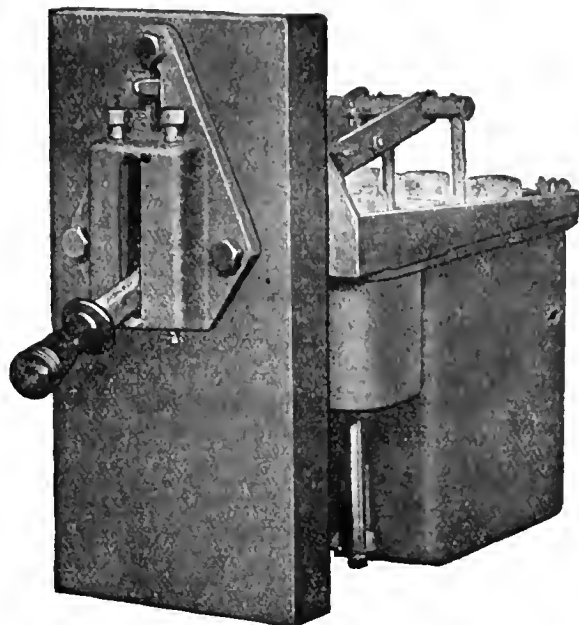


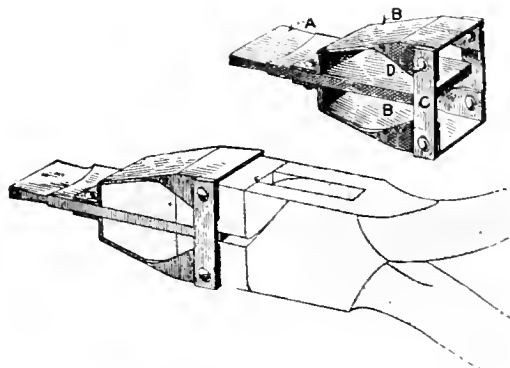
FIG. 1.—B.T.H. OIL-BREAK SWITCH, FORM C.

slate base, as shown in fig. 2; contact is made by laminated brushes bearing on solid copper blocks, and the brushes have renewable sparking contacts for the protection of the main contacts. Various combinations of trip coils can be provided, and in such cases B.T.H. time-limit fuses are fitted, giving a wide range of adjustment for time and current. The switch-operating mechanism is of the free-handle type, and auxiliary indicating circuits fitted with bell or lamp can be installed.

Screwdriver Attachment for Cutting Pliers.

Since pliers and screwdrivers are the tools most frequently used by the electrician, they should be in such a form that they can be easily carried around. Pliers with a screwdriver forged at the end of one of the handles are common, but the screwdriver is unhandy and is seldom used.

After considerable experimenting, the screwdriver attachment shown in the illustrations was developed and has proved very useful.



FIGS. 3. AND 4.—SCREWDRIVER ATTACHMENT FOR PLIERS.

In fig. 3, A is made of tool-steel and hardened. The jaws B are bent from $\frac{1}{8}$ -in. soft sheet iron and held together by the two straps C, and rivets D. Dimensions cannot be given, as curves and shapes change in accordance with the shape of the pliers used. The form is obtained by bending the sheet iron round the pliers and riveting it to the tool-steel blade A. The device is so small that it can be easily carried in the vest pocket. Fig. 4 shows the screwdriver attachment in place ready for use.—M. P. BERTRAND, in *Power*.

Drawn-wire Lamps in Austria.—The patent dispute concerning the rights in drawn-tungsten filaments is reported to have been settled in Austria, where the Patent Office has decided in favour of the A.E.G. and its allied companies in this particular matter.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

RUSSIA.—A Decree of the Provisional Government was promulgated on August 23rd putting into force the Decree prohibiting the importation of all goods except under licence—see the ELECTRICAL REVIEW for September 21st. The prohibition is stated to be applicable to imports by sea (all frontiers), *via* the Russo-Finnish frontier, *via* the station of Manchuria on the Asiatic frontier, and covers both ordinary shipments and goods sent by parcel post. In view, however, of the fact that it is practically impossible to send goods to Russia except by arrangement with the Commission Internationale de Ravitaillement, the above-mentioned prohibition is of little real interest to shippers. Goods shipped under permit issued by the Commission require no further licence.

SWITZERLAND.—A Federal Decree has been issued consolidating and extending the Swiss prohibitions of export. The effect of the measure is to prohibit the export of goods of all kinds with the exception of a specified list, which includes china insulators and electric lamps. Dynamo-electric machines, electrical transformers, induction coils, and high-tension coils for dynamos are among the prohibited goods.

TUNIS.—A Decree, dated July 31st, has been promulgated which imposes on the importation of goods into Tunis restrictions similar to those imposed in France by the Decree of July 8th—see the ELECTRICAL REVIEW of October 5th.

MEXICO.—The retirement of the paper pesos, known as *infalsificables*, by means of a surtax on imports and exports, and on the production taxes on petroleum and metals, has been decreed. As from April 1st last, all import and export duties, and also the stamp tax on metals, &c., were to be subject to a surcharge of one dollar *infalsificable* paper for each gold dollar or fraction thereof of the amount payable.

COSTA RICA.—A Decree has been issued by Congress establishing export duties, payable in American gold, on certain articles, including manganese ore, the duty on which is fixed at 6 per cent. *ad val.*, and rubber, the duty on which is 10 per cent. *ad val.* These export taxes are to be paid in bills of exchange drawn on the place to which the goods are destined.

REPUBLIC OF COLOMBIA.—Certain modifications of the import Tariff of the Republic have been made by a recent Law. Steam or electric motors and accessories, iron or steel towers, steel cables, rails, and accessories of iron—all for aerial lines—are now admitted free of duty. Gauze or netting of copper wire is now dutiable at the rate of 6 cents (about 3d.) per kilogram.

CHILE.—As from April 12th, export duties are now payable as follows:—60 per cent. in notes, with the corresponding surcharge, as noted in the ELECTRICAL REVIEW of August 24th; 30 per cent. in drafts on London at 90 days' sight, the amount in drafts to be paid for each gold peso to be determined according to the average exchange value of drafts—to be ascertained weekly; and the remaining 10 per cent. in national gold coin.

ECUADOR.—A recent Presidential Decree provides that samples having a commercial value, introduced by commercial travellers, are granted temporary duty-free admission, under bond for re-exportation within 120 days. A slight modification has also been made in the conditions under which duty-free admission is accorded to commercial advertising matter in the form of sheets, pamphlets, or cards, and objects which are not and do not contain articles for sale. These must now bear an inscription, in letters of a size not less than half a centimetre, that the articles are intended for gratuitous distribution ("*que estan destinados para obsequios*").

ARGENTINE REPUBLIC.—The Argentine Budget Bill for 1918, which has recently been submitted to Congress, contains a clause which provides that the tariff valuations shall be increased by 10 per cent. in respect of goods which, under the Customs Laws, have to pay duty on their weight plus that of the immediate wrappings and packings, in cases where such goods are imported into the Republic without such internal wrappings and packings.

It is also proposed that, from September 1st, 1917, to the end of the year 1918, all goods exported from the Republic shall pay an export duty at the rate of 2 per cent. *ad val.*, except certain articles which are to pay specific duties. Products the export of which can only be effected under licence are to pay a tax of 20 per cent. *ad val.* The export duties are to be payable in gold currency.

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, 11th Holborn, London, W.C., and at Liverpool and Bradford

- 14,538. "Machine for generation of electric currents." A. YOUNG. October 8th.
- 14,557. "Electric snap switches." HART & HEGEMAN MANUFACTURING CO. AND J. S. WITHERS. October 8th.
- 14,560. "Circuit-breakers for ignition apparatus." REMY ELECTRIC CO. October 8th. (U.S.A., November 10th, 1916.)
- 14,561. "Magnet coil windings for dynamo-electric machines, transformers, &c." LANCASHIRE DYNAMO & MOTOR CO. AND H. B. WHITMORE. October 8th.
- 14,588. "Tool for clenching terminals for electric, &c., couplings." ROSS, COURNEY & CO. AND J. A. ROSS. October 9th.
- 14,597. "Signalling systems." BRITISH THOMSON-HOUSTON CO (General Electric Co., U.S.A.). October 9th.
- 14,598. "Alternating-current generators." T. F. WALL. October 9th.
- 14,607. "Cathodes." A. A. LOCKWOOD. October 9th.
- 14,613. "Electric rheostat or resistance indicators for switchboards, &c." C. R. ISENHILL. October 9th.
- 14,622. "Detecting low-frequency impulses." R. A. FESSENDEN. October 9th. (U.S.A., May 21st.)
- 14,652. "Amplification of small currents." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). October 10th.
- 14,653. "Leading-in wires for electric incandescent lamps, &c." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). October 10th.
- 14,654. "Electrical circuit-breaker." W. H. HILGORTH. October 10th.
- 14,664. "Electrically-heated clothing for aviators, &c." A. A. LEMERCIER. October 10th.
- 14,723. "Electric switches." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). October 11th.
- 14,727. "Dynamo-electric machines." H. CHITTY. October 11th.
- 14,738. "Portable transformers." JOHNSON & PHILLIPS AND W. C. KENNEL. October 11th.
- 14,742. "Fitting safety fuses in electrical circuits." A. SMITH. October 11th.
- 14,748. "Electrically-heated apparatus." J. KELL & A. A. SIOW. October 11th.
- 14,749. "Apparatus for electro-deposition." S. O. COWPER-COLES. October 11th.
- 14,750. "Coupling devices for electric cables." C. W. DURNFORD & SUBMERSIBLE AND J. L. MOTORS, LTD. October 11th.
- 14,753. "Ignition devices for explosion engines." R. HADDAN & MOTOR COMPONENTS, LTD. October 11th.
- 14,759. "Electric junction boxes." CALLENDER'S CABLE & CONSTRUCTION CO. & F. MOOR. October 12th.
- 14,796. "Directive wireless telegraphy." E. R. CLARKE. October 12th.
- 14,798 & 14,799. "Ignition apparatus for internal-combustion engines." G. A. LISTER, M.L. MAGNETO SYNDICATE, & E. A. WATSON. October 12th.
- 14,814. "Electric condensers." F. R. SIMMS & SIMMS MOTOR UNITS, LTD. October 12th.
- 14,824. "Telegraphic apparatus." C. DOMANICO. October 12th.
- 14,838. "Method of construction of electric furnaces of the heated-coil type." J. E. P. KIEVITS & KYNOCH, LTD. October 13th.
- 14,839. "Portable electric battery lamps." A. M. DUNLOP. October 13th.
- 14,858. "Auxiliary ignition attachment." P. HAY. October 13th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

- 8,618. ANTI-RUBBING OR ELECTRIC KNITTING NEEDLES. E. T. BARTHO and G. M. SIMPSON. June 19th, 1916. (109,628.)
- 11,730. ADVERTISING AND OTHER DEVICES PROVIDED WITH PARTS ADAPTED TO BE BROUGHT INTO SUCCESSIVE POSITIONS. H. K. HARRIS. August 18th, 1916. (109,637.) (Patent of addition not granted.)
- 11,844. METHOD OF PRODUCING AND CONTROLLING HIGH TEMPERATURES IN ELECTRIC FURNACES. J. J. DENION. August 21st, 1916. (109,639.)
- 12,781. TELEPHONE SYSTEMS. WESTERN ELECTRIC CO. & A. E. REINKE. September 9th, 1916. (109,640.)
- 13,343. METHOD OF FORMING METAL ELECTRODES USED IN ELECTRIC ARC SOLDERING AND DEPOSITION OF METALS. F. H. JONES. September 20th, 1916. (109,652.)
- 13,931. AIRCRAFT FOR OBSERVATION AND FIRE PURPOSES. P. J. PYBUS and PHOENIX MANUFACTURING CO. September 30th, 1916. (109,672.)
- 14,658. PROTECTION OF ELECTRIC CABLES. F. B. WHITAKER. October 16th, 1916. (109,679.)
- 14,885. AUTOMOBILE VEHICLES AND TRACTORS. Daimler Co., E. Boughton and H. J. BLOMBERG. October 19th, 1916. (109,680.)
- 15,359. ELECTRIC HEATING ELEMENT FOR KINDLING. R. K. HERRN. October 27th, 1916. (Addition to 4,600,15.) (109,684.)
- 16,814. MEANS FOR ATTACHING LAMPS TO ELECTRIC WIRING. W. W. O'FERRIS. December 14th, 1915. (102,719.)
- 17,266. APPARATUS FOR ATTACHING SHIELDS TO THE HOLDERS OF ELECTRIC LIGHT FITTINGS. J. DOBLE & W. CASHON. December 1st, 1916. (109,706.)
- 17,319. POLARISED ELECTRIC RELAYS. M. B. RODRIGUEZ. December 2nd, 1916. (109,707.)
- 17,410. APPARATUS FOR THE TRANSMISSION OF SOUND THROUGH THE AURICULAR CAVITIES OF THROAT AND HEAD. V. DREW. December 4th, 1916. (109,708.)
- 17,890. MANUFACTURE OF CYLINDRICAL AND TUBULAR ARTICLES OF GLASS. D. WEBB. December 13th, 1916. (109,711.)
- 18,609. ELECTRIC WARMING APPARATUS. H. L. PINNOCK. December 29th, 1916. (109,719.)

1917.

- 2,794. FLOOD METERS. Cutler-Hammer Manufacturing Co. March 23rd, 1916. (105,061.)
- 4,539. ENGINE STARTER. V. Bendix. March 29th, 1917. (109,747.)
- 7,973. MAGNETIC SEPARATORS. Hardy Patent Pick Co. & G. J. M. SMITH. June 4th, 1917. (109,746.)
- 10,354. PORTABLE DRY BATTERY ELECTRIC TORCHES. M. H. Goldstone. July 18th, 1917. (Addition to 2,036,15.) (109,776.)

Electric Steel in Italy.—The Società delle Ferriere di S. Giovanni Valdarno inaugurated, on August 7th, the first of the Siemens-Martin furnaces which it has decided to lay down to complete its projected equipment and to assist in developing its lignite mines. The new steel furnace will work with electrical energy supplied by the company's own works, which utilise lignite as fuel.

THE ELECTRICAL REVIEW.

VOL. LXXXI.

NOVEMBER 2, 1917.

No. 2,084.

ELECTRICAL REVIEW.

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THE TRAINING OF ENGINEERS.

ELSEWHERE in this issue we report the meeting which was held at the Institution of Civil Engineers last week, to form a "Central Organisation for improvement in and better co-ordination of Engineering Training." In this we see the culmination of a movement which has been in progress for many years, which has been accelerated by the lessons of the war, and which owes its successful issue very largely to the disinterested and indefatigable efforts of Mr. A. E. Berriman and Mr. A. P. M. Fleming, to whom the hearty thanks of the engineering world are due. The meeting was unanimously in favour of the proposition which it had been summoned to discuss, but which, by a curious departure from customary procedure, was not placed before it in the form of a resolution until most of the speakers had expressed their views. The adoption of the resolution without a dissentient voice was a foregone conclusion, and the scheme was launched with universal approbation.

The objects of the new Central Organisation can hardly fail to appeal to everyone who is interested in the welfare of the nation in general, and of the engineering industry in particular; the latter is essential to the former, and permeates the whole of our national life to an extent which can scarcely be realised by anyone who is not himself an engineer. Upon the maintenance of our position as an engineering nation depends our economic future in the coming industrial conflict, and it is of the utmost importance that every effort shall be made immediately to remedy the deficiencies in our methods of training engineers and securing the development of brains and talent in all ranks. We are glad to note, therefore, that the promoters of the scheme are fully alive to the necessity of providing for the adequate training not only of the engineer properly so-called, but also of the rank and file of the industry, whose functions are of equal importance to the State.

In point of fact, we doubt very much whether the facilities already provided in this country for the training of the engineer are greatly in need of improvement in themselves; many of our colleges are admirably equipped and staffed—the only respect in which they are deficient is in cheapness. Unless a youth can win a handsome scholarship, of which the supply is meagre, he cannot hope to follow the recognised curriculum and obtain a degree in engineering without imposing on his parents or guardians an expenditure which is prohibitive to all but the well-to-do. This is a grave defect in our educational system. No one would support the absurd contention that talent is confined to the progeny of the wealthier classes, and it stands to reason that many a boy of inherent engineering ability, or even genius, is either compelled to seek some other vocation less costly to enter, or, following his natural bent, is handicapped throughout his career for want of the training that his gifts deserve, and is unjustly condemned to a lifelong struggle to fulfil his true destiny.

A careful study of the three main objects of the scheme will show that, in fact, this fundamental principle underlies them all—help those who are worthy to help themselves. It is definitely crystallised in the third paragraph, which states what, in our opinion, is the most pressing need of all. We were exceedingly pleased, therefore, that Mr. Acland was able to state that, in spite of the post-

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The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 8d.; Canada, £1 3s. 10d. (\$5.80). To all other countries, £1 10s.

FOREIGN AGENTS:

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Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

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NEW YORK: D. Van Nostrand, 25, Park Place.

PARIS: Boyvean & Chevillet, 22, Rue de la Banque.

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SYDNEY: The Mining & Engineering Review, 273, George Street; Gordon and Gotch, Pitt Street.

TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 182, Bay Street.

WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

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ELECTRICAL & ALLIED TRADES DIRECTORY

(THE RED BOOK),

1917 EDITION

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ponement of the Education Bill to the distant future, his successor at the Board of Education would shortly bring in as a measure of urgency a Bill to authorise the allocation of over £300,000 a year to this important purpose.

It will be recalled that so long ago as July last year the Consultative Committee on Scholarships for Higher Education, of which Mr. Acland was Chairman, in an interim report recommended that the Government should give grants in aid amounting to nearly £340,000 a year for the strengthening of the higher parts of secondary schools, for maintenance grants to scholars to enable them to receive higher secondary education from 16 to 18 or 19, and for scholarships to universities in scientific and technical subjects and research. The forthcoming Bill, no doubt, embodies these suggestions, and we trust that the Government will take care to smooth its path through Parliament, for the matter is too urgent to permit of further delay. While it is true that the sums referred to are not restricted purely to engineering, we have no doubt that a very large proportion will be allocated to that supremely important industry, and will go a long way (though still very far short of our true needs) towards meeting the third aim of the Central Organisation.

While we have dealt mainly with this item, we are in cordial agreement with the whole of the programme outlined, and we join with Mr. Acland and other speakers in welcoming the proposal to form an Information Bureau to which, like them, we shall be able to forward the inquiries which we are constantly receiving from "the perplexed parent whose son is approaching the completion of his last term at school."

**Government
"Control"
of Trade in
War Time.**

THE trade control methods that have been employed by the Government through its innumerable Departmental Officials during the war formed the subject of a very large and unanimous gathering held at Cannon Street Hotel on Thursday last week. Speaker after speaker insisted that they did not, of course, object to the principle of Government control in a time of such serious national emergency as is now upon us, but one and all of them did protest most strongly against the unbusinesslike way in which many of the restrictions have been imposed, and the incompetence and ignorance that have been displayed in carrying these restrictions into effect. Sugar, tea, leather, hay, dried fruits, metals, and paper were all in turn drawn upon by their respective experts or exponents to show how muddle has been caused in regard to each and all of them, and why? In the main because the Government has not seen fit to avail itself of the experience of the merchants and traders of this and other great cities in the country who have built up great business connections in all parts of the world because of their lengthy specialised and most intimate acquaintance with these particular commodities, and the procedure attending their purchase and import for home consumption. It was complained that in very few trades had the Government consulted the trades themselves in connection with such matters. Happily, the electrical trade was mentioned as one in which the exception had been made, but the feeling displayed by the representatives of the metal trades, which are the nearest allied section to the electrical, was very strong indeed. The arguments used do not, save in respect of this section, materially concern us as an electrical journal, but they certainly do appeal to us from the point of view of Governmental control generally. Our own pages have shown from time to time that even in the favoured electrical trades all has not been well when the Government hand has come down upon them, but in respect of commodities

which came more directly in evidence at the meeting there was a procession of examples of colossal ignorance which had been shown, and blunders perpetrated, by officials who possessed no qualifications based on experience of the particular trade which they as Civil Servants, permanent or temporary, had "authority" to "control." The point needs no labouring. Under such conditions as obtain at present, control there must be, and it is for the Government to see that while it must last, in the interests of ourselves and our Allies, such control is imposed with efficiency and fairness, and by men who *know*, not by clerks who have to learn their business by groping their way through a forest of mistakes while incoming supplies are badly regulated, both as to quantity and as to port of discharge. Of course, there is another side to the matter. Tonnage accommodation, the need for independence and freedom from suspicion on the part of officials, and so forth, are factors of overwhelming importance. What seemed to enrage the merchants at Cannon Street Hotel more than anything else was the tendency shown by the Government to eliminate the merchant. They protest that they have done more than anybody else to build up our vast foreign trade, and that often they have to give credit and so produce business where the manufacturer will not give it. That the merchant has had in the past a large place to fill in our economic machinery, and that he will continue to do so, goes without saying, but the manufacturer of machinery for export markets has had to complain that the merchant at his foreign branches has not always helped British industry, but has far too often sent business to present enemy countries. The Government Commercial Intelligence representatives went to Birmingham and urged the brassmakers to combine or they would go under. Sir W. Ashley has also been to Birmingham on a similar mission. The merchants consider that the Government has thus exceeded its authority. Combinations of manufacturers dealing direct with foreign and Colonial markets through competent technical salesmanship might have little use for merchant assistance. The subject is a very large one, with many aspects, and it affects manufacturing industry as well as commerce. The merchants of the United Kingdom are preparing to make their voice heard unitedly in defence of their own interests. Their businesses in many cases are suffering owing to the hardness of the times, and they naturally resent being described as "parasites," but, while we have no sympathy with those who so describe them, we cannot dispose of so vast a question by means of a series of resolutions of protest forwarded to the Government. Furthermore, the protest can hardly help in the efficient conduct of the war when the Government is involved in such great difficulties every hour of the day. The control organisation is undoubtedly imperfect, and if it can be satisfactorily improved upon by enlisting the services of representatives elected by the trades affected the Government should repair the deficiency. But control itself cannot be lessened in such times as we are living in. The Cannon Street meeting was one of protest by men whose personal business interests have been affected, yet who must appreciate the manifest intention on the part of the Government to secure the safety of shipping and the sufficiency of food and raw material supplies, and to strengthen the spirit of unity among the people. Being a protest meeting, of course, one could not hear the other side. The Government case, if it could have been stated in reply, might have done something to temper the storm. The meeting decided to ask the Government to declare what its policy toward the merchant is going to be. We have our doubts whether our statesmen are yet prepared to define that policy in detail. So much depends upon so many things.

MESSRS. FULLER'S CARBON WORKS.

In addition to their manufacture of primary and secondary batteries and insulated wires and cables, Messrs. John C. Fuller & Son, Ltd., decided to establish new works for the manufacture of arc lamp and battery carbons, and the carbon factory has now been at work for several months. It is controlled by a subsidiary company, and is designed to produce all kinds of carbons for batteries, arc lamps, kinematographs, welding, &c.

From previous descriptions of carbon works which we

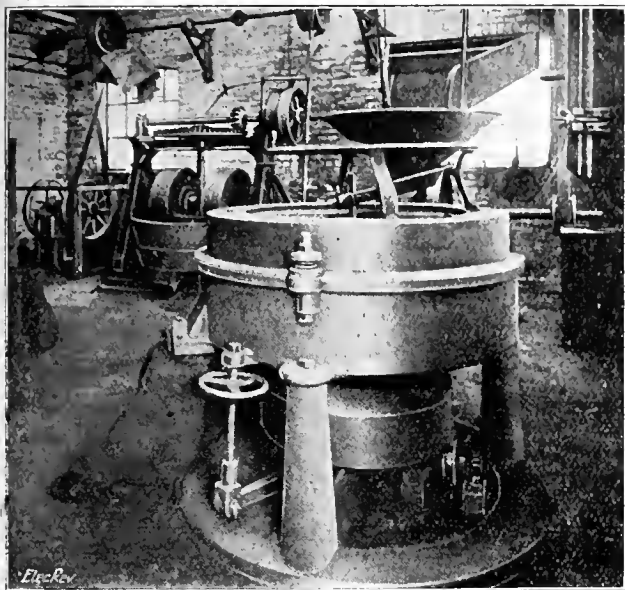


FIG. 1.—GRINDING AND MIXING MACHINES.

have published, our readers will be aware that the industry is one which calls for a heavy outlay at the very start, owing to the necessity of laying down an elaborate and costly system of furnaces, and this feature no doubt has deterred many would-be manufacturers from incurring the risks attending an enterprise which cannot be inaugurated upon a modest scale—and which, moreover, before the war was subjected to intense competition by German and Austrian manufacturers. We are all the more pleased, therefore, to welcome the new undertaking as an additional guarantee of the establishment of the carbon industry in this country, and of our being self-contained in the future in respect of this most important industry, a "key" industry essential to the national safety.

The fundamentals of carbon manufacture may be briefly summarised as follows:—The raw materials usually consist of gas-retort carbon, soot, and tar. The carbon is carefully picked by hand to eliminate foreign material as far as possible; it is then crushed and ground to powder in ball or roller mills. The soot is specially manufactured by the incomplete combustion of oil, and the tar is of special quality. These three constituents are intimately mixed in steam-heated kneading machines and calenders, and the material is finally formed into cylindrical blocks for use in the hydraulic press. The latter extrudes the hot carbon mixture through dies shaped according to the desired product, and the rod or bar is cut into lengths of about 4 ft. as it comes from the press. These sticks become fairly stiff when cold, and are tied up in bundles, which are packed in fireclay crucibles with a filling of carbon dust to exclude air.

The furnace chambers are arranged in the form of a

flattened ring, with ducts supplying producer gas between them, and flues to carry away the waste gases round the outside; by means of movable pipes and water-sealed valves in the roof of the chambers, gas can be admitted at any point, and, after combustion, carried into the flues. In order to avoid loss of heat, the waste gases are conducted through a number of the chambers before discharging them to the flues, thus warming up the chambers and their contents. By shifting the points of entrance and exit at regular intervals, it will be seen, the hot zone is gradually moved round the circuit of furnaces, each time bringing one or more cold chambers into operation, and removing a corresponding number of chambers from the active zone at the rear. The baking operation occupies a period of about seven days. The air required for combustion is passed through the chambers containing carbons which have been baked and are cooling down, thus recovering a portion of the heat and assisting in the cooling process.

The baked carbons, which are hard and ring when struck, are next cut to the appropriate lengths by a chopper machine, sorted, and flattened at the ends with an emery wheel. Carbons for magazine flame lamps are usually left flat at both ends; for open arcs and the Excello flame type they are pointed at one end.

The accompanying illustrations show some of the plant.

As the building of carbon-baking furnaces does not exist as an industry, it was necessary for the company's own staff to design and erect them; naturally many difficulties were met with, but were all overcome in turn. Much of the machinery had also to be specially made to their own designs.

The processes may be regarded as commencing with the manufacture of lampblack. The heavy oil from which it is derived is burnt in a pan about 4 ft. in diameter, with a limited supply of air; the products of combustion pass through iron flues into a series of large brick chambers, in which the soot is deposited. Periodically the operation is stopped, the chambers are cleared of foul gases by means of a motor-driven fan, and the lampblack is collected.

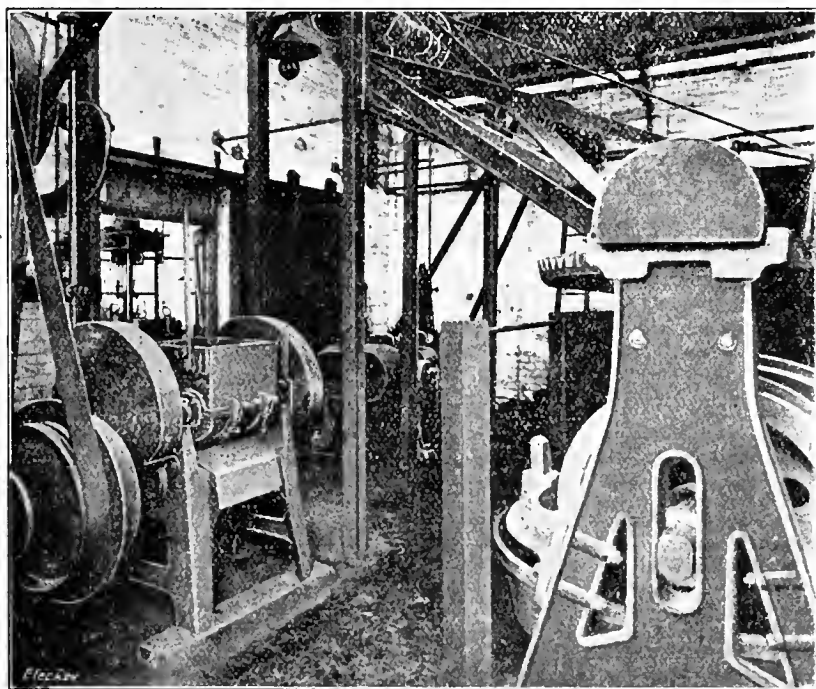


FIG. 2.—MIXING AND CALENDERING MACHINES.

The company have a small paint works in operation, in which they utilise a part of the product of their lampblack plant, and doubtless this business will also be developed.

Figs. 1 and 2 show grinding, mixing, and calendaring machines in the mixing shop, which prepare the materials for the press. Here the carbon is crushed in an ordinary

stone-crusher to the size of a walnut, after which it is passed through an edge-runner, which grinds it to coarse powder. It is finally put through the "fine grinder," which reduces it to powder, and is then ready for mixing with the other constituents.

Fig. 3 is a view in the press-room, showing a large

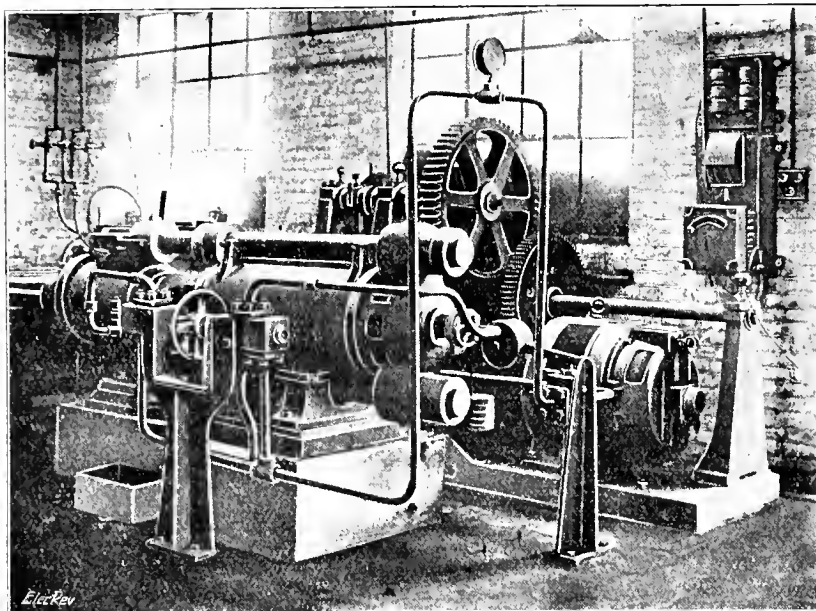


FIG. 3.—CARBON PRESS.

hydraulic press which, like all the other apparatus, is driven by an electric motor. The press motor is of 20 h.p., and was made by Messrs. Mawdsley's; all the rest are E.C.C. motors.

Fig. 4 shows the interior of the furnace-room, with some of the baking chambers open. At the far end of this

While the demand for carbons for primary batteries, kinematographs, search-lights, and welding purposes, is certain to increase, it may be questioned whether the position of ordinary arc-lamp carbons is equally secure, in view of the growing popularity of the "half-watt" lamp. On this score, however, there need be no misgivings. While the

high-efficiency incandescent lamp is unrivalled for many purposes, especially for indoor lighting, the flame-arc lamp of the magazine type (to which we refer nowadays when we speak of the ordinary arc lamp) remains by far the most efficient, economical and effective illuminant where large areas are concerned. Yellow flame 10-ampere arcs, with clear globes, give an "efficiency" on the basis of the lower hemispherical candle-power of 0.152 watt per candle, when clean, falling to 0.268 w./c.p. after burning for 100 hours. On the basis of mean spherical candle-power, the figures are 0.292 to 0.5 w./c.p. According to Mr. Maurice Solomon, from whose I.E.E. paper in 1912 these data are taken, while the cost of renewals, attendance, and depreciation of metal-filament lamps per 1,000 m.s.c.p. per annum is less than that of flame arc lamps by £2 4s., the cost of energy at 1d. per unit is less than £7 for the arc lamps and more than £18 for the metal-filament lamps, leaving a balance in favour of the arc of about £10 per annum. At higher prices for energy,

the advantage of the arc lamp would be correspondingly increased. There is therefore no reason to suppose that the flame arc is approaching extinction.

For open and kinematograph arcs the positive carbon is cored. In this case the carbon rod is squirted from the press, with a hole in the centre, which is filled with the

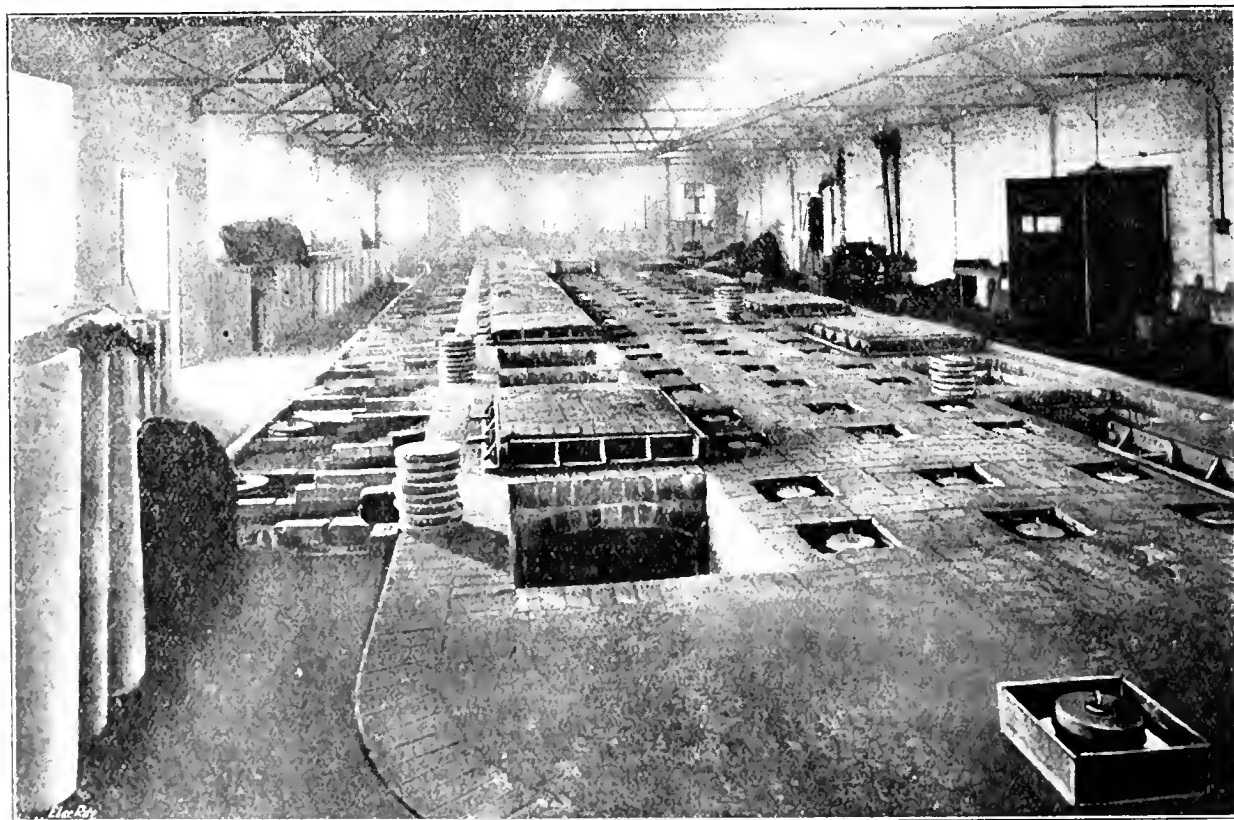


FIG. 4.—INTERIOR OF FURNACE ROOM.

building is the producer house, where fuel gas is generated from small coal in a producer of the Dowson type. The tapping holes for connecting the gas duct with the chambers, and the chambers with the flues leading to the chimney, are visible in this view.

core material after the baking operation. For colourless arcs the filling consists mainly of alkaline silicates and finely-ground carbon powder; yellow arcs are produced with alkaline silicates, fluor spar, and carbon powder; for white flame arcs, cerium earth salts are substituted for

the fluor spar (calcium fluoride), and for red coloration strontium salts are used. In direct-current flame lamps, the flame material is usually inserted in the positive carbons only; for A.C. flame arcs both carbons are cored. Long carbons (over 15 in.) are fitted with a metal wire which passes down through the carbon to lower the resistance. This is a better plan than to copper-plate the carbons, which causes them to burn unsteadily. In the case of high-class kinematographs, the negative carbon is sometimes coppered, which enables it to be made of small diameter, and is provided with a solid core, 3 mm. in diameter, which produces a little pip on the end of the negative, and results in remarkably steady burning.

Although the factory has not yet been six months in operation, it is now being extended. We learnt with pleasure, also, on the occasion of our recent visit, that a canteen is about to be built for the comfort of the work-people, taking the place of the existing temporary arrangements. On every hand there was evidence of progress and abundance of work, and in thanking the firm for the courtesies extended to us, we may add the hope that both during and after the war its affairs will continue to prosper.

ELECTROSTATIC VOLTMETERS.

By C. H. WRIGHT.

As a standard and also a readily-applied connecting link between direct and alternating voltages, a good form of electrostatic voltmeter is, without doubt, the best for commercial test rooms.

A suspended reflecting instrument of this kind *permanently installed* in a laboratory or test room runs little risk of mechanical derangement by accident, especially if the excellent plan of fixing standards permanently to a wall is adopted, as is done in most well-equipped laboratories.

The instrument can be checked quickly against a potentiometer by direct-current pressures, and by employing high non-inductive resistances with suitable tappings for the application of the voltages to be measured (the instrument being applied across a definite fraction) the range of a low-voltage instrument can be extended as required, a suitable multiplier being employed. The value of this multiplier is determined by the ratio of the whole resistance in use to that part of it across which the actual instrument is applied.

A well-constructed multicellular electrostatic instrument, being unaffected by changes of frequency or wave form or by magnetic fields in the neighbourhood, is especially suitable for use in a commercial test room as a standard of reference against which to check the working testing instruments for alternating-current work.

It is important to see, however, that an instrument of this class is of the best design and construction if for use as a standard of reference. In this connection the following note may be of interest:—

Some years ago the writer had some tests made in which a reflecting electrostatic voltmeter of unknown make was used. These tests showed anomalies which were ultimately traced to the voltmeter. The instrument was fitted with 10 aluminium vanes, attached to the spindle by means of aluminium wire pins, and had been in use in an atmosphere somewhat bad for electrical instruments generally, for about 10 years.

On testing it against a potentiometer on D.C., it was found correct, the largest error being less than one-half of 1 per cent., yet, as compared with a well-made hot-wire voltmeter on an alternating circuit, it indicated consistently lower, and the discrepancy was found to increase with increase of frequency, being about 3 per cent. at 60 cycles and $6\frac{1}{2}$ per cent. at 100 cycles.

On D.C. both the electrostatic and the hot-wire instruments agreed with each other and with the potentiometer. The trouble was traced to the fact that two or three of the vanes of the electrostatic instrument were not in good contact with the stem to which the suspension was attached, and presumably owing to the high resistance between them and the stem, they required a definite time to become charged

as fully as the other vanes. The oxidation or corrosion of the very small aluminium pins was probably the cause of the trouble.

After efficient connection had been made between the affected vanes and the stem, the instrument became normal, and was correct on both D.C. and A.C. at all the frequencies available for testing at the time—namely, up to 130.

In the latest Kelvin low-tension electrostatic voltmeters the vanes are actually soldered to the stem, which is an excellent arrangement.

In electrostatic voltmeters for very low voltage it is desirable to have the fixed and movable elements of the same metal, as otherwise in calibrating with D.C. two sets of readings with reversed polarities are required, which involves extra labour, and is a precaution which may possibly be omitted on occasions.

This desirable feature is arranged for in low-voltage instruments by the best makers.

AMERICA'S EXPORT TRADE IN ELECTRICAL GOODS.

By MALCOLM CHALMERS.

THE ousting of German electrical goods from the world's markets and the restrictions which the war's demands have placed on British firms has been very beneficial to the electrical industry of the United States. It is not surprising, therefore, to learn that the year ended June 30th, 1917, the returns for which have recently come to hand, has been a record one so far as the exports of electrical goods are concerned, the value of such exports having reached nearly £11,000,000 in that year.

The following figures for the last four years show the progress that has been made since the war:—

Year ended June 30th, 1914	...	...	£5,312,000
Year ended June 30th, 1915	...	...	4,187,000
Year ended June 30th, 1916	...	...	6,399,000
Year ended June 30th, 1917	...	...	10,976,000

It will thus be seen that, as compared with the previous year, last year's figures show an increase of just over 70 per cent., whilst as compared with the last pre-war year the increase has been one of 105 per cent.

When we turn to the details we find that this increase has been fairly general, but that increases are especially noticeable in the case of batteries, wires and cables, metallic-filament lamps, electric motors, and telegraph and telephone instruments. On the other hand, exports of dynamos, transformers, and arc lamps were less last year than before the war.

In the subjoined statement details of the exports last year are shown in comparison with those for 1913-14, the last pre-war year:—

	1913-14.	1916-17.	Inc. or dec.
	£	£	£
Batteries	143,000	631,000	+ 438,000
Dynamos and generators ...	549,000	532,000	- 17,000
Fans	90,000	101,000	+ 11,000
Insulated wire and cables ...	415,000	1,498,000	+ 1,083,000
Interior wiring supplies (including fixtures) ...	150,000	234,000	+ 84,000
Lamps: Arc	16,000	3,000	- 13,000
Lamps: Incandescent:—			
Carbon-filament	36,000	33,000	- 3,000
Metallic-filament	46,000	416,000	+ 400,000
Meters or measuring instruments	*	216,000	+ 216,000
Electric motors	916,000	1,228,000	+ 252,000
Telegraph instruments (including wireless apparatus)	28,000	112,000	+ 84,000
Telephone instruments ...	324,000	407,000	+ 73,000
Transformers	303,000	263,000	- 40,000
Electric locomotives	91,000	110,000	+ 19,000
Other electrical goods ...	2,175,000	5,112,000	+ 2,937,000

* No information. The exports, however, in this year were probably quite small.

Of course, the increases shown above do not in all cases represent an increased volume of trade; some of it is doubtless due to inflated prices. After allowing for this factor, however, it must be admitted that the development has been phenomenal. Unfortunately, the returns do not show quantities, except for electric fans and lamps. In these cases, however, increases are shown in the actual quantities exported. Thus in the last pre-war year 32,816 fans were exported, valued at £2 15s. each; in 1915-16, 26,519, valued at £2 16s. each, were sent abroad, whilst last year the exports numbered 44,690, worth £2 5s. each. The exports of carbon-filament lamps in 1913-14 numbered 1,285,858, the average export value of which was about 7d. per lamp. In 1915-16 the number exported was 1,197,751, and the value about 6d. per lamp, whilst last year 1,341,444 of these lamps valued at less than 6d. each were exported. The increase in the case of metallic-filament lamps has been much more pronounced, as in 1913-14 only 849,261 lamps, valued at about 1s. 1d. each, were shipped abroad, whilst last year the number was 10,707,014, and the total value £446,000, *i.e.*, about 10d. per lamp.

Whilst on the subject of lamps, it is interesting to note that the United States does a large import trade in metallic-filament lamps, the figures for the last four years being as follows.—

1913-14	6,925,753	£114,154
1914-15	6,210,173	118,153
1915-16	4,863,060	146,208
1916-17	7,664,746	46,185

It will be seen that up to June, 1916, the imports were declining, but that prices were rising rapidly. Last year, however, the number imported increased by 50 per cent. over the previous year, whilst the total value was less than a third of the value in 1915-16. The figures are so peculiar that some explanation is necessary, though none is given in the American official returns. The most probable explanation is that whereas in earlier years the bulk of the imports consisted of ordinary lamps for house lighting, and came chiefly from the Netherlands, last year the great majority were miniature lamps for pocket flash-lights. It is known that Japan has been manufacturing this class of lamp in large quantities for the last year or so, and it is most likely that that country is the chief source of the lamps specified in the returns for 1916-17.

As regards the markets to which American electrical goods were shipped last year, no information is given in the returns, nor will they, in all probability, be available for some considerable time yet. From the record of past years, however, and an examination of the import returns of other countries, it appears that America does a world-wide trade in this class of goods, but that the principal markets at the present time are the United Kingdom, France, Italy, Canada, Australia, Central and South America, and Japan.

With regard to future possibilities, it would be useless to attempt a prediction. It may be that the American electrical industry will continue to improve its export position, but it must be remembered that in pre war times Germany's export trade in this line was about 10 millions sterling, and that of the United Kingdom about eight millions. At the present time, Germany can be doing hardly any export trade owing to the difficulty of obtaining copper and other necessary raw material, to war demands, and the stringency of the Allied blockade. The United Kingdom export trade has also decreased considerably, the exports last year being valued at only £9,000,000, in spite of increased prices. Once the war is over, however, both Germany and this country will be active competitors in the world's markets once again, and it will remain to be seen to what extent America will be able to maintain her present position as the leading export-

ing country in electrical goods. It must be remembered, too, that Japan has entered the field as a manufacturer of this class of goods (see *ELECTRICAL REVIEW*, August 10th, p. 124), and although it will probably be some years before she will be able to compete successfully in other markets against the United Kingdom, Germany, and the United States, she will probably be able to retain the home market, which has hitherto been a good one for imported electrical goods.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The E.T.U. or the A.E.S.E.?

In asking you to afford us space in which to reply to the A.E.S.E. campaign of misrepresentation, we would point out that it was the intention of the promoters of the station branches of the E.T.U. to abstain from any criticism of the A.E.S.E.: but as this Association has thought proper to attack the station engineers' branches by a misrepresentation of the facts of the situation, we feel sure you will allow us to put our position before your readers. Mr. Ebben and the members of his Association were invited to join our organisation with a view to a common programme; he replied: "I am seriously considering the whole position"; this was about six months ago, since which no further communication has been received. Was it expected that we should forego our progress until his Association had decided what they would do? Instead of working for the common good of the station engineers, they opened a public attack on those who were, and are, seriously attempting to improve the conditions obtaining in this branch of the industry.

1. They state that we do not represent station engineers, when, as a matter of fact, we represent every electrical power sub-station and mains electrical grade, including the supervising grades of power station charge engineers, sub-station superintendents, mains engineers, &c., employed by over 40 of the largest power and lighting authorities; in London alone our membership is just under 1,000.

2. They publish a list of concerns which they purport to represent.

Let us take two of the concerns mentioned—*viz.*, the L.C.C. and the North Metropolitan Electric Supply Co. Our membership on the L.C.C. is over 100; our membership on the North Metropolitan is over 50, and, moreover, we obtained the Engineering Award for our North Metropolitan members just recently.

3. In criticising our trade card, they state that the "A" card was not drawn up by technical men. "B" grades are mentioned, which do not exist, and grades which do exist are not included with reference to "A." This card was drawn up at a series of open meetings, attended by all station and mains grades, several of whom can write I.E.E. after their names; surely these would be counted as technical men.

With reference to "B," the grades not included are probably those mentioned by the A.E.S.E. appeal of October 19th; mains superintendent, mains assistant, meter superintendent, draughtsmen, testing engineer, installation inspector, commercial assistant, and publicity engineer. Apart from the fact that none of these designations are power station designations, they are really reiterations of the same, inasmuch as most of the supply authorities reduce at least five of these designations to one—*viz.*, mains assistant, who is invariably the utility man.

4. They state that we have set a flat rate for engineers. No such suggestion appears on our card; what is claimed is a uniform minimum rate, and it clearly states that where the conditions are better they are to be upheld.

5. They state that "We suspended action during the war"; probably, but they did not fail to attempt to take full advantage of the Trade Protection Certificates, "Engineering War Awards," obtained as the outcome of action by us in conjunction with the other Engineering Unions.

We did not suspend action during the war, with the result that the attempt to patriotically (?) exploit wounded soldiers and sailors by engaging them for sub-station work at 25s. per week was stopped by our representatives on the National War Pensions Dilution Committee, who also established the precedent that, while not offering any objection to any soldier or sailor going into a sub-station, on no account was a pension to be regarded as part payment of wages. The justice of this claim was recognised by the Government; and, moreover, we have by our actions in numerous instances been the means of improving the station man's wages during the war, as can be observed on reference to the *Labour Gazette*.

The reprehensible tactics of this Association in the Technical Press are too obvious to need any comment from us; sufficient is it for us to notice that so appreciative are they of our progress that every move we make they follow, but never lead. The value of the Association is clearly stated by Mr. Ebben in the *ELECTRICAL REVIEW* of June 14th, 1917, when he states:—

"He seconded an amendment which was proposed by a member of the Electrical Trades Union at a meeting of electrical employers

and employes in London some years ago. This was the only time the electrical engineers took the A.E.S.E. seriously; as soon as the General Committee and members severed all connection with the E.T.U., the London chief engineers, being clever and far-seeing men, ignored the A.E.S.E. members, and have done so ever since, because they knew they had nothing to fear."

Any further justification for our present action is contained in the remarks of the Editor, ELECTRICAL REVIEW, September 28th, when he states:—

"We cannot recommend young men of ability and ambition to join the staffs of power stations, unless it be for the purpose of acquiring a first-hand knowledge of the organisation and working conditions of such stations as part of their technical training and not as a career."

In conclusion, it has been suggested that the E.T.U. are unpatriotic. This can be at once denied, as hundreds of our members are on active service, and are being kept in full benefit by the members at home, and on a ballot for continuance of the war, or against, an overwhelming majority voted in favour of continuance to a successful issue. It must be clearly understood that the E.T.U. is not ruled by any individual, but by a National Executive elected by all members in Great Britain and Ireland.

H. H. Morton,
Secretary of Station Engineers,
No. 1 London Branch.

London, S.E.,
October 29th, 1917.

The article in your valuable journal, enclosing the letters addressed to Sir George Askwith, is lacking one thing, and that is Sir George Askwith's reply to the request for the A.E.S.E. to be represented at the next conference.

The following is the letter:—

[COPY.]

"Chief Industrial Commissioner's Department,
"Ministry of Labour, Montagu House,
"Whitehall, S.W. 1.
"October 18th, 1917.

"Dear Sir.—With reference to your letters of September 17th and October 16th, any further conferences will be held between the Unions by whom claims have been made and representatives of the Borough Councils, and I suggest that you should communicate on the subject with Mr. W. J. Webb, Electrical Trades Union, 76, Gray's Inn Road, W.C. 1.

"I am, yours faithfully,
"(Signed) G. R. ASKWITH.

"W. Arthur Jones, Esq., A.M.I.E.E.,
"Association of Electrical Station Engineers,
"26, Little Park Gardens, Enfield."

The notice as to the adjustments of rates and wages for the men employed by the St. Pancras Borough Council is also incomplete, as the following letter also shows:—

[COPY.]

"St. Pancras Borough Council,
"Town Clerk's Department,
"Town Hall, Pancras Road, N.W. 1.
"October 26th, 1917.

"Dear Sir,—With reference to your communication of the 16th of June last, I have to inform you that the Council have received a report from their Electricity and Public Lighting Committee, also a report from the Special Committee who have considered the question of the wages and war bonus paid to the employes of the electricity undertaking. The Council have revised the scale of wages for the employes of the electricity department, and I enclose for your information a copy of the revised scale.

"In addition to this, the Council are granting the employes of the electricity undertaking a war bonus of 15s. per week to those who are 18 years of age and over, and who receive a wage or salary of not more than £160 per annum, 7s. 6d. per week from £160 to £200, 5s. from £200 to £250.

"Yours faithfully,
"(Signed) C. BARRETT,
"Town Clerk.

"Mr. W. J. Webb,
"Electrical Trades Union,
"76, Gray's Inn Road, W.C."

The staff also of the North Metropolitan Electric Power Supply Co. have something to thank the Electrical Trades Union for, as the following letter will show:—

[COPY.]

"The North Metropolitan Electric Power Supply Co.,
"Electric Railway House,
"Broadway, Westminster, S.W. 1.
"October 17th, 1917.

"Dear Sir.—In reference to the conference which took place this morning at the office of the Industrial Commissioner, and to the subsequent interview which the general manager of the company and I had with representatives of your Union, I undertake that the company will, as from the week commencing September 1st, 1917, grant to the undermentioned grades (adults only) a war wage of 15s. a week, or such less sum as will bring up to 15s. a week the increase or increases in the wages granted since the outbreak of the present war, provided that where the wage of any man has been increased since the outbreak of the war by reason of his promotion to a higher or more responsible job, such increase is

not to be taken into account in assessing the amount of the war wage.

"It is understood that the above arrangement only apply weekly or hourly paid men.

"In regard to boys and youths under 18 years of age, the 6s. 6d. a week is to apply in place of the 15s. a week above mentioned.

"List of Grades.

- "Electrical fitters and their mates.
- "Shift or charge engineers (senior and junior).
- "Switchboard attendants (senior and junior).
- "Electrical erectors.
- "Wiremen and their assistants.
- "Jointers and their assistants.
- "Are lamp trimmers.

"Will you be good enough to acknowledge the safe receipt of this letter?

"Yours faithfully,

"THE NORTH METROPOLITAN ELECTRIC
POWER SUPPLY CO.,

"(Signed) JAMES DEVONSHIRE,
"Managing Director.

"W. J. Webb, Esq., London District Secretary,
"The Electrical Trades Union,
"76, Gray's Inn Road, E.C. 1."

The claim of the A.E.S.E. as being the Association to represent charge engineers is too laughable for words, and one wonders whether that is the reason that Mr. Ebben is no longer the hon. sec. From my personal knowledge of Mr. Ebben, when I was a member of the A.E.S.E., he would not stoop to the touting tactics now being adopted by certain engineers. Not touting for membership of the A.E.S.E., but touting (peaceful persuasion, one might almost call it) by engineers for Bill Smith (sub-station attendant) to say that the Electrical Trade Union does not represent him (Bill Smith), but the Electrical Trade Union is going on its way undisturbed, doing its best to obtain living conditions for station engineers of all grades.

W. J. Webb, London District Secretary.

London, E.C., October 29th, 1917.

The Prospects of the Central-Station Engineer.

To those who have followed closely the recent development of the Association movement amongst London power-station engineers, it must come as a great relief to realise that a serious crisis in their history has been circumvented. By how narrow a margin the situation has been saved, only those who have made it their immediate concern to steer the course can fully appreciate.

To get a true perspective, it is first necessary to view the relationship in which central stations stand to the engineering industry and to the war. It is in no sense an over-statement of the case to place power stations in the position of the hub of the engineering industry—the greater proportion of the efforts of which industry are directed into war channels. The full significance of this statement will be realised if the paralysis following a stoppage of all power-station output can be imagined.

The next step is to note how many engineers are responsible for the smooth and uninterrupted running of this hub. So far as London is concerned they number, not thousands, but just a few hundreds. Now picture the strength of the weapon which would be placed in the hands of an unscrupulous Association, Union, or Society. There is no need to labour the point—it must surely project itself right into the haziest vision.

To enlarge the perspective—what reward has accrued to those few hundred engineers, from chief to junior, who daily, during the past years, have shouldered increasing responsibilities and considerable additional work? They have seen outputs trebled and quadrupled profits beyond the dreams of avarice piled up on their industry, energy, and experience; and, let this not be forgotten, meanwhile nailed to the posts.

The exigencies of war demanded it, and they were content—content to see the market value of their stock-in-trade of experience depreciate 50 per cent.; content to rub along under conditions that would charge a Trade Union official with high explosive.

Trade Unions up and down the country did not sit still under the increasing oppressiveness, and all grades of war workers, by and around that gallant few hundreds, have been considered, and considered well. Moreover, some of those Unions were stretching a welcoming hand to those few hundreds—whether or no it was an interest with a single purpose is beside the point. The temptation was great.

The answer of those few hundreds to the overtures so made must redound to their ever-lasting credit, and it must be self-evident that they are made of the right stuff. The answer in effect was: This is our career—an engineer's career. True, the rewards for our industry and efforts fall lamentably short of the barest justice; but our career means more to us than the immediate acquisition of shillings. We prefer to adjust our own affairs, and will not allow any menace to the smooth running of the industrial career. The exigencies of war demand that some of those men are about to come under review by the London supply authorities. Is it too much to ask that a correct estimate be taken of their value—a true sense of appreciation formed of their action in banding themselves together—the preservation of their entity, and all that it means to the future of central station life, from chief to juniors? The gift of clear and expansive vision was never in greater demand amongst those about to mete out justice—not generosity—to those few hundred.

One of the Herd.

As a humble unit in central-station life, may I claim the privilege of tendering my thanks for the able manner in which you are supporting the much-discussed "engineer"? Moreover, your footnote to a letter of "Staff Electrician" in the issue of September 28th, has drawn an adverse criticism, in which the argument put forward is open to endless discussion.

The letter from your Manchester correspondent is the first of its kind up to the present, and, quoting the old adage that "Open confession is good for the soul," may we not confidently look forward to expressions of opinion from senior engineers, both London and Provincial?

A well-known business gentleman has stated recently that it is the old men who, at present, are running the world and the war, and we must not lose sight of the fact that the chief engineer of to-day is the same chief of the early days (in the majority of cases), and in these tumultuous times he has not had time to spare to carefully consider the immediate needs of his juniors.

The time has surely come when a member of the staff can approach his chief, and feel that he is not hampered in his quest by a fixed scale, and the usual referring to committee.

It has often been said that, if a position is not good enough for one, he should "get out." Is this always the right policy to pursue? And, to return to your correspondent's letter, he says: "Young men of ability and ambition are sorely wanted"—yes, and these young men will always be forthcoming, whose enthusiasm for their work often makes them forget the energy involved; are these men to meet the same reward as those who started years ago?

Engineer.

After reading through the correspondence on the militant organisation of power-station engineers, I am struck with the fact that the most salient feature of most of the writers is the emphasis which they lay upon "status." Surely it was high time that this nonsense was dropped. Status is a bogey which has been and always will be the enemy of democratic, and consequently real, progress.

The "superior technical staffs" may be very excellent people, and probably very clever too, but it never struck me that the mechanical routine of power-station operation was beyond the powers of any man of average intelligence and ordinary training; consequently, it is a source of amusement to observe the frantic efforts which the "Gabriels" of the recently resuscitated A.E.S.E. make in loudly trumpeting their patrician isolation.

The fact is quite clear that until the E.T.U. proved that they were alive, the "superior gentlemen" were still *ensomme*, and no doubt were waiting until post-war days before demanding an adequate wage to meet ferocious and continuously advancing prices. It is well to point out that the Labour movement in its new phase will need, and will get, men of capacity in its leading ranks. The superior brand of status-hunters will find themselves left completely frigid if they imagine that status will confer upon them any degree of effective force. They will learn that they must fight to obtain any improvement in salary, wages, or conditions, and a digest of any of the economic historians will prove to them that the fighting will be hard fighting too. It is beside the point to indicate the might of the organised medical and legal professions; these bodies have State protection—a bolster which no Government will be inclined to bestow further.

My advice to the authors of the long circular which secured free advertisement in the ELECTRICAL REVIEW columns, is to discard the "stilts" and come down to democratic terra-firma. As an electrical man in charge of a mere converting plant, I am no doubt offering impudent advice; but when I see the portents of increased centralisation of power supply, I think that many of the men at present numbered among the power station "superior" staff may be looking for jobs in competition with the sub-station charge or shift engineers who are so socially and technically "impossible."

W. F. K.

London, S.E., October 28th, 1917.

The Association Movement.

Although I have not recently had an opportunity of reading the ELECTRICAL REVIEW, I understand that a difference of opinion has arisen in your "Correspondence" columns concerning the origin of the Cable-Makers' Association.

As one who was present at the first meeting, I can say that all of those who attended that meeting have frequently referred to Mr. Henry Edmunds as the father of the C.M.A. At the same time, it is a fact that I was first approached, so far as the cable works at Charlton were concerned, by Mr. H. H. Berry.

F. S. Paterson.

Lieut. R.E. (T).

October 29th, 1917.

Apprenticeship In Electricity Supply.

I was interested to read in your issue of October 19th the course of training laid down for apprentices in the employment of your correspondent. Now, I think it is only fair to recommend parents of would-be apprentices who should be tempted to have their children bound to such luring employers to look before they leap.

As far as my own experience goes, I have been one of those who have been gulled by a similar advert. for electrical engineering apprentices. The fee was rather high (£50) considering that no pocket-money was allowed during the first 12 months, and also taking into account that my parents had to pay for my keep whilst out of home. The course of training was anything but near that laid down in my "indentures." Of the wiring work which was to

consist of motors, heating and cooking apparatus, &c., I only saw two motors being installed during my term of apprenticeship, and I think three cookers was about the limit of our cooker wiring. Your correspondent explains what our wiring contracts were like when he says they were "not large." No they were not large—the largest was one of 20 lights. The extent of our modern instruments for mains and meter testing consisted of one antiquated P.O. bridge and a Megger for the former tests, and for the latter we had a unipivot dynamometer about 10 years old.

The plant consisted of two water turbines and an old-fashioned horizontal steam-engine which should have been scrapped A.D. 1900. The generators were A.C. Morley Victoria, the newest of which, according to our cable jointer, who seemed to have been in the service of the company since its inauguration, was about 22 years old. The only mechanical repairs I saw during my term were the renewal of a few armature coils and the recasting of one generator bearing.

I also note what your correspondent says about the type of apprentice which they take on not being able to afford a mechanical training. Now, I would wish to ask him if for the fee he charges, (as I don't think he would be so kind as to give all his knowledge gratis), does he honestly think that any parent could make better use of his money than handing it over to the "manager of an electricity supply" that his son may obtain a knowledge of electrical engineering equal to, or if I might say so, less than that which may be had at any technical school at a less cost?

I do not wish to occupy too much of your valuable paper. I only wish to point out to parents of would-be engineers what a risk they take in having their sons apprenticed in a small power station where the manager distinctly states that the training is to be given as far as his knowledge goes. It would be far better for them to pay a little more at first and get their charges into a proper engineering firm, the owners of which aim at turning out engineers and who do not take on apprentices just because they wish to run their power stations cheaper than if proper engineers were employed.

Pro Bono Publico.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Drying Fruit and Vegetables by Warm Air from Turbo-Alternators, &c.

The Duisburg electricity station has erected a series of racks on which fruit and vegetables may be dried by the warm ventilating air escaping from turbo-alternators. This idea is due to the station engineer Fietz. The arrangement used is shown in the accompanying sketch. At the cost of a very small outlay, the staff and workpeople of the station have been enabled to dry a large part of their winter requirements of fruit and vegetables. The proposition deserves to be taken up by central-station engineers in this country. It should be possible, even at this late season, to add materially to the storable food supplies of the nation, and this without burning any additional fuel or incurring any serious capital expenditure.

The additional equipment required commences where the ventilating air leaves the alternator casing. The warm air, which

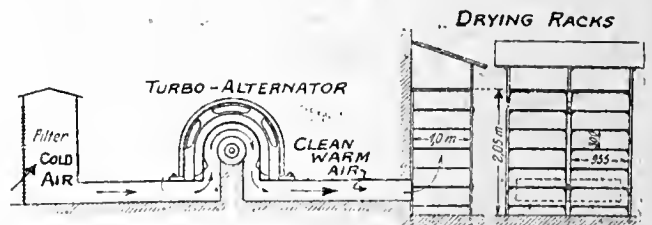


FIG. 1.—ARRANGEMENT OF DRYING APPARATUS.

is filtered as a matter of course before being admitted to the ventilating machine, is taken through a suitable duct to the bottom of a drying press, which consists of a sheet-iron enclosure containing a series of wire-netting drying trays. The top of the enclosure is open, but a roof is set about a yard above it to keep off rain and dirt. The drying trays are removable for filling and emptying, and provision is made for controlling the air flow. The sketch shows accommodation for 12 trays (2.05 m., or 6 ft. 9 in. in overall height) and the inside dimensions of each compartment are 1.00 × 0.95 × 3.00 mm. (about 39½ in. × 37½ in. × 12 in.). The trays, if not the rest of the iron work, should be galvanised to prevent rusting. About 22 lb. of vegetables can be dried in each tray, and from four to five hours is sufficient to dry vegetables or sliced fruit.

Condensing Plant.

An interesting catalogue (No. 38) of condensing equipment has just been issued by MESSRS COLE, MARCHENT & MORLEY, LTD., of Bradford, which covers many examples of independent plant suitable for turbines and reciprocating engines. The equipment is of the low-level jet, barometric jet and surface types. As regards the former, both the weir and nozzle patterns are supplied, and

the firm's patent vacuum breaker is fitted, which, in the event of the water in the condenser body rising above a predetermined level, operates in such a way as to admit air to the system until the vacuum is reduced and the working level regained, when normal working is automatically reintroduced.

In connection with surface condensing plants, Messrs Cole, Marchent & Morley are prepared to supply any of the recognised types of equipment, with either reciprocating or rotary pumps. In many cases the well-known Edwards type of air pump is adopted, but the firm are also building a well-known type of rotary air-pump, and as an alternative they are prepared to supply a double-acting horizontal dry vacuum pump, which can be designed with multiple stages, when very high vacua are desired.

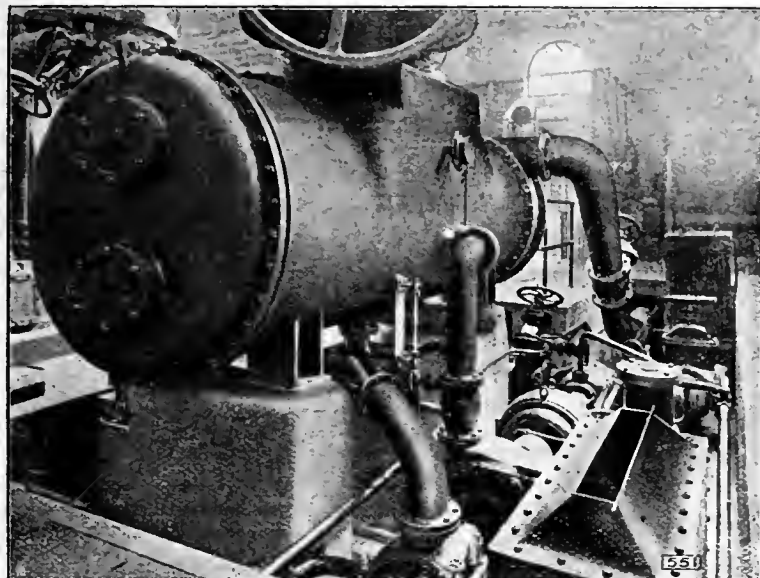


FIG. 2.—COLE, MARCHENT & MORLEY CONDENSING PLANT.

The catalogue is well illustrated, and we select a view, fig. 2, showing a standard surface condensing plant, operating in conjunction with a 2,000-kw. turbine set. This condenser is, owing to special conditions, placed beside the turbine, and is provided with rotary air and extraction, and circulating pumps coupled to the same shaft and driven by an electric motor.

LEGAL.

THE OSRAM-ROBERTSON LAMP WORKS, LTD., v. POPE'S ELECTRIC LAMP CO., LTD.—APPEAL ALLOWED.

AT the House of Lords, on October 25th, judgment was given in the appeal by the Osram-Robertson Lamp Works, Ltd., from an order of the Court of Appeal affirming a judgment of Mr. Justice Joyce in the Chancery Division. The action was brought by the present appellants to restrain the respondents, Pope's Electric Lamp Co., Ltd., from producing filaments of pure tungsten for use in electric lamps under a process which the appellants contended was an infringement of their Patent No. 23,899*, of 1904. Both Courts below held that there was no infringement, as the process used by the respondents was substantially different from the process described in the specification of the patent sued on, and the action was therefore dismissed with costs. The case was reported in the ELECTRICAL REVIEW of July 2nd—23rd, 1915, and the hearing before the Court of Appeal in our issues of November 19th—December 31st, 1915. The appeal was heard on 10 different days, and judgment was reserved on July 9th.

Mr. Walter, K.C., Mr. Colefax, K.C., and Mr. Gray appeared for the appellant company; Mr. Thos. Terrell, K.C., Mr. E. M. Kirby, K.C., and Mr. E. Russell-Clarke for the respondents.

Their Lordships differed in opinion. The Lord Chancellor, Lord Atkinson, and Lord Parker were for allowing the appeal, while Viscount Haldane and Lord Parmoor were for dismissing it. By a majority of three to two the appeal was allowed.

The LORD CHANCELLOR, in the course of his judgment, said:—The patent was granted to Alexander Just and Franz Hanaman. A patent had been granted to Welsbach (No. 1,535 of 1898) for the manufacture of filaments from osmium, and the method of manufacturing such filaments as described in his patent was adopted in the appellants' patent and applied to the manufacturing of filaments from tungsten. There can be no doubt that the application of an old method to a new substance may constitute a good subject matter for a patent if invention is required for the application. According to the specification, the tungsten or tungsten compound is to be mixed with an organic binding medium "such as collodion or a solution of cellulose in chloride of zinc or cupreous ammonia oxide or the like." From the mass so formed filaments are to be formed in the usual manner. The filaments are then to be carbonised—that is, they are to be subjected to heat in the absence of

oxygen as in the manufacture of charcoal, so that the other materials are driven off by destructive distillation and the carbon is left. The specification goes on to direct that the filaments are to be subjected to the following further treatment:—"First of all the carbon which has only served as a binding medium, is removed by subjecting the filaments to the passage of current in an atmosphere of steam and hydrogen, and thus raising it to a high temperature. By this means the carbon is completely oxidised so as to form carbonic oxide, and the filament of tungsten is left." It is mainly upon this last passage that the question of infringement depends, for the defendants do not heat the filament by passing the electric current through it but by the agency of external heat, and they do not subject the heated filaments to an atmosphere of steam and hydrogen formed *ab extra*, but it is alleged by the appellants that such an atmosphere is created *ab intra* by the heat, and that the respondents' process is in substance the appellants'.

In my opinion the respondents' process does amount to an infringement of the appellants' patent. The great merit of the appellants' patent consists in the discovery that tungsten can be successfully used for the manufacture of filaments for electric lamps. The respondents, like the appellants, used tungsten for this purpose, but say that they did so by a process different from that of the appellants. It was alleged by the respondents that the appellants used a "soft paste," there being a larger proportion of the binding material than of the metal, while the respondents use a "hard paste" composed of the metal with only enough of the binding material to act as a lubricant. It appears to me that the binding material is used as such in both processes, and that there is no ground for the respondents' contention that the filament is formed by them merely by the cohesion of the metallic particles under the pressure by which it is forced through the aperture. In both cases the cohesion is due to the presence of the binding material. On this point there is substantial identity between the appellants' patent and the respondents' processes. The filaments when formed are, according to the patent, to be "carbonised," and the respondents contend that there is no carbonisation by them as a distinct step. As a matter of fact, the respondents carry out carbonisation while the filaments are passing through the first furnace. In each case carbonisation is effected, and

there is no material difference between the two processes on this point.

The serious contest on the issue of infringement was raised on the passage of the specification which describes the treatment of the filament by the passage of current in an atmosphere of steam and hydrogen. Upon this the respondents made two points. First, that there is no infringement, because they apply heat externally to the furnace, and not by passing the electric current through the filament; and, secondly, that they do not use an atmosphere of steam and hydrogen. It appears to me that the passage of the electric current was used in the appellants' process merely to produce a high temperature, and not for the sake of any other effect on the filament by the application of electricity, and that, in fact, it operated only by the production of a high temperature. It follows that if a high temperature be applied *ab extra* to effect the same purpose as by passing the filament through a furnace, the respondents cannot escape liability by this variation in the means used to produce the requisite temperature. In substance, the appellants' process is adopted on this point.

A more serious question was raised upon the point that the specification prescribes the use of an atmosphere of "steam and hydrogen," in which the filaments are to be raised to a high temperature, the respondents denying that they use any such atmosphere. It was admitted by the appellants that they could not succeed on this appeal unless it could be shown that the process of the respondents, in substance, consists in the application of an atmosphere of steam and hydrogen.

When the process described in the patent is carried out, the water forming the steam is decomposed by the carbon in the filaments and carbonic oxide is formed, so that ultimately the whole of the carbon is removed. At the same time the hydrogen liberated by the decomposition of the steam, as well as the hydrogen which forms part of the "atmosphere" prescribed by the specification, combines with the oxygen which is to be found in all commercial tungsten and forms more steam. In the result, the carbon disappears and a pure metallic filament of tungsten is left. The agent by which the carbon is removed is the water forming the steam, the oxygen of which, at a temperature of 700° C., or thereabouts, combines with the carbon. In comparing with this the process carried on by the respondents, although they are superficially different, I think the two are in substance the same.

His Lordship then dealt with the evidence given as to the two processes, and said that it was claimed by the respondents that there were advantages in their process which were not possessed by that in the terms of the patent of the appellants. He thought that was the case, and that there were improvements in a process followed by the respondents as compared with that under the patent. But the fact of improvements did not cure the fact that the respondents' process was substantially one which employed an atmosphere of steam and hydrogen. Upon the whole, he came to the conclusion that the respondents had infringed the appellants' patent.

It remained to consider the question whether the patent was valid, and his Lordship dealing with this point said:—

The objections are set out in the particulars of objections, and may be summarised as follows:—First, want of novelty; second, want of subject-matter; third, want of utility; fourth, insufficiency, ambiguity, and misleading nature of description of process. The first and second of these objections, in my opinion, fail. The application of the Welsbach method of manufacture to tungsten was new. Tungsten and its compounds were excluded by Welsbach from his patent, and it required invention and experiment to find out that this method could be successfully applied to tungsten. The third objection also fails upon the evidence, as there can be no question as to the utility of the invention. The fourth head of objection requires careful examination so far as it depends on the allegation that filaments cannot be made by employing with tungsten a solution of cellulose in cupreous ammonia oxide. This point depends upon the interpretation to be put upon the first sentence of the instructions in the specification. If that sentence is to be read as directing that either tungsten or any one of its compounds may be mixed with any one of the forms of organic binding material which are mentioned—viz., collodion or a solution of cellulose in chloride of zinc or cupreous ammonia oxide—the patent would be bad. The solution of cellulose in cupreous ammonia oxide may be used with tungsten compounds, such as tungstite, tungstic acid, or tungstic sulphide, but not with tungsten itself. It follows that if the specification directs that it may be so used, the direction is misleading and the patent would be vitiated. In the present case the evidence establishes that it was well known in 1901 to everyone who had experience in making filaments that if cupreous ammonia oxide were used as a solvent for the cellulose, the result would be a failure if the metal tungsten were used with it. This was proved at a very early stage of the case by Dr. Passmore, a witness for the appellants. The fact that the cupreous ammonia solution of cellulose would act with all the enumerated compounds of tungsten is sufficient to support the language of the specification. Upon the whole, I think that the objection to the validity of the patent fails. I may add that if the language be ambiguous, a construction which will give effect to the patent is upon the authorities to be preferred to one which would nullify it. As, in my opinion, the patent is valid and infringement has been established, I think that this appeal ought to be allowed.

Lord Haldane's judgment (which was read by Lord Dunedin) was in favour of the appeal being dismissed. Having dealt with the facts, and compared the process as described with that proposed by Welsbach for application to osmium, he stated that the distinction between "hard" and "soft" paste was not material. The respondents did not heat their filaments by the passage of a current, and while in one of their processes they applied external heat in a current of hydrogen, there was no atmosphere of steam, as prescribed in the patent sued on. Even if hydrogen and water vapour were present in the way suggested, he did not think that they were present in such a fashion as to constitute such "an atmosphere of steam and hydrogen" as Just & Hanaman's specification directs to be employed. There might be present no steam at all excepting what the action of the hydrogen on the oxide of tungsten called momentarily into being. Any combination of hydrogen with oxygen which formed steam was brought into, and at once dissociated, by the new combination which its oxygen straightway formed with the carbon. No prepared atmosphere of steam was required or provided for. He was therefore of opinion that, so far as this aspect of the respondents' processes was concerned, it did not infringe the methods directed by the specification. Moreover, the respondents' mode of manufacture, unlike that of the appellants', does not require free carbon at any stage. The appellants' patent was one only for a process in which known factors were combined in a particular fashion. The novelty lay in the fashion of combination, and the fashion of the respondents' combination was of a substantially different character, to which the doctrine of equivalents had no application.

With regard to the question of validity, in his opinion the patent indicated a useful and patentable invention. But a question arose whether the practical directions which the specification gave were sufficient even for a trained lamp maker. It told those to whom it was addressed that they might take finely divided tungsten and mix it with cupreous ammonia oxide. It was admitted that this would not work. The instruction in regard to tungsten appeared to him to be unambiguous, and consequently fatal to the validity of the patent. For these reasons he thought that the appeal failed, and ought to be dismissed with costs.

LORD ATKINSON read an extremely long judgment prepared by Lord Parker, who was for allowing the appeal. He said that he so entirely agreed with the opinion expressed by Lord Parker that it was unnecessary for him to deliver a separate judgment. He agreed in the appeal being allowed.

LORD PARMEOR read a judgment agreeing with the opinion expressed by Lord Haldane.

On the motion of the LORD CHANCELLOR the appeal was allowed, with costs, in the terms of the prayer.

SOCIÉTÉ ÉLECTRIQUE DE PARIS v. ADAM BROMLEY & SON, LTD. In the King's Bench Division, last week, before Mr. Justice Bailhache, plaintiffs brought this action against defendants, who are coal merchants of London, to recover damages for alleged breaches by the defendants of contracts for the supply of coals to the plaintiffs *c.i.f.* Rouen.

The case for the plaintiffs was that they were a large company with vast electrical power undertakings in Paris. They supplied electrical power to various tube railways, munition works and

factories, and required to have some 500 tons of coal per day. When the supplies in France became depleted they had to make arrangements to get coal here, and they entered into various contracts with the defendants, breaches of which were now alleged. The defendants set up a variety of defences to the contention of the plaintiffs that they failed to make proper deliveries at the proper times. The defendants relied on the condition of things brought about by the war, and pleaded that the contract was ended.

Ultimately the case was settled in Court on terms agreed between the parties, the terms providing that the plaintiffs should have the taxed costs of the action, and that money should be paid out to them that they had paid into Court as security for costs.

HOUSE OF LORDS APPEAL.

THE appeal of the Metropolitan Water Board against the order of the Appeal Court reversing a judgment of Mr. Justice Bray, in the case between the Board and Messrs. Dick, Kerr & Co., Ltd., was before the House of Lords on Thursday last week. It will be remembered that the litigation related to contracts for the construction of reservoirs, the execution of which was interfered with by the Ministry of Munitions.

DAMAGING ELECTRIC LAMPS.

AT Dublin Southern Police Court, Eric Cantley, a boy of 15, was convicted, at the instance of the Pembroke Urban Council, of damaging public electric lamps and extinguishing the lights. He was ordered to find bail in £5, or, in default, to be imprisoned for a fortnight and to pay £1 compensation.

KENT v. LIVERPOOL CORPORATION.

IN the Liverpool Court of Passage, last week, Judge Taylor, K.C., gave his decision in an interesting case in which he had previously reserved judgment. The case was one in which Mrs. Caroline Kent, broker, of Wavertree Road, claimed damages from the Liverpool Corporation for personal injuries. The plaintiff was standing in the London Road, when part of the overhead tramway wire fell unexpectedly, and she received a fright or shock. She suffered some illness and was put to expense, and she claimed damages for alleged negligence.

HIS LORDSHIP, in giving judgment, said it was clear that the general management of the overhead wires was without fault. The accident happened at what was known as a section insulator. There was a cap or cup, inside of which was a screw, and the accident would not have happened if the screw had not become unscrewed. For the plaintiff an expert suggested that the copper screw had not been tightened, and that it might have become unscrewed by passing traffic or vibration. The Corporation expert held that it was wrong to draw that inference, because it was extremely unlikely that their servant would be guilty of such a thing, and that one ought to assume that some accident had happened, such as a stone thrown by a boy, which had produced the unscrewing. It was not an ordinary case, and no accident of the kind had happened before. That was extraordinary when one considered the number of years the system had been working, and the number of section insulators.

HIS LORDSHIP concluded that the mishap was much less likely to be due to negligence of Corporation workmen than to an accident. He was satisfied that it was not due to negligence, and he gave a verdict for the defendants.

WAR ITEMS.

Exports to China.—The "London Gazette" for October 30th contains a further list of bodies and persons to whom exports to China may be consigned.

Tar Oils.—An Order is published under which the Minister of Munitions will from November 1st take possession of all tar oils in the United Kingdom.

Leaving Certificates.—The question having arisen as to whether Section 3 of the Munitions of War Act, 1917, enables a workman who has undertaken the performance of a definite job to give a week's notice and leave before the completion of the job, the Minister of Munitions announces that he has been advised that the section does not apply to contracts of service for a definite period or for the doing of a particular job, but is confined to contracts which, apart from the Act, are determinable by notice or at pleasure. The answer is, therefore, that the section does not enable a workman who has undertaken the performance of a definite job to give a week's notice and leave before the performance of the job.—*Daily Telegraph*.

Reports received from several parts of the provinces go to show that the operation of the leaving certificates alteration is causing disquiet among the workers, because it is said that in certain cases men have been refused employment by one firm because they have left the employment of another. There are suspicions that employers in a district have agreed among themselves to prevent workmen leaving one shop and going to another. Trouble is threatened if this is proved to be correct. In one district it is complained

that men have travelled long distances in order to settle upon new work, by arrangement with a foreman, and have been dismissed after a few hours. Birmingham, Manchester, and several other places are mentioned as centres of dissatisfaction.

Coal Shortage in Russia.—The "Times" correspondent at Odessa states that since the revolution the miners in Russia have been working short time, and devoting their attention to politics. There has been a progressive decline month by month in output. The writer adds that "unfortunately wood cannot be used as a substitute for coal in the furnaces of many large factories, waterworks, electric light and similar works. The closure of these institutions would turn into the streets thousands of men. The serious character of the outlook is now recognised by the revolutionary authorities here, who have appointed a committee to deal with the question."

Trading with the Enemy.—The "London Gazette" for August 26th contains names of further bodies and persons with whom trading is prohibited in Argentina, Paraguay and Uruguay, Brazil, Chile, Ecuador, Greece, Morocco, Netherlands, Netherlands East Indies, Norway, Persia, Peru, Spain, Sweden, and Venezuela.

Engineers' Bonus.—With reference to the Order published in our last issue, the following official list sets forth certain occupations in which skilled men employed under the conditions prescribed in the Order are entitled to the bonus of 12½ per cent. Only those skilled men in the specified occupations who are paid at or above the current district time rate for turners or fitters are covered by the provisions of the Order:—Blacksmith, borer, coremaker, fitter, gauge maker, gear cutter, grinder, hardener and temperer, jig maker, miller, millwright, moulder, patternmaker, planer, shaper, slotter, toolmaker, toolsmith, turner.

Also skilled men employed in the following capacities whose trade is one of those specified above:—Charge hand, draughtsman, examiner, foreman, gauger, inspector, marker off, rate-fixer, setter-up, viewman.

Leaving Certificates and Electrical Undertakings.—Early in October, before the date for the abolition of Leaving Certificates, a deputation from the Tramways & Light Railways Association, the Incorporated Association of Electric Power Companies, and other associations, sent a deputation to the Ministry of Munitions to show the possible effect of such abolition upon their undertakings. As a result, a memorandum was submitted explaining the situation and advancing suggestions for meeting it. This memorandum appears in the October issue of the Tramways and Light Railways Association *Journal*. It was stated that the staffs of these undertakings had been heavily depleted already, and any alteration which might have the effect of still further reducing the labour necessary was viewed with the gravest apprehension.

The operations of electricity, tramway, and gas undertakings are carried on under Statute, and differ from those of many other industries which could restrict their output at their own discretion. They, however, were bound by Acts of Parliament to give and maintain their services. The memorandum continued:—

"Public service undertakings demand special consideration. Any insufficiency of the necessary labour will affect not our own concerns only, but will most seriously interfere with the output and operation of thousands of firms who employ many times more men than the public services, by stoppage of traffic facilities and supplies of electricity and gas used for power and other industrial purposes. It is understood that there is no possibility of the Government reconsidering the proposed withdrawal of Leaving Certificates, but we would suggest that the position would be rendered less difficult if it were possible to enact that the power of leaving should be limited to movements within each particular trade, and also that the period for giving notice of any proposed transfer of service should not be less than one month."

In case no modification of the abolition could be entertained the memorandum, in reply to the request of the Ministry, formulated suggestions for easing the situation:—

1. All skilled and semi-skilled men (and also unskilled men who have special training) who have been taken from public services to serve with H.M. Forces, should be restored at the earliest possible date.

2. The heavy burdens already put upon us by frequent increases in wages, and the possibility of further increases and alterations in conditions of employment now being demanded, should be met by giving to:—

(a) Electric Lighting and Power Undertakings—authority to increase prices (if necessary above the present statutory maxima) by way of an adjustment of charges in proportion to the increased wages paid. This would entail amendment of existing long-time contracts.

(b) Electric Tramway Undertakings—authority to raise or revise their fares, including workmen's fares.

(c) Gas Undertakings—relief from the operations of sliding scale and maximum price regulations.

It was also recommended that in order to facilitate the work required of public service undertakings, higher class priority certificates should be issued for materials. This would have the effect, amongst others, of economising labour.

In the Parliamentary questions, Sir G. Toulton asked the Minister of Munitions whether, in view of the abolition of leaving certificates, he had considered the question of protecting electricity undertakings from the danger of interruption arising from the loss of their men and consequent difficulties in the supply of electrical energy to munition and other works; if he was aware that his predecessor recognised the gravity of the position, and undertook that this aspect of the matter would be borne in mind on any amendment of the

Munitions of War Act, 1915; and if he would say whether he proposed to take any steps in the matter.

Mr. Churchill, in reply, said he had received representations on this matter from the interests affected, and he was fully alive to the importance of their being able to retain or secure an adequate supply of labour. While he had no reason to think that the difficulties would be as serious as the representatives of these undertakings anticipated, he was prepared to take whatever steps were possible to meet such difficulties as might arise.

Exemption Applications.—In our report last week of the application respecting Mr. C. C. Hodges, we stated that he was doing the work of the Dawlish electric light concern with the aid of two pupils. What was actually stated at the Tribunal was that he *had been* doing the work. As a matter of fact, he was doing so for three weeks owing to inability to secure a stoker-driver. One had, however, been obtained some days before the hearing.

At Burnley, an electrical fitter, aged 29, B.I., was appealed for, his employer stating that he was the only man he had at present, whereas he usually had five or six. He was responsible for looking after the electrical equipment of several large works. The Tribunal thought the man ought to have a certificate, and they adjourned the case to the end of the year to enable him to get one.

Camberwell Tribunal have unanimously adopted a resolution, which is to be forwarded to the Army Council and the Local Government Board, protesting against the retention of young men in Woolwich Arsenal, fit for general service, whilst they were called upon to send into the Army men between 35 and 41 years of age, in low medical categories. The Military Representative said there was a certain amount of combing-out now going on at Woolwich Arsenal, as the Munitions Area Recruiting Officer was withdrawing certificates every week. Mr. May said it was about time something was done, for these young men were being granted protection by the M.A.R.O., doing work which could easily be learnt by older men in a very short time.

At Southwark, Mr. W. H. Donovan, a director of the London Commercial Electric Stores, Ltd., of 13, Farringdon Avenue, was summoned to show cause why his certificate of conditional exemption should not be withdrawn. He was 36 years of age, and passed for sedentary work at home (C3). He stated that he did all the buying, and had been granted his exemption on domestic and medical grounds. He supported his father and mother, aged 74 and 68 years. They had a turnover at the firm of £30,000 a year. There was another director, who was a Czech. He stated that he had not joined the V.T.C. or the Special Police, although it was a condition of his exemption that he should do something of this kind. The Chairman: We asked you to do something—to make some sacrifice—but you have done nothing. Appellant said his business kept him fully occupied. Coun. Weaver: We can find work in the Army for C3 men like you. The case was adjourned for a month to enable appellant to join either the Special Police or the V.T.C.

At a West Riding Appeals Tribunal, at Dewsbury, last week, Messrs. Ward & Co., electrical engineers, Dewsbury, appealed for B. H. Allen (23, Class A, married), electrical fitter, and for H. Hirst (31, A, single), skilled wireman. Mr. Nicholson, representing the firm, admitted that both men were young and fit, but so was the electrical trade young, and it was not likely that old men could be obtained to do the work efficiently. He contended that the local tribunal had been wrong in deciding that the men were not in a certified occupation, and he referred to the official list. Major Collins (Military Representative) said the latest instructions were that such men as these were needed in the Army. Mr. Nicholson said the firm were the only electrical engineering contractors left in Dewsbury, and were engaged in electrical installation at the military base hospital at Staincliffe, work which had been much delayed owing to labour scarcity. They had also contracts in mills and collieries. In reply to a suggestion by the Military Representative that the firm were not on the Government list, Mr. Nicholson said they were in communication with the Ministry of Munitions on that matter. The appeals were dismissed, but grace was allowed to January 1st in the case of Allen, and December 1st in the case of Hirst, both final.

Further exemption on business and health grounds was sought at Hastings by P. W. Bridger (28, B3), electrician, engaged in his father's business. The Military opposed the appeal on the ground that applicant would be useful in the Army for electrical work. A final two months for a substitute to be found was granted.

Exemption until April 30th has been granted to H. W. Taylor (33, C2), electrical engineer, of Leyton, who attends to the wiring, &c., at the Council schools.

At Colchester, an arrangement was arrived at whereby certain men in the Corporation tramway department should be released for military service. It was stated that 64 men had been parted with, and that the Tramway Committee hesitated to adopt a suggestion to employ female drivers owing to the gradients and heavy military traffic in the streets.

At Brierley Hill, Messrs. Holmes & Cartwright, electricians, asked for further exemption for an electrical engineer (28, C2), the only one left capable of doing electrical work, and the only man in the district who could repair motors in local works. Three months were allowed.

At Kidderminster, exemption on the ground of being in a certified occupation was claimed by J. A. Mitchell (40, Class A), electrical engineer. Mr. Pilling, for the Military, said that after inquiry he was satisfied that appellant should have exemption, and conditional exemption was conceded.

At Quarry Bank, a works electrician (27) was appealed for by a firm of brush manufacturers. As he holds a red card, the appeal was resented *sine die*.

At Oxford, the Tramway Co. appealed for renewed exemption for M. F. Sadler (37, C1), unit adjuster, and C. W. Millard (37, C1), driver. The manager (Mr. A. A. Tyler) said that the men were absolutely necessary for the carrying on of the public service. Each was allowed three months' temporary exemption.

On a Military review, conditional exemption held by E. E. Hill (C2), engine driver at the Winscombe electric supply station, has been cancelled.

At Axbridge, Mr. S. Hill appealed for the retention of P. J. Brown (30), Class A, in charge of the electrical plant on an estate at Churchill. He was stated to be of no value as a soldier. The case was put back for substitution. Brown not to be called up until a suitable substitute is found.

An appeal was made to the Herts. Appeal Court by C. E. W. Parker (18), second-year student for electrical engineering, and now engaged as electrical fitter and draughtsman with Messrs. Vickers, Ltd., Crayford. Exemption was refused.

Herts. Appeal Court have granted six months' exemption to M. J. Connari (38, B2), electrician, of Watford.

Lancashire Appeal Court has refused an appeal by the Grove Dyeing Co., Littleborough, for the retention of J. Humphreys (26, Class A), electrician, and he is to report for service on November 30th.

Gloucestershire Appeal Court has dismissed a military appeal against the chief engineer to Messrs. T. B. Worth and Co., Thrupp, Stroud (34, A1), responsible for the running of the electricity plant, and six months' exemption was granted.

BUSINESS NOTES.

An Exhibition in New Zealand.—Notwithstanding all the difficulties of the present export trade situation, there has lately been organised and held at Hawera, New Zealand, an exhibition of British-made goods. The exhibition is due to the initiative of Mr. R. W. Dalton, H.M. Trade Commissioner in New Zealand, and its object has been to bring before buyers in that promising market manufactures made by British firms which will meet their requirements. The exhibition, which was well supported by agents and importers, included tires, hardware, tools, weighing machines, &c. It is hoped that other exhibitions of a like character will be held in other parts of the Dominion. As Mr. Dalton has shown in his reports, he attaches great importance to the matter of preparations during the war if we desire to secure and extend our hold on the New Zealand market. The present exhibition is a practical object-lesson of the advice that he gives. There can be no question about the future electrical importance of New Zealand, but British engineers will be required on the spot to show that British manufacturers are able to meet the market's needs, or else our disadvantages consequent upon the war will continue after the war, the advantage being gained by those who have now for some time reaped the benefit accruing to them from our occupation with munitions.

China Clay Combination.—It was stated at a meeting of the St. Austell China Clay Works, last week, that as the result of an agreement entered into with other china clay producing companies, with the exception of about 2 per cent. of the industry, there would be a great combination, which would ensure the regular distribution of the output of clay according to the capability of each company to produce it, and according to its quality of production. According to the *Times*, as a result the sale of the pre-war standard of the company's output was assured, as well as a fair and proper rate of wages, and the combination assured the master who had invested his money in china clay companies a fair and proper return for that investment. The result of the combine was that the price of their clay would immediately advance 33½ per cent., the supplies of coal from colliery proprietors would be regulated, and the china clay companies would be able to deal much better and more satisfactorily with the questions of railway transport and shipping facilities.

Book Notices.—"National Physical Laboratory: Collected Researches." Vol. XIII, 1916. London: Harrison & Sons, Price 20s. Also Report for 1916-17. From the Laboratory.

This volume of researches contains papers on optical apparatus, experiments on ship models, the hydrogen spectrum, the analysis of aluminium alloys, copper-tin alloys, and fuel oils, as well as one by Mr. Albert Campbell and Mr. D. W. Dye on "The Magnetic Testing of Bars" (I.E.E. paper), and one by Mr. F. E. Smith on "The Manufacture and Testing of Prismatic Compasses" (read before the Optical Society). An abstract of Messrs. Campbell and Dye's valuable paper has appeared in our pages. Mr. F. E. Smith's paper describes the tests applied to prismatic compasses for military purposes at the National Physical Laboratory, and discusses in detail the errors to which such instruments are liable, containing also a mass of

information of use to the manufacturers of compasses. The report on tests of fuel oils, carried out for the Royal Commission on Oil Fuel in 1914, by Messrs. J. R. Pannell and W. F. Higgins, covers the flow of oil in pipes and the physical constants of the oils.

Cycling Manual. London: Temple Press, Ltd. Price 9d. net.—This little book fills a want long felt by the multitude of "users" of bicycles, who far outnumber the class who may fairly claim the title of "cyclists" and stand less in need of instruction and advice with regard to their mounts. It professes to tell "all about cycles and cycling in simple language," and, so far as the choice, care, and repair of the bicycle are concerned, it fully attains its object. After an interested perusal of the whole of its contents, we are of opinion that no one who rides a bicycle should be without a copy of it.

"Terms of Industrial Peace." By A. Ramsay. London: Constable & Co. Price 3s. net.

"Power Wiring Diagrams." By A. T. Dover. London: Whitaker & Co. Price 6s. net.

"Continuous-Current Motors and Control Apparatus." By W. P. Maycock. London: Whittaker & Co. Price 6s. net.

"British Standardisation Rules for Electrical Machinery." Report No. 72 (1917) of the British Engineering Standards Committee, revised September, 1917. London: Crosby Lockwood and Son; or the Committee. Price 1s. net. (See our "Notes" columns to-day.)

Trade Statistics of Spain.—The figures given below show the imports of electrical and other similar goods into Spain during the year 1916 according to official statistics. The figures for 1915 have been added for the purposes of comparison, and increases are also shown. The detailed returns giving countries whence the goods were imported will probably not be available for some months:—

	1915. Pesetas.	1916. Pesetas.	Inc. or dec. Pesetas.
Arc lamps	14,000	16,000	+ 2,000
Carbons for arc lamps ...	33,000	6,000	- 27,000
Incandescent electric lamps, mounted ...	2,420,000	2,218,000	- 202,000
Ditto, unmounted ...	34,000	7,000	- 27,000
Dynamos, electric motors, induction coils, resistances, transformers, &c., up to 100 kg. weight	1,847,000	2,351,000	+ 504,000
Ditto, weighing from 101 to 400 kg. ...	937,000	1,731,000	+ 794,000
Switchboards and interrupters, up to 400 kg. weight ...	312,000	576,000	+ 264,000
Dynamos, electric motors, &c., and switchboards, weighing from 401 to 2,500 kg. ...	1,076,000	2,339,000	+ 1,263,000
Ditto, weighing from 2,501 to 5,000 kg. ...	560,000	392,000	- 168,000
Ditto, weighing more than 5,000 kg. ...	1,804,000	2,369,000	+ 565,000
Accumulators and electric batteries ...	98,000	150,000	+ 52,000
Cables and electric wire with or without insulating material, of 1 cm. diameter or more ...	155,000	123,000	- 32,000
Ditto, less than 1 cm. in diameter ...	127,000	121,000	- 6,000
Telegraph and telephone apparatus, electric meters and parts ...	2,444,000	4,688,000	+ 2,244,000
Electrodes ...	63,000	79,000	+ 16,000
Hydraulic motors ...	1,627,000	1,119,000	- 508,000
Steam and gas engines (stationary) up to 10,000 kg. weight ...	515,000	607,000	+ 62,000
Ditto, from 10,000 to 25,000 kg. weight ...	49,000	200,000	+ 151,000
Ditto, over 25,000 kg. weight ...	250,000	360,000	+ 110,000
Cylindrical boilers ...	156,000	141,000	- 15,000
Multitubular boilers ...	1,801,000	2,355,000	+ 554,000

Lamp Prices in Germany.—The German Association of Electric Lamp Manufacturers has recently issued a new price list, which shows an advance of 40 per cent. in the price of metal filament lamps and of 20 per cent. in those of carbon filament lamps.

Trade Inquiries.—H.M. Consul-General in Paris states that an agent there desires to get into touch with United Kingdom manufacturers of railway material, electrical appliances, &c., with a view to obtaining agencies for trade after the war. Inquiry No. 369, Department of Commercial Intelligence, 37, Basinghall Street, E.C. 2.

Catalogues and Lists.—THE B.E. CO. (of London and Birmingham), LTD., Mansion House Chambers, Queen Victoria Street, London, E.C. 4.—Two leaflets, one giving net prices for non-association V.I.R. cables, the other describing the "Beco" dimmer. Copies will be sent on application.

Patent Application.—THE MENNO LUBRICATOR CO., LTD., has applied for restoration of Patent No. 27,131, of 1905, granted to J. F. Lewis for "Improvements in Automatic Grease Cups."

Liquidations.—In the Chancery Division, last week an order was made for the winding up compulsorily of the GOLD-SCHMIDT, LTD., which has already been ordered to be wound up under the Trading with the Enemy Act.

UNITED CARBORUNDUM AND ELECTRITE WORKS, LTD. [Enemy Company].—The last date for creditors' claims to be sent in to the controller, Mr. C. Eves, 62, New Broad Street, E.C., is November 30th.

Lantern Slides.—MESSRS. ED. BENNIS & CO., LTD., inform us that they have a large number of lantern slides dealing with the development and present practice in connection with automatic stokers, coal elevators and conveyers, &c., which they will be pleased to loan to any responsible inquirer for lecture purposes. A set of slides on the subject of ash removal is in course of preparation, and will be ready shortly. A list of the slides and particulars of their subject matter can be obtained on request. Applications should be made as far as possible in advance of the lecture date to Messrs. Ed. Bennis & Co., Ltd., 28, Victoria Street London, S.W. 1.

Trade Announcements.—MR. A. E. BLOWER has resigned his position with the Wandsworth Electrical Manufacturing Co., Ltd., by mutual agreement, after many years' service with the company, and has commenced business on his own account, in company with Mr. A. Cooper, under the style of Blower & Cooper, electrical and engineering suppliers, having purchased the business carried on for some years by Messrs. Cooper & Roberts, at 3, Paul's Bakehouse Court, Godliman Street, E.C.

By permission of the Ministry of Munitions, and by order of the trustee, the stock-in-trade of MR. B. C. COUSINS, electrical and nautical contractor, Wyre Dock, Fleetwood, has been disposed of by auction.

Bankruptcy Proceedings.—R. E. CONNOLD, late electrician, now R.N.A.S., Canterbury.—Trustee released July 27th, 1917.

A. E. FELGATE, electrical engineer (late trading with W. Storey as Felgate & Storey). Reading.—November 22nd is fixed for hearing application for debtor's discharge.

Sterling Fire Brigade at Work.—On Friday last an outbreak of fire on property near the Sterling Works was promptly overcome by the swiftness of the fire brigade connected with the Dagenham works of the STERLING TELEPHONE AND ELECTRIC CO., LTD. The managing director, Mr. Guy Burney, superintended the efforts of the amateur firemen, assisted by Mr. A. Crawford, and others. Had it not been for the alertness of the brigade, in all probability a whole row of cottages would have been burnt to the ground; as it was the damage was confined to some stables and store-houses.

LIGHTING AND POWER NOTES.

Accrington.—PRICE INCREASE.—The Electricity and Tramways Committee has decided to advance the charge for current, in order to meet the greatly increased cost of production. Where the consumer is on the rateable value system, and also where current is used for heating purposes only, 10 per cent. is to be added to the consumer's account each quarter. A similar addition will be made to the charges in the case of power users not affected by the sliding rate regulated by the price of coal, whilst power users under agreement are to be charged at the increased rate of 0.6d. per unit, in addition to the increase owing to the advance in coal prices.

Argentina.—A strike of the stokers and engine-room staff employed at the South Dock power station of the German Trans-Atlantic Co. recently occurred, which also spread to the company's power station at Boca, and to the employés of the tramway running to South Dock. The company appealed to the municipal authorities, who secured the services of a naval force to operate the power plant and guard the station. The *Review of the River Plate* contrasts the prompt action of the authorities in the case of this German company with their attitude during the recent railway trouble, when, after considerable delay, the troops sent were unable to prevent considerable damage being done. Owing to the strike the Anglo-Argentine Tramways Co. had to reduce its services between 5 and 9 p.m.

Bedford.—The mains are to be extended to the works of the Cryselco Co., Rogers' Flour Mills, English Bros., and Hobson and Co., and an additional cable provided for the Queen's Engineering Works. The cost in the case of the Cryselco Co. will be £3,835, and the company is to be asked to pay £2,420 and guarantee at least £550 per annum for seven years.

Belturbet (Co. Cavan).—A dispute with regard to the electric lighting supply has been settled by the Council agreeing to pay the contractor's terms for the season, £70. Fears were entertained that the power plant might be removed if the dispute continued, and protests were made at a ratepayers' meeting.

Bradford.—PRICE REVISION.—Last week the Electricity Committee, after a lengthy discussion, reaffirmed its proposed revision of electricity charges (previously enumerated in the ELEC. REV.), which were referred back to the Committee by the City Council on October 9th; the proposed charges have been re-sub-

mitted for approval. The chief objection at the Council meeting was the proposed raising of the charge to the 4d. flat rate consumers; the Council decided to defer the matter for three months.

The Electricity Committee has authorised the Town Clerk to protest, on the Committee's behalf, that it is unfair that the increased price of coal for works is retrospective to September 17th, and to urge that the advance for works be brought into line with that for household purposes, and be retrospective, therefore, only to October 15th.

Permission has been obtained to proceed with the provision of a coal conveyor at Valley Road works.

Brighton.—The electrical engineer reports that he has been in negotiation with Messrs. D. Selby-Bigge, for the sale of two disused boilers at the North Road works, at £1,900. These boilers cost £2,150 in 1901. The Electricity Committee has decided to agree to the sale at the price mentioned.

Burnley.—PRICE INCREASE.—The Electricity Committee has decided to recommend the T.C. to increase the price of electricity by 12d. per unit for power and traction, and 1d. per unit for lighting.

Continental.—FRANCE.—A new company has lately been formed at Toulouse with a capital of £60,000 and the title *La Société l'Electro-Metal*, to acquire the rights to certain waterfalls near Griff, in the Upper Pyrenees, to establish a hydro-electric plant to utilise the same in the generation of electrical energy, and to establish works for the electrical production of ferro-silicon.

ITALY.—The impossibility of procuring coal at the present time has brought about the bankruptcy of the *Società Anonima Lucana di Industrie Elettriche*, at Salerno. The company was formed in 1913 with the object of generating and distributing electric energy at Valla Lucana. This company is to be distinguished from the *Società Lucana per Imprese Idroelettriche*, of Naples, which generates its current from water power obtained from an artificial lake or reservoir built and leased by the State, the only instance of its kind of the Italian Government helping the electrical industry. — *L'Elettrotecnica*.

Owing to the scarcity of labour, the *Società Mineraria ed Elettrica del Valdarno*, Florence, has found it impossible to finish the projected 7,000-volt transmission line which was to bring energy from the hydroelectric station at Terni. The company, however, contemplates carrying out other hydroelectric installations, on which some 6,000,000 lire are to be expended.

Croydon.—YEAR'S WORKING.—The report of the 20th year's working of the Corporation electricity undertaking shows a net increase in revenue of £2,586, but an increase of £2,739 in working expenses. The net loss on the year's working is £1,690. The units sold totalled 8,258,778, an increase of 290,544 over the previous year. Electricity to the value of £203 was supplied free to hospitals, convalescent homes, &c. Coal cost £3,616 more than the year before, and the heating value per ton (says the borough electrical engineer) has seriously deteriorated. The purchase of a 4-ton electric lorry has resulted in a saving in haulage charges equivalent to £250 a year. Of the 51 men of the department who have joined the Army four have been killed.

Edinburgh.—YEAR'S WORKING.—The annual accounts of the Corporation electricity undertaking show that 18 million units were sold, practically half being for power purposes. The total revenue was £142,611 and the gross surplus £59,250; after meeting the usual loan charges, taxes, &c., there remains a deficit of £4,726, which was provided out of reserve, the latter fund now having a balance in hand of £100,172.

Falkirk.—PRICE INCREASE.—The T.C., in view of the increase of 2s. 6d. per ton in the price of coal, has raised its charges for gas and electricity for the second time within a month. For electricity charges for lighting are increased by 1d. per unit, and for power purposes by 0.75d. per unit.

Gillingham (Kent).—The T.C. has rejected a recommendation by the Electricity Committee to further increase the charges for current by 10 per cent., in addition to the recent advance of 15 per cent.

Glasgow.—PRICE REVISION.—At a meeting of the Sub-Committee on Finance of the Electricity Committee, the engineer intimated that the Controller of Mines had authorised an increase in the price of coal by 2s. 6d. per ton at the pit mouth from 17th ult., and he reported that this would entail on the electricity department an additional expenditure on fuel for the current year of about £25,000, to meet which an increase in the charges for electrical energy would be necessary. The Sub-Committee agreed to recommend that the charges for motive power purposes be increased 7 per cent. as from and after the date of last survey. At a subsequent meeting of the Electricity Committee this decision was rescinded, and it was decided to recommend the T.C. that the charges for all purposes be increased by 0.75d. per unit as from and after the date of the last survey. R.T. mains are to be laid from the new electricity works at Dalmaruock to St. Andrew's Cross works.

Greater London.—ELECTRICITY SUPPLY.—Meetings have been held of the conference of local authorities owning electricity undertakings in Greater London. At the first meeting 24 authorities were represented by 42 delegates. It was resolved—“That the Electric Power Supply Committee be requested to hear evidence from the conference with respect to the supply of electrical energy in Greater London by local authorities.” It was

further resolved to appoint a Committee consisting of three municipal representatives, three town clerks, and three engineers, to prepare evidence, one of each to be elected from the Outer London authorities. On the invitation of the L.C.C. Special Committee, it was decided to appoint delegates to meet the L.C.C. Committee to discuss the situation created by the conclusions arrived at by the Board of Trade Committee. It was resolved that each local authority represented at the conference be asked to subscribe the sum of two guineas towards the expenses of the conference. At further meetings it was reported that the B. of T. Committee had agreed to hear one witness. It was resolved that the Committee be again asked to hear three witnesses—viz., one municipal representative, one town clerk, and one engineer, and the three witnesses suggested were appointed. It was stated that the L.C.C. Special Committee desired representatives of the Outer London authorities to be included in the delegation, and representatives from the following authorities were elected—viz., Croydon, Erith, Ilford, and Walthamstow.

Halifax.—At the T.C., last week, there was criticism on the bill of charges presented in the accounts of the Electricity Committee for the services of Sir John Snell, as adviser in connection with the purchase of the site at Copley with a view to expected power station developments in the future. The item was £112, which, it was contended, was excessive. Upon a vote being taken, an amendment referring the item back to the Committee was carried by 20 votes to 19.

Heywood.—PRICE REVISION.—In view of the increased cost of coal, &c., it has been decided to advance the charge for current for power purposes from January 1st next.

London.—L.C.C.—The Finance Committee recommends the Council's sanction to the borrowing of £1,500 by the Poplar B.C. for the provision of an electricity sub-station, and of £2,088 by the Woolwich B.C. for electricity mains.

Leeds.—ELECTRICITY EXTENSIONS.—We have received from Mr. Nelson Hefford, manager of the Corporation electricity undertaking, a report on the further extension of the Whitehall Road generating station. This report has been adopted by the Electricity Committee, and, subject to the approval of the City Council, the first portion of the extensions, embracing a 12,000-kw. turbo-alternator, boilers, auxiliary plant, buildings, &c., will be put in hand, at an estimated cost of £300,000; also the replacement of two 1,400-kw. reciprocating sets by a 6,000-kw. turbine set, at an estimated cost of £35,000. It may be recollected that in 1914 the Corporation adopted a report under which the older works on the Whitehall Road site were to be reconstructed, new engine, boiler, and switch houses, &c., being provided to accommodate 36,300 kw. of generating plant in three 12,000-kw. sets. The first portion, comprising about one-third of this scheme, estimated to cost £198,250, but actually having cost some £25,000 more, will be completed by the end of the year, and the present recommendations deal with the further stages of the work.

The older portion of the works contains at present 26,600 kw. of generating plant and 21,000 kw. of boilers, while the first section of the new works contains 18,000 kw. of generating plant (i.e., a 12,000-kw. set and a 6,000-kw. set installed as a safeguard against breakdown in the older plant) and 12,800 kw. of boiler plant. There will therefore be 44,600 kw. of electrical and 33,800 kw. of boiler plant installed at the end of the year.

On the basis of past experience it is estimated that the maximum demand will reach 28,000 kw. in 1918, and that the plant margin will be 1,800 kw. electrical, with a shortage of 1,500 kw. in boiler plant; in 1919, 31,500 kw. max. load, with margins of 1,500 kw. electrical, 50 kw. boilers; in 1920, 35,000 kw. max. load, with 5,500 kw. electrical and 3,150 kw. boiler margin; and in 1921, 38,500 kw. max. load, with 11,000 kw. margin electrical and 8,450 kw. margin of boiler plant. The total available plant at that date will be 52,500 kw. of electrical and 46,950 kw. of boiler plant. The electrical total includes, in addition to the two 12,000-kw. sets required to complete the 1914 scheme, two 6,000-kw. sets, which it is intended to install in place of the last remaining reciprocating sets (four of 1,400 kw. each).

The report contains some interesting calculations evidently based on the actual conditions existing in the present plant; thus Mr. Hefford estimates that the use of the more efficient 6,000-kw. set for 3,000 hours in place of older turbine plant would result in a saving of £178 per annum in coal, and again the use of the older turbine plant for 500 hours in place of the displaced reciprocating plant, would save another £900 in coal. In addition, the boilers on the new basis would supply 1,282 kw. more plant, equivalent to a saving of £21,110 on new boilers, &c., and £2,111 in annual charges.

It is proposed to utilise surplus profits and reserve in paying off the outstanding debt on reciprocating plant, &c., and allowing for the residual value of this plant and setting the financial charges on the new 6,000-kw. plant against that on the displaced plant, leaves a net increase in annual charges of £1,120, against which the savings (previously mentioned) of £3,519, would result in a net return of £2,399 per annum, or 8½ per cent. on the investment, during an estimated period of eight years. Mr. Hefford points out that this is approximately £1,000 per annum more than would be obtained by investing surplus money outside the business.

Manchester.—The Electricity Committee met specially to consider the reports of the Committee for the Interconnection of the Lancashire and Cheshire Electric Supply Systems, and a resolution was adopted without dissent approving of the principles contained in the reports, and without endorsing all the details at

this stage, authorising the chairman, deputy-chairman, and general manager, together with the town clerk, to attend further conferences on the subject.

Rochdale.—The Rochdale Tramways Committee has agreed to a recommendation of the general manager, Mr. George Webster, to close down the present electricity sub-station at Littleborough, and to substitute an additional cable from Smallbridge to Hurstead, at a cost of £450. It is expected that the new arrangement will result in a considerable saving to both the tramways and electricity departments, which will share the cost.

Salford.—PRICE INCREASE.—The E.C. recommends a further increase in the charges for electricity of from 10 per cent. to 20 per cent. for lighting, and from 15 per cent. to 30 per cent. for power, as from December 1st.

LINKING-UP.—The Electricity Committee agrees to the main outlines contained in the second report of the Committee for the Interconnection of the Lancashire and Cheshire Electricity Supply Systems, but considers the details thereof should be referred for consideration to a Committee consisting of representatives of each of the supply authorities concerned.

Southampton.—PRICE INCREASE, &c.—The T.C. has decided to increase the charges for electricity by 10 per cent. from the December readings, and to spend £6,300 out of capital account, £2,700 being for a new feeder for the Northam district and £3,590 for a new tramway feeder.

U.S.A.—ELECTRIC COOKING.—Data published by the N.E.L.A. shows that during 1916 the Boston Edison Co. sold 1,019 electric ranges, with an estimated rating of 5,225 kw.; more than 1,200 ranges were on circuit this year, or one range per 1,000 of population. A Western city had 1,194 electric ranges installed, or 46 per 1,000 of population; in San Francisco it is computed that there is one range per 1,000 of population, and in Ohio 1.3 ranges per 1,000 of population.

TRAMWAY AND RAILWAY NOTES.

Belfast.—The half-yearly return of the revenue of the tramways shows that, allowing for all fixed charges, there was a credit balance of £315, which, under the existing war circumstances, was considered satisfactory.

Continental.—SPAIN.—Application has lately been made for a concession for the construction and working of an electric tramway in the town of Burgos.

Croydon.—YEAR'S WORKING.—Presented on Monday, the annual report of the Corporation tramways shows total receipts amounting to £89,585, working expenses £69,713, and war allowances £5,823. After allowing for bank interest and income-tax on stock, there remained a gross balance of £16,297; as £17,930 was required for interest, sinking fund, and taxes, the deficit on the year (ended March 31st) was £1,631, which had been taken from the reserve and renewals fund.

During the year over 19 million passengers were carried, giving a traffic revenue of 10½d. per car-mile; the car-mileage was 2,027,135. The chairman of the Committee (Alderman Allen) fore-shadowed great expense after the war in relaying the track and in needed extensions. The 75 cars, he said, had been kept thoroughly in order; many had been entirely rebuilt during the war. To October 19th the traffic receipts showed an increase of £14,236 over the corresponding period of last year.

Dewsbury.—Great inconvenience to working people has been caused by the suspension, owing to shortage of drivers, of the morning car service between Dewsbury and Earlsheaton. The tramway company has assured the Corporation Tramways Committee that every effort is being made to secure additional drivers.

Dover.—B. OF T. REPORT.—Col. J. W. Pringle, reporting on the runaway tramway accident which occurred on August 19th, comes to the conclusion that the driver "lost his head" at the critical moment, the accident being caused by his failure to cut off power as he approached the compulsory stopping place on the summit of Crabble Hill, and his further failure to utilise properly the sand and brake equipment. In the inspector's opinion, the driver's own statement that he was unable to move the controller (small) handle into the emergency brake position, confirms the view that power was applied as the car ran down hill; the inspector found, after the accident, no difficulty in manipulating the controller-handle with the power-handle in the "off" position. Col. Pringle states that men discharged as unfit for military duties on account of nervous breakdown are unlikely to prove suitable, two months later, as drivers on difficult routes; he doubts whether Local or County Appeal Tribunals are aware of the difficulties of finding suitable men, or whether they realise the public risk incurred when insufficiently trained men are employed. He points out that the war has materially reduced safe working conditions on tramways, and recommends that such a route should not be worked unless by men who have had at least a year's experience to their credit; that drivers be familiarised with the rheostatic brake; and that either single-deck cars be used on the route, or no passengers permitted to travel on the upper deck.

The T.C. has decided to levy a 1s. 6d. rate to meet compensation claims arising out of the above accident, which resulted in the death of 11, and injury to 59 other people.

Glasgow.—**WAGES.**—Sheriff Fyfe has issued an interlocutor regarding the wages of certain classes of employes in the tramway department. Generally speaking, the award provides (a) for male employes now in the service of the department having their pre-war remuneration increased by 15s. per week (7s. increase of wages and 8s. of war advance), so far as this has not already been done; (b) for female employes receiving remuneration, so far as not already given, equivalent to the remuneration set forth in certain orders by the Minister of Munitions. The result is that male employes in the various grades will receive increases varying from 2s. up to 7s. per week; female employes will receive no advance, as they have already 8s. per week more in the tramway service than they would have in a munition factory; the arbiter is of opinion that it is reasonable that male workers should be brought within the principle of the awards of the Committee on Production; and the principle which should be applied to female workers is that expressed in the orders of the Minister of Munitions above referred to.

Leeds.—The lighting restriction on the tramways has been considerably modified recently, with the consent of the Home Office—much to the satisfaction both of passengers and conductors—but some members of the public have shown a tendency to go beyond the intentions of the authorities, and it has been necessary to issue a warning against the removal of any of the shades still remaining on the cars.

London.—The Highways Committee of the L.C.C. recommends that the requests of the men employed at the Greenwich generating station for the application to them of the awards of the Committee on Production relating to the engineering and foundry trades, of leading cable hands, and cable hands, for an increase in wages of 100 per cent. on pre-war rates, and of wiremen and wiremen's mates on the depot wiring staff for increased war wages, be referred to the Electrical Conciliation Board.

The increase in fares on the Metropolitan Electric Tramways came into force last week, the services affected being Enfield and Euston, North Finchley and Finchley Park, and Bruce Grove and Finsbury Park. One of the longest penny sections in London—Finsbury Park to Wood Green—disappears, the stage now ending at Turnpike Lane, Hornsey.

Manchester.—**TRAFFIC FIGURES.**—The total revenue on the Corporation tramways for the half-year ended September 30th was £513,624, compared with £506,558 in the corresponding period last year. The working expenses were £310,325, and with war service allowances and bonuses, &c., the total expenditure was brought up to £455,011. The total car-miles run were 9,381,230. Expenditure on renewals amounted to £13,000. The recent arbitration awards granting further bonuses will cost the department about £45,000 per annum, which makes the total payable as war bonuses and war service allowances nearly £200,000 per annum.

TELEGRAPH AND TELEPHONE NOTES.

Argentina.—Automatic telephones have been installed at Cordoba and Rosario, and have given excellent results. An installation is shortly to be set up at Buenos Ayres.

A German submarine telegraph cable scheme hung up by the war is that from Emden to Pernambuco. The scheme was being carried out by a German cable firm of Nordenheim, and two sections from Emden to Teneriffe and from Teneriffe to Monrovia in the Republic of Liberia, were completed in March, 1911; the third and last section—that to Pernambuco—remains uncompleted.

Australia.—The transference of the Eastern Extension Co.'s cables ending at La Perouse, N.S.W., and Wakapuka, N.Z., respectively to Sydney and Wellington was to have been completed by the end of August, establishing direct communication between Wellington and Sydney, and thus avoiding two repetitions of messages en route.

New Cables.—A concession has been granted to the Western Telegraph Co., whose headquarters are in London, for a cable connecting Rio de Janeiro with the Isle of Ascension and for another cable joining Belem-Para, in the north of Brazil, with Barbados. The construction of these cables will greatly facilitate telegraphic communication between South America and the rest of the world.

Storm Damage.—Considerable damage to property was done by the gale in the West Riding last week, and telephone and telegraph wires were reported to be down in over a hundred places around Leeds and Bradford, communication with distant parts, including London, being considerably interfered with.

Wireless Telegraphy on Board Ship.—The Defence of the Realm Regulation which made compulsory the installation of the wireless telegraph on certain British ships of 3,000 tons and upwards has been amended by the reduction of the tonnage to 1,600.

Wireless Telegraphy on Zeppelins.—According to the *Times*, a French officer, who has examined the Zeppelin that was brought down intact at Bourbonnes les Bains last month, states that

the fleet of which it formed a part came to grief partly owing to the breakdown of its wireless apparatus due to the extreme cold at the high altitudes attained. There was also a failure on the part of the wireless stations on land from which the Zeppelins got information as to their position by code messages. Owing to the number of airships which lost their bearings, the land stations got confused, and their answers to questions asked of them were unintelligible.

It is known that, before the war, the Germans established a series of wireless stations near their frontiers for the purpose of guiding aircraft, but whether this system would be of any practical use in the case of airships moving at a considerable distance outside the ring seems to us very questionable, unless some form of directive receiving apparatus such as the Bellini-Tosi, or some system elaborated since the outbreak of war, has been installed on each airship.

CONTRACTS OPEN AND CLOSED.

OPEN.

Aberdeen.—November 19th. G.N. of Scotland Railway. Telegraph material for six or twelve months. Stores Superintendent, 80, Guild Street.

Australia.—**PERTH.**—December 5th. Deputy P.M.G. Telegraph and telephone instruments and parts, also battery material, according to schedule and conditions, a copy of which may be seen at the offices of the ELECTRICAL REVIEW, or at the Commonwealth Offices, Australia House, W.C.

December 12th. Deputy Postmaster-General. Switchboards, telephone parts, as per schedule, a copy of which, as well as the contract conditions, may be seen at the offices of the ELECTRICAL REVIEW, or at the Commonwealth Offices, Australia House, W.C.

Beckenham.—November 12th. U.D.C. Three months' supply of coal for the electricity works. See "Official Notices" to-day.

Enniskillen.—December 1st. Sligo, Leitrim & Northern Counties Railway Co. Telegraph material for 12 months. Mr. J. Duff, Secretary, Enniskillen.

South Africa.—November 12th. S. African Railways. 4,466 train-lighting cells. Secretary, Tender Board, S.A. Railway Headquarters, Johannesburg. Specifications may be seen at the Department of Commercial Intelligence, 73, Basinghall Street, London, E.C. 2.

Spain.—The municipal authorities of Soria have lately invited tenders for the concession for the electric lighting of the town during a period of six years.

Walsall.—November 5th. Corporation Tramways Dept. Twelve months' tramway stores. Tramways Manager, St. Paul's Buildings, The Bridge.

York.—November 2nd. N.E. Railway. Telegraph stores for six and twelve months. See "Official Notices" Oct. 26th.

CLOSED.

Bradford.—Electricity Committee. Portable wagon and truck loader for handling stock coal at Valley Road power station: Goodall, Clayton & Co., Ltd., Leeds. 12,000-KW. turbo-generator, £45,775; Parsons & Co., Ltd.: the Committee has authority to order a condenser for same.

East Ham.—Town Council. Accepted tender:—

Edison Accumulators, Ltd.—Six electrically-propelled dust-vans, at £1,121 each, and one automatic electric filler, at £2 10s.

Ilford.—U.D.C. Accepted tenders:—

General Electric Co., Ltd.—D.C. switchboard for sub-station, £286; E.H.T. switchgear, £174; additional equipment for switchboard, £72. Herbert Morris, Ltd.—7½-ton overhead travelling crane and rails, £106.

FORTHCOMING EVENTS.

Salford Technical and Engineering Association.—Saturday, November 3rd. At 7 p.m. At the Royal Technical Institute, Peel Park. Members' short papers for gold medal given by Mr. W. O. Larnmeth.

Chief Technical Assistants' Association.—Saturday, November 3rd. At 3 p.m. At the Tavistock Hotel, London. Ordinary meeting.

Roentgen Society.—Tuesday, November 6th. At 8.15 p.m. At the Royal Society of Arts, John Street, Adelphi, W.C. Presidential address.

Institution of Civil Engineers.—Tuesday, November 6th. At 5.30 p.m. At Great George Street, Westminster, S.W. Presidential address and presentation of medals.

Faraday Society.—Wednesday, November 7th. At 5.30 and 8.30 p.m. At the Royal Society of Arts, John Street, Adelphi, W. Discussion on "Pyrometers and Pyrometry."

Institution of Electrical Engineers.—Thursday, November 8th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Inaugural address by the president, Mr. C. H. Wordingham, and presentation of premiums.

NOTES.

Volunteer Notes.—COUNTY OF LONDON VOLUNTEER ENGINEERS (FIELD COMPANIES).—Headquarters, Balderton Street, Oxford Street, W. 1.

Orders for the week, by Lieut.-Colonel C.B. Clay, V.D., commanding:—
Officer for the Week.—Second Lieut. P. Bowden.
Next for Duty.—Second Lieut. E. A. Ullmann.
Drills.—Week ending Saturday, November 10th, 1917:—
 Monday.—No. 3 Company, Left Half. Recruits, signalling, 6.30.
 Tuesday.—Physical drill and bayonet exercise, 7.30.
 Wednesday.—No. 1 Company, 6.30.
 Thursday.—No. 2 Company, 6; signalling, ambulance, 6.30.
 Friday.—No. 3 Company, Right Half. Recruits, 6.30.
 Saturday.—Commandant's Parade for Route March and Drill. Parade Headquarters, 2.45. Uniform. Compulsory for A, B, and C men.
 Musketry.—Belvedere Road. Tuesday, Wednesday, and Thursday, 5.30 to 7.
 Note.—The Medical Officer will attend for examination of recruits, &c., on Thursday, at 6.
 An inspection of all A, B, and C men has been arranged for Saturday, November 17th. Full particulars in next week's orders.

(By order) MACLEOD YEARSLEY, Capt. and Adjutant.

Employers' Organisation.—The *Daily Chronicle* states that an agreement which has just been reached between some of the larger Employers' Associations will shortly crystallise into a permanent organisation with large powers. The Associations which have already signified general approval of the scheme include the National Employers' Federation, the Engineering and Shipbuilding Federations, the Federation of British Industries, and the Sheet-Metal Workers. The root idea is to establish a central authority which will constantly review the conditions of work and wages without an extension of the principle of State intervention, and will have the power to make agreements with the labour organisation for whole areas and whole industries.

Dangerous Mischief.—At the Saddleworth Police Court, last week, a 16-year old boy named James Whitehead, who was stated to be earning 30s. per week, was ordered to pay £1 damage and 15s. 6d. fine for fusing an electric fitting at the Gatehead Mill, Delph, where he was employed. After inciting another lad to mischief, the defendant applied a bit of wire to an electric light fitting, protecting himself from shock by using woollen waste. The result was the fusing of the wire, a burst of flame, and the extinction of many lights. There was danger both of the destruction of the mill by fire and of injury or loss of life by the panic which might have resulted from the sudden darkness. The proceedings were taken as a warning, there having been a succession of these mischievous acts. The shed was a new one, costing £20,000, and the firm had had a destructive fire in 1915, which might have originated in some such way.

Educational.—BLACKPOOL.—The Education Committee has refused to accede to a request to commence classes in Blackpool on electrical subjects, though it was stated that a satisfactory number of students would be forthcoming. In explaining the refusal, the chairman of the Higher Education Committee stated, on Tuesday, that if the class was held there would have to be other classes in physics and practical mathematics, and provision would have to be made for a suitable amount of machinery and apparatus. In view of the expense and the probable small number of students, the Committee did not think the present was an opportune time to start such classes. Commenting on this decision, a local contemporary remarks: "Surely this is not the new spirit which is going to do such great things educationally in England."

BRISTOL UNIVERSITY.—Mr. Henry H. Wills has presented to the University of Bristol, property covering nine acres adjoining the present site of the university buildings, for future extensions.

Electric Lamp Stealing from Trains.—A 14-year old boy, of Ashton-on-Mersey, was fined 45s. at the Manchester County Police Court, on Monday, for wilfully removing and breaking an electric bulb in a third-class compartment on the Manchester, South Junction and Altrincham Railway, whilst passing through a tunnel at Old Trafford. An inspector of the Great Central Railway police stated that 500 lamps had been stolen from railway carriages during the last six months, and 70 bulbs that had been missed had not been replaced, on account of shortage.

Industrial Combination.—The speeches which were delivered by Mr. Paish and Mr. C. Hamilton Wickes before the Birmingham Brass Masters, urging them to co-operate and combine in readiness for after the war, have been followed by another along the same lines but in greater detail delivered in the same city by Sir W. Ashley. In this case the audience consisted of the Federation of British Industries and the National Union of Manufacturers. Sir W. Ashley showed that it was in the national interest that there should be far more combination between manufacturers within the several trades. In the past combinations had broken down because their object had been to maintain prices without effecting economies in production. This put a premium on unprogressive equipment and incompetent management. The combination that would be approved by the public, and would extend its hold upon the world's markets, would be one which combined a reasonable profit to the manufacturers with reasonable cheapness to the consumer. Under modern conditions these ends could only be achieved by the introduction of specialisation rendering possible the continuous employment for each process of the most suitable machinery. Each trade must settle for itself how this should be carried out. The necessity, however, must be recognised, and it must also be seen that the carrying out of the principle of combination involved some amount of restraint on the present freedom of business concerns. Referring to unemployment

questions, he stated that the root cause of the instability of employment was the inability of uncombined manufacturers to stabilise production. There was still far too wide a range of manufacture where a single obstinate concern was able to upset or disregard a trade agreement to which the great bulk of the industry concerned had consented. Out-of-date individualism caused social mischief. If the manufacturers in a trade could not manage to make wage agreements binding on competing concerns, the State would have to enforce such agreements. In regard to the question of industrial training, every trade ought to be able to provide for itself the amount of skilled labour that it required. This could be done by concerted action. The difficulties of industrial reconstruction called for a sufficient knowledge of facts and statistics, in order that they might be properly handled. Where employers and employed were properly organised, and through properly organised trade combinations, such material could be easily obtained.

Inquiries.—A correspondent wants a vacuum oven to take armatures up to 3 ft. 6 in. in diameter, or suggestions as to the cheap construction of one. Makers of the "Elco" recorder are asked for.

Appointments Vacant.—Mains superintendent, also meter tester and erector, for the Kettering U.D.C. electricity works. Newport Corporation wants an installation inspector, a mains foreman, E.H.T. jointers, and wiremen. See our advertisement pages to-day.

Reconstruction.—The November issue of the *World's Work* contains a lengthy article on the "Reconstruction of Prosperity," by Dr. G. B. Hunter, chairman of Messrs. Swan, Hunter & Wigham Richardson. The writer describes, in a most interesting way, the steps that, in his opinion, are necessary for the reparation of the wastage of war and the restoration of our commercial prosperity.

British Standards for Electrical Machinery.—We have received from the British Engineering Standards Committee a copy of the new edition of the "British Standardisation Rules for Electrical Machinery (excluding Motors for Traction Purposes)," being Report No. 72-1917 of the Committee. The first issue of this Report was made in October, 1915, and special attention is directed to the new form in which these rules appear. In line with all new and revised Specifications and Reports issued by the British Engineering Standards Committee, this publication is octavo size, and is issued at the uniform price of 1s. net. French, Italian, and Spanish translations of this Report will be available shortly. The Committee is particularly anxious that the issue of its publications at the flat rate of 1s. should become as widely known as possible, for it is hoped that this will lead to their very extensive dissemination amongst engineers, managers, designers, draughtsmen, foremen, and, in fact, all those engaged in the engineering and allied industries. The principal modifications introduced during this revision of the rules are as follows:—

The permission to use the thermometer method of measuring the observable temperature of continuous-current shunt-wound stationary field coils, provided the maker can show that if the resistance method had been employed the limits of observable temperature and observable temperature rise permitted by the rules would not have been exceeded. (Clause 68.) The thermometer method is in this case penalised with a 5° C. reduction in the permissible temperature limits. (Clause 67.)

In the first edition of these rules the use of embedded temperature detectors was permitted for large machines, but in the present rules measurements made with embedded temperature detectors are no longer to be considered as an essential part of the acceptance tests.

The excess-current tests have been reduced in the case of machines for continuous service from 100 per cent. to 50 per cent. (Clause 79.)

A few alterations have been made to the high-pressure tests, and a clause has been added dealing with the application of a high-pressure test to a machine which has been out of service for some time and to which it is desired to apply a high-pressure test to ensure that the insulation should be in sound working condition before the machine is put back into service. In this case it is stated that the test pressure should be 75 per cent. of the test pressure required in the case of a new machine.

The rules have been re-arranged, and an introduction, the object of which is to explain briefly how the rules should be used, has been included.

Wages of Electrical Wiremen.—The General Purposes Committee of the L.C.C. recommends that the Council's list of wages and hours be amended by the addition of the following:—"That from and including July 1st, 1917, the agreed rate for wiremen in the electrical trade has been advanced to 1s. 2d. an hour and for assistants to 11d. an hour."

Electrical Instruction at Barcelona University.—Under the title Instituto de Industrias Electricas, a school of electrical engineering has lately been established in Barcelona, in connection with the University of that city.

Society for Electrical Development (U.S.A.).—There will be no national "electrical week" celebration this year, owing to war conditions: it has been decided to hold it next year, and there is a strong feeling in favour of the time being changed from the autumn to the spring season. A special electrical campaign, however, will be conducted in the form of "a big drive for Christmas appliance business," the idea being to encourage the purchase of electrical appliances for Christmas presents.

Stolen Club Funds.—At the Manchester County Police Court, on Monday, Albert Robertson Stark (42) was sent to prison for six months, with hard labour, for stealing the sum of £231 5s. 6d. in July last. It was stated that the prisoner was employed at the Lancashire Dynamo & Motor Co.'s works, Trafford Park, Manchester, as a costs clerk, and he had acted as treasurer of the works' holiday saving club, which was carried on by the employés. When the books were examined on August 3rd, it was found that there was a deficiency of £108, but later it was found to reach the figure mentioned above. At that time the man was missing, and he was arrested on Saturday night through an employé from the works visiting a suburban theatre and recognising the prisoner, who was performing under an assumed name, by his voice.

Institution and Lecture Notes.—Diesel Engine Users' Association.—At the October meeting, after the election of a further list of members, a proposed amendment of the Standard Policy of Insurance of Diesel Engines against Breakdown was considered, and arrangements were made under which differences arising between the underwriters and the policy holders as to the interpretation of the policy may be submitted for decision to a special committee appointed by the Association.

The president, MR. GEOFFREY PORTER, reported on the position in regard to the supply of tar oils as Diesel engine fuel to members of the Association, as discussed with the Director of Munitions Petroleum Supplies. In the discussion which followed, the difficulty of making satisfactory arrangements for continuous supplies of fuel for the short periods allowed for by the licences issued by the Director of Munitions Petroleum Supplies was referred to. Attention was drawn to the point that the action of the Association in encouraging the use of tar oils as fuel in Diesel engines should be of advantage in the national interest in stimulating the economical use of the country's coal reserves and in permitting of the extraction of valuable products from the coal, several of which are of especial importance to the country in present circumstances. As an example, the Hon. Secretary produced the figures of the Diesel engine plant at Chelsea, in which case the consumption of 700 tons of fuel oil per annum resulted in the replacement of a total weight of 6,000 tons of coal per annum which would otherwise have had to be transported by the railways, and which would have produced about 500 tons of clinker and ashes for which cartage facilities would have had to be provided.

MR. H. S. RUSSELL read a paper on "Automatic Control of Blast Pressure for Diesel Engines," in which he described the construction and working of Messrs. Mirreles, Bickerton & Day's apparatus for regulating the blast. Among the advantages claimed for the apparatus are smoother running of the engine, saving in fuel, less attendance on the engine, improvement in the condition of exhaust valves, and the replacement of the blast bottle by a small separator.

Textile Congress.—At the annual meeting of the Textile Institute recently held at Preston, a paper was read by Dr. J. F. Crowley on "Science as a Factor in the Development of the Textile Industry," in the course of which he pointed out the need for co-ordination between the textile machinist and the power engineer. Much of the present-day machinery was designed when main line shafting speeds were 40 r.p.m. or less, and though such speeds have considerably increased they are still below the most suitable from the electrical point of view. Individual electric driving has been the most significant advance in textile machine driving of recent years, but the best results can only be obtained if modifications are made in the driven machines, and such modifications can only be made if the textile machinist and power engineer act in close co-operation.

As showing in a broad way the possibilities in the application of electricity to the industry, it may be noted that only 5 per cent. of the power required by textile factories in this country is obtained from electricity generated in the factories themselves and only one-half of 1 per cent. from electricity purchased from outside supply undertakings, and this although the textile industries furnish nearly one-fifth of the total power load of the United Kingdom.

On the question of labour, Dr. Crowley says it is easy to show that a high net output per operative and a high horse-power per operative are invariably associated with high wages. Statistics for the cotton trade in 1833 and the Census of Production (1917) give the following figures:—

	1833.	1907.
H.P. per operative	709	216
Net output per operative per annum ...	£175	£79
Wages per operative per annum ...	£214	48

In the period under review, nearly three-quarters of a century, the H.P. per operative has increased 24 times, and the net output of the individual by 66 per cent., while wages have increased by 121 per cent.

As regards the question of research work, Dr. Crowley contends that "industrial" research has been much neglected.

The necessity for developing industrial research, made apparent when war broke out, led to the formation of an Advisory Council on Research on which, however, all the members but one are fellows of the Royal Society—membership of which is the blue ribbon of the pure scientist; the sole exception is referred to as the "administrative chairman." Dr. Crowley considers that it was evidently the intention of the Privy Council that this Council should consist not only of eminent scientific men but also of men actually engaged in industries dependent upon scientific research.

Every step taken by the Council for Research thus far seems to indicate the intention of maintaining an over-riding position for the pure scientist, and the standing committees already formed show what a large percentage of these bodies is nominated by a largely academic Council.

Reputations in pure science are frequently built up in extremely limited spheres of work, and the whole atmosphere of academic work is fatal to that broad outlook and grasp of the tendency of industrial development so essential in deciding on types of research to encourage.

Institution of Electrical Engineers. The first meeting of the Institution for the session is to be held on Thursday next at 6 o'clock (light refreshments at 5.30 p.m.), when Mr. Worthingham will deliver his presidential address. Other arrangements for the session are as follows:—

November 22nd.—"Gas Firing Boilers," by Mr. T. M. Hunter.
December 6th.—"Electrical Cooking as Applied to Large Kitchens," by Mr. W. A. Giltott.
December 13th.—Discussion on "The Metric System," with introductory papers by Messrs. L. B. Atkinson and A. J. Stubbs.
January 10th, 1918.—"Electrical Signalling and Control on Railways," by Mr. C. M. Jacobs.
Subjects for February 7th, March 7th, and April 11th will be announced later.

The inaugural address of the chairman of the BIRMINGHAM LOCAL SECTION (Mr. S. T. Allen) is to be delivered on Wednesday, November 14th, at 7 p.m., at the University. On December 5th, Mr. T. M. Hunter, M.A., B.Sc., will read a paper on "Gas-Firing Boilers."

Association of Mining Electrical Engineers.—A meeting of the Yorkshire Branch was held at Wakefield on Saturday last. Mr. Roslyn Holiday, of Aekton Hall Collieries, occupied the chair, and delivered his presidential address. A paper on "The Installation and Maintenance of Underground Plant" was then read and discussed.

British Fire Prevention Committee.—The Committee commenced its winter session during October, and has planned a number of testing operations for the coming spring, and the usual issue of its publications during the winter. It has issued some of its usual Red Books on recent American fires, but some of the reports of the Committee on fire preventive questions that were prepared earlier in the year for the use of the authorities cannot be made available to the public during the war.

The Committee's service of fire "warnings" continues to be extended, and there have been numerous re-issues during the past quarter. New issues of notices have also been made in respect of storage of coal in bulk and the treatment of buris under an up-to-date non-proprietary system.

Electricity in Agriculture.—In the report of the Conjoint Board of Scientific Societies, just issued, it is stated that the Sub-Committee on the Application of Science to Agriculture emphatically believes that a great future awaits the development of electrical applications to agriculture in this country. Reference is made to the probable action of the Board of Trade Committee on Electric Power Supply in the direction of rendering cheap power available in agricultural districts, and to the extended use of electricity on farms in Germany; the advantages of electric ploughing are emphasised, and electroculture receives a favourable notice. It is added that on October 10th the Conjoint Board recommended the Board of Agriculture to grant funds for the construction and testing of an electrical tractor and other agricultural machines. Owing to the late arrival of the Report, we must defer detailed reference to its contents till next week.

Association of Electrical Station Engineers.—A meeting was held in Manchester, on October 25th, to continue the efforts of the Local Committee of the A.E.S.E. to obtain further support for this Section of the Association. The Committee reported that the membership was increasing rapidly. The following resolution was approved:—"That each application for admission to the Association should be considered on its merits, special emphasis being laid on the necessity of training, general capabilities, and responsibility of position." A vote of thanks was unanimously accorded to the Editors of the ELECTRICAL REVIEW for their sustained support of electrical station engineers in their efforts to improve their status. A special general meeting is to be held at Seller's Restaurant, 86A, Market Street, Manchester, at 7.30 p.m., on Thursday, November 8th, to discuss the question of the awards of the Committee on Production and their applicability to station engineers, and it is hoped that all station engineers interested will attend. Inquiries concerning this Section of the Association should be addressed to the Hon. Secretary A.E.S.E., 15, Lotherton Street, Harpurhey, Manchester.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station and Tramway Officials.—The L.C.C. Highways Committee recommends that Mr. H. R. DOCKER, second-class assistant in the Council's tramways department, be appointed time-tables assistant at £262 per annum, rising to £300, and that Mr. H. W. WOODS, A.M.I.E.E., at present senior charge engineer in the service of the Manchester Corporation, be appointed a charge shift engineer at Greenwich generating station at £250 per annum, rising to £300. The Committee considers that the present time is not opportune

for making a permanent appointment of a publicity assistant for the tramways, and proposes that, as a temporary measure, a woman be engaged to assist in publicity work.

The Luton E.C., which for some time past has been considering the question of revising the salary of Mr. W. H. COOKE, the electrical engineer, now suggests an increase from £600 to £700 a year.

Mr. HENRY CLAYTON has been appointed assistant engineer and manager of the Preston Corporation tramways, at a salary of £200 per annum. He has been in the service of the Corporation for about 12 years.

Heston and Isleworth D.C. has agreed to Mr. P. RYCMORT, its electrical engineer, devoting his full time to his duties in the Coal Control Office, and giving his honorary supervision to the Council's electricity department when required.

Mr. W. A. TORRIN, testing and commercial assistant at Greenock Municipal electricity works, has been appointed assistant electrical engineer under the Chesterfield Corporation at £250 per annum.

The Doncaster Town Council last week accepted the Electricity and Tramway Committee's recommendation granting Mr. G. A. ROBERTS, acting electrical engineer, and Mr. T. POTTS, acting traffic manager of the tramways, an increase of £50 per annum each on their salaries, during the absence of Mr. RAYNER, the chief engineer, on Government service.

The Blackpool Tramways and Electricity Committee has decided to grant the following salary increases to officials in those departments:—Electricity Staff: Works superintendent, £250 to £300; mains superintendent, £234 to £284; chief clerk, £175 to £225; two engineers-in-charge, £175 to £215 each. Tramways Department: Traffic superintendent, £250 to £300; resident engineer, £234 to £284; chief clerk, £156 to £206. No war bonuses are to be granted in addition.

Congratulations to Mr. R. TORRY, Loughborough electrical engineer of Tumble Wells, who has been presented with a Royal Humane certificate for entering the sea fully dressed and rescuing a bather. The presentation was made by the Mayor of Eastbourne.

General.—Major HENRY NEWTON, D.S.O., a member of the firm of Newton Brothers (Derby), Ltd., electrical engineers, has been appointed Assistant Director of Trench Warfare. He went out to France as a Territorial Captain in the 5th Notts. and Derby. Battalion, which was mobilised at the outbreak of war, early in 1915. His experience of actual trench warfare soon supplied the necessary material for his inventive talent. Many useful and efficient devices were the outcome of his labours for the destruction of the enemy and the greater comfort of our own men, which in those lean days of want were very much appreciated. He then founded the Second Army workshops, which became well known to those in France, where a large number of hands are employed in the manufacture of his inventions and other war material. His services were recognised with the award of the D.S.O., and he was later appointed a member of the Trench Warfare Committee. His hard work and ability have led to this new appointment, and he has earned the congratulations of his many friends.

Mr. A. W. JAMES, the assistant works manager and a keen supporter of the Sterling Athletic and Social Club, has presented a handsome cup for a rifle shooting competition, for which in the first round, as well as for the gold medal presented by Mr. F. W. WILKINSON, there has been some very keen shooting. The Club, by a narrow victory over Hendon and Crickelewood, has passed into the second round of the Burroughs & Watts Competition.

Mr. WALTON, who for the past eight years has been on the engineering staff of W. T. Henley's Telegraph Works Co., Ltd., has obtained a position with the Ministry of Munitions (Air Board). Mr. Walton belongs to the old school of electrical engineers, and has been connected with electrical work almost from its infancy. He served his apprenticeship at the works of John Fowler & Co., Leeds, going through the drawing office and the shops. The Leeds electric lighting station was the first undertaking with which he was connected. He has contributed several articles to our pages.

Roll of Honour.—Second-Lieutenant H. F. GILL, R.E., Wireless Section, of the secretarial department, County of London Electric Supply Co., who had been awarded the Military Medal in 1916, has recently been wounded in France, and is at present convalescent in London, and has now been awarded the Military Cross.

Corporal G. WHILDON, London Regiment, formerly in the London office of the India-Rubber Co., was killed in France on October 1st. Sergeant N. G. FAIRALL, Australian Infantry, who was in the electric light department before joining the Sydney branch of the same company, was wounded in France on the 12th inst. Private J. BROWNING, Middlesex Regiment, formerly in the general office of the company at Silvertown, was recently wounded in France.

Gunner A. HOMER, R.F.A., who has died of wounds, was in the employ of the British Westinghouse Co., Ltd., Trafford Park.

The death in action reported of Private T. COOK, King's Liverpool Regiment, who was employed by Messrs. Dick, Kerr & Co., Ltd., of Preston.

Sapper E. CLAVEL, R.E., who was mentioned in dispatches to him Lieut.-General Sir Stanley Maude for gallant and distinguished service in the field, and who has died in hospital,

was employed in the Warrington Corporation electricity department.

Temp. Captain E. MANNOCK, R.E., attached to the R.F.C., who has been awarded a bar to the Military Cross gained last September, was formerly on the National Telephone Co.'s staff at Canterbury. On the outbreak of war he was in Constantinople, engaged on a contract for telephones for the Turkish Government. He was detained for a time as a prisoner of war, but was released, and reaching England joined the R.A.M.C.

Lance-Corporal W. BANNING, Machine Gun Section, who has been wounded, was an overhead linesman on the Mewborough & Swinton Tramways.

Second-Lieutenant C. H. PLATT, Royal Warwickshire Regiment, who has been severely wounded, was a draughtsman with Messrs. Siemens Bros., Stafford.

Private W. W. HOLEY, Royal Warwickshire Regiment, who has been killed whilst attending the wounded, was in civil life engaged as an electrical engineer at Whitby.

Corporal E. P. MOORE, Machine Gun Section, who has died of wounds, enlisted from the electrical laboratory of the B.T.H. Co., at Rugby.

Rifleman B. C. LANE, Rifle Brigade, who has died as the result of wounds received in action, was in the drawing office of the B.T.H. Co. at Rugby. He was discharged from the Army last April.

Company-Sergeant-Major G. H. HAYES, Royal Warwickshire Regiment, who was an employee of the B.T.H. Co., at Rugby, has died of wounds received in action.

Wireless Operator F. J. STIBY, killed whilst serving with a siege battery, enlisted from the staff of the Bath Corporation electricity works.

Private C. W. EDWARDS, Royal Welsh Fusiliers, killed in action, was on the staff of Messrs. Crispin, electrical engineers, of Bristol.

Private J. BAIN, R.A.M.C., who has died from wounds, aged 33, was a fireman at the Falkirk Corporation electric power station.

Sergeant A. HARISREICTER, first reported missing, and now reported killed, was employed by Messrs. C. Macintosh and Co., Ltd.

Private J. BUENS, Argyll and Sutherland Highlanders, who was employed by the Scottish Electric Power Co., Falkirk, is lying in a London hospital wounded.

Second-Lieutenant K. L. JAMES, who fell in May last, and is believed killed, aged 29, took a first-class in electrical engineering at the City and Guilds Technical College. When war broke out, says the *Times*, he was superintending the laying of an underground telephone cable for Callender's Cable, &c., Co.

The Military Medal has been awarded to Rifleman T. BARNETT, London Regiment, for carrying ammunition to the front line through a heavy barrage during advance at Ypres. Private A. W. MORRIS, Machine Gun Corps, has been wounded in France. Both were in the electric light department of the India-Rubber Co., Silvertown.

Private J. E. ASHTON (21), Royal Warwickshire Regiment, formerly in the employ of the Electric & Ordnance Works, Birmingham, has been killed in action.

Private F. G. WHARTON (21), Worcester Regiment, has fallen in action. He was an employee of the General Electric Co., Ltd., at Witton.

Lieutenant R. B. MATHEWSON, R.F.C., who was an electrical engineer with the Dundee Corporation, and was a grandson of the late ex-Provost Brownlee, of Dundee, is reported missing.

Acting-Major G. S. TAYLOR, R.E., who was chief assistant electrical superintendent of the N.E. Bly. Co., has been awarded the Military Cross.

Gunner G. H. WILSON, formerly a driver on the Leeds City Tramways, who has been killed in action, has been awarded the Military Medal.

Second-Lieutenant L. FLEET, R.F.C., who was formerly an electrical engineer in Manchester, was killed on Saturday last at Doncaster, a mishap to his machine causing it to crash to the ground.

Obituary.—MR. W. K. D'OYLEY BIGNELL.—The *Morning Post* records the death, on Friday last, of Mr. William Kd D'Oyley Bignell, of the Indian Telegraph Department, in his 78th year. Mr. Bignell was appointed to the department in 1857, and 11 years later became Superintendent at Nagpur. He subsequently served in the Punjab, and arranged telegraphs during the Hazara Expedition in 1888, and became Chief Superintendent in 1892, retiring three years later.

CITY NOTES.

Dick, Kerr and Co., Ltd.

The annual meeting was held on Wednesday, at the Cannon Street Hotel. Mr. CLAUD T. CAYLEY, who presided, said that, comparing the present balance-sheet with that presented a year ago, the net profit showed an appreciable increase. The figures, taken in conjunction with the

totals of assets and liabilities, indicated the magnitude of the company's operations, although they would quite understand that under present circumstances they were unable to publish details. The total of the assets shown in the balance sheet was £2,193,688, as compared with £1,753,410 last year. The increase in the investments was the result of the acquisition of the shares in the United Electric Car Co., Ltd. The capital expenditure at the works showed a decrease on last year's figure, due to their policy of writing off what they considered ample depreciation against this item. Nobody could forecast what post-war conditions would be in the business world, and it therefore seemed essential to avoid the least possibility of inflation of their capital assets. The liabilities side of the sheet showed one particularly important variation from last year's figures, namely, the increase under the heading of creditors and estimated liabilities. This figure was £953,596, which was a large advance upon last year, although the increase was, of course, set off by the increases on the asset side of the balance sheet. The reason for this increase in creditors was that it included the reserve they had set aside for the Excess Profits Duty, as, although their liability under that heading had not yet been definitely settled, it was very obviously necessary for them to reserve what they considered a sufficient sum to meet this charge. The Government continued to be their principal customer, with continuously increasing demands both in quantity and variety. He wished he was allowed to tell them in detail of the ramifications of manufacture and construction which had been undertaken and successfully completed by the company, and still more would he like to tell them of what was being done now, and about to be done in the immediate future. Suffice it to say that all the Departments for which they were working showed their appreciation and confidence in a very practical way, by entrusting them with important work to the limit of their capabilities. The national factory erected under their auspices had been handed over to the Government, and they had now in hand the erection of two more factories for another purpose, and these, together with the construction of important works in different parts of the country, on which they had been occupied for some time, kept the contracting department very busy, and their staff of trained engineers fully occupied. In regard to the controlling interest which had been acquired in the United Electric Car Co., Ltd., the board already felt that transaction to be fully justified, so much so that steps had been taken to extend the shops to cope with work of great importance. The United Electric Car Co. were next-door-neighbours of theirs at Preston, the works occupying an area of some 15 acres, and they made a speciality of tramway car-building. The directors were satisfied that after the war there would be no difficulty in keeping them fully occupied upon profitable work, and, in the meantime, they were serving the national interests. Last year they reported the acquisition of control in Messrs. Willans & Robinson, Ltd. The position had now been consolidated by the acquiring of 86 per cent. of the preferred "B" stock of that company, which had certain participating rights. This transaction was carried through partly by payment in cash and partly by exchange of shares. As it did not take place until after the close of the year under review, it was not reflected in the balance sheet. Steps were now being taken to consolidate the organisations of the two companies, and considerable economy was to be expected both in selling and production. Considerable interest had been shown in the contracting world and among the legal profession in the now somewhat celebrated case of the Metropolitan Water Board v. Dick, Kerr & Co. This was still *sub judice*, as, although it was argued last week in the House of Lords, judgment had not yet been given. He had given them the position as they saw it at present, and he thought it might be taken for granted that their organisation and works would be fully occupied during the continuance of the war period. Last year, and the year before, he indicated the likelihood of their having to face a period of uncertainty during the transition from war conditions to normal conditions of peace, whatever the world had in store for them in that direction. The directors and management committee fully realised this, and, therefore, in spite of the abnormal amount of work thrown upon their shoulders, particularly the latter gentlemen, they were doing what they could towards organising for the future, so as to make this transition period as short as possible. He thought they might safely assume that the immediate demand for the product of their different manufacturing works, and also of their engineering contracting organisation, would be very great, and it behoved the management to see that they were in a position to step into the breach without delay. Like all large employers, naturally they were following the attitude of Labour itself, and fully realised that to meet the necessities of after-the-war conditions a complete understanding and co-operation between Capital and Labour was both desirable and necessary. The directors and the management committee had confidence that all would be well in this direction provided Labour was met in a spirit recognising that an entirely new basis of relationship must be established. Given the country and the Empire met the new conditions that were bound to arise after the war fairly and squarely by adopting new methods of Empire and international commercial relationship, he thought the internal relationship of employer and employed could safely be left to the common sense of those directly concerned.

Mr. R. H. PRESTWICH seconded the motion, and the report was adopted without discussion.

International Light and Power Co.

The net profit, after payment of debenture interest, London and Canadian administration expenses, and interest on loan, and setting aside £2,500 as a special reserve, amounts to £10,331, plus £6,744 brought forward, which is to be carried forward. Further cash advances were made to subsidiary companies on account of capital expenditure, amounting to £19,400. The directors regret that on account of the position of the Mexican undertaking, and the necessity for increasing the advances to subsidiary companies out of earnings; it has not been possible since October 1st, 1915, to pay a dividend on the cumulative preference shares. If, however, the present improvement in Mexico is maintained the directors hope that during the current year they will be in a position to resume payment of dividends on these shares. The subsidiary companies operating in Venezuela and the Argentine have placed to reserves for renewal and general purposes £7,123. Including the reserve of the Mexican company, which has not been added to, the total reserves of the three subsidiaries now reach £39,442.—*Financier*.

Eastern Telegraph Co., Ltd.

Sir J. WOLFE BARRY presided at the meeting held on October 21st. He said that owing to delays due to the war they had not been able to submit their accounts at the usual time. The net result of the year's working was remarkable, the gross revenue for 1916 being nearly £415,000 in excess of that for 1915. The expenses showed an increase of about £201,000. The actual profit was better than for 1915 by £213,400. Notwithstanding heavy duties and large increase in expenditure, they had been able to put £500,000 to the general reserve, to pay 8 per cent. free of tax, and to carry forward £28,000 more than for 1915. The company now held on account of the general reserve fund £1,700,000 of the 5 per cent. War Loan Stock. The total amount of that stock held by this and the other associated companies in Electra House was about £6,000,000. At the last meeting he stated that the principal factors that had caused an increase in the number of words carried were the interruption of the Indo-European Telegraph Co.'s line to India, and also the reduction in the carrying capacity for commercial work of the Great Northern Co.'s route to China and Japan on account of the Government requirements; but the further increase over last year was no doubt to a large extent due to the increasing uncertainty of postal correspondence throughout the Empire, which had caused merchants and others to rely more than ever upon the more certain medium of cable communication.

Eastern Extension, &c., Telegraph Co., Ltd.

At the annual meeting, on October 23rd, Sir J. WOLFE BARRY, who presided, referred to the reasons for the delay in submitting the annual accounts. The gross receipts for 1916 amounted to £1,221,000, an increase of £271,000, which was due to development of traffic all over the company's system, including the important local traffic between India and China, Japan, Straits Settlements, &c. Working and other expenses increased by £44,000. The net revenue was increased by £227,000. The agreement entered into by the French Government with the company in 1884 for providing and maintaining, under a subsidy arrangement, cable communication between the French possessions of Cochinchina and Tonquin had expired, and the cable had been sold and formally transferred to the French Government. After crediting capital expenditure with the cost of that cable (£121,454), which was originally debited to that account, the loss resulting from the transaction, amounting to £66,153, had been debited to the general reserve fund. Under arrangements made with the Governments of the Australian Commonwealth and New Zealand, the company's cable stations at La Perouse (near Sydney) and Wakapuaka (near Nelson) had been closed, and its cables between Australia and New Zealand extended to Wellington, where they were now being worked direct with Sydney under greatly improved conditions. The cost of the extensions and partial renewals of these cables would be debited to the general reserve fund in the accounts for 1917.

Drake and Gorham, Ltd.

The directors report that after payment of all charges, including staff bonuses, &c., and making provision for contingencies, the net profit for the year ended June, 1917, is £11,395, plus £2,150 brought forward. A dividend of 5 per cent. for the year absorbs £6,250, £5,000 is applied to writing down goodwill, and £2,296 is carried forward. The trading profits have increased by £2,868, an improvement of 30 per cent. on the previous year's figures. Contracts have been completed for the Admiralty, War Office, Ministry of Munitions, and other Government Departments, and a considerable amount of similar work is in hand. Both the wholesale trading department and the works show improved results, and the sale of self-propelled electric vehicles has grown rapidly. Arrangements have been completed for the leasing of a larger warehouse as well as works with greater manufacturing facilities. The directors have voted the further £854 to which they are entitled under the Articles as a war bonus to the office staff.

Credenda Conduits Co., Ltd.—The directors are unable to present the accounts for the year to April 30th. They are satisfied that the interim dividend paid on July 25th last has been earned, but it is not their intention to recommend any further distribution for the year.

Hurst, Nelson & Co., Ltd.—The gross profits for the year to July 14th were £78,770, against £78,426. Dividend at the rate of 10 per cent., and a bonus at the rate of 2½ per cent., free of tax, the same as a year ago.—*Times*.

Russia.—The Electrical Power Co. (capital 9,000,000 roubles) made a profit of 2,036,781 roubles in 1916, against 2,290,590 roubles in the preceding year, and it has paid 780,000 roubles in dividend, the same as for 1915.

The Synchronous Transmission Co. has been formed. Capital: 100,000 roubles.

Calcutta Electric Supply Corporation, Ltd.—Interim dividend of 7 per cent. per annum (3s. 6d. per share), less income-tax, on ordinary shares for half-year.

Victoria Falls & Transvaal Power Co.—The net earnings for the quarter ended June 30th were £224,978, before providing for taxation in South Africa and the United Kingdom.

Anderston Foundry Co., Ltd.—Interim dividend, 4s. 6d. per share, less income-tax.

Westinghouse Brake Co.—Interim dividend of 5 per cent., less income-tax, on ordinary shares.

anyway, of the proprietors' claims to higher rates. The electrical railways are, of course, not so directly under the eyes of the Government as the steam companies are, and there is at least a faint chance of the Metropolitan's modest 1 per cent. being improved upon in January.

Cable stocks and shares are very firm, on the issue of the final dividends and reports in respect of the year 1916. The industry has done well out of Government and Press work; the uncertainties of postal correspondence, said the Eastern Co.'s chairman the other day, have caused merchants and others to rely more upon the surer medium of cable communication. Seven of the largest of the cable companies increased their net receipts to an aggregate of £3,589,773, an improvement of £350,000 over the 1915 figures. The Cuba Submarine raised its dividend from 5 per cent. to 7 per cent., the Western from 7 per cent. to 8 per cent., and the Great Northern from 22 per cent. to 24 per cent.

The Eastern Telegraph owns, or leases, 46,638 miles of cables and 3,950 miles of land lines. The "China" has 27,258 miles of cables and various working agreements with other companies. The Great Northern owns 8,000 miles of cables, the Indo-European 3,800 miles, and the Cuba Submarine 1,600 miles. The Great Northern Co.'s report illuminates some of the difficulties of present-day working. "Nearly all the cables," says this report, "belonging to the company in Europe cross the continually expanding minefields and prohibited areas, and should breaks occur in such places it may prove impossible to have the cables repaired." There must be plenty of material, one would suppose from the recent cable reports and meetings, for a book to be written on the danger and romance of cable work in war-time.

STOCKS AND SHARES.

TUESDAY EVENING.

News from the Italian front led to a weakening of Stock Exchange prices at the first part of the week, and the disappointment felt with the prospect of the war's being protracted as the consequence of our Allies' reverse was responsible for a generally subdued tone throughout the stock markets. It cannot be said to have acquired any influence over electrical issues, but the mere fact of business having been checked was sufficient to colour the tone drab. Sentiment began to recover on Tuesday, though the volume of buying is perceptibly less, and markets go cautiously in all departments.

With the publicly-announced entry of Brazil into the war, there has been a little selling of Brazilian stocks, Government, railway, and industrial. Why this should be is something of a puzzle, but the fact remains, and Brazil Traction further weakened to 44. Argentine industrials are also out of favour, thanks to a series of very poor results from the principal railway lines of the Republic. Anglo-Argentine Trams are not notably lower, but the market is not a good one. Much the same description applies to Mexicans, though here, again, there are no movements to record.

Charing Cross ordinary shares are ½ better at 4, and South London keep a very firm spot at their advanced price of 3. Edison Swans are being bought again, the fully-paid rising to 2½, the others to 26s., and the 4 per cent. debenture stock to 74½. Callenders recovered their dividend of 5s. per share, the price being left unchanged at 14½ xd. British Westinghouse debenture is up a point to 69. Aron Motors, after having been dormant for many moons, nearly doubled in price to-day (Tuesday). The ordinary, from being eighteenpence, rose to half-a-crown, while the preference improved from 1s. 6d. to 7s., with hardly any shares offering of either class.

British Insulated Wire shares are now quoted in their new guise of £1 shares, the ordinary being 3 and the preference 1, equal to 15 and 5 respectively for the previous £5 shares. The ordinary show a rise of ¼ on the old shares. At 3, the yield is 6½ per cent. on the money. Babcock & Wilcox declined to 3½; the armament list is firm, with Armstrongs all but 40s. India-Rubber preferences are harder at 7½.

Marconi shares went back on the Italian news, the decline being explained by a market humourist as due to the nationality of the famous inventor! This little joke did not amuse the operators, who have been recently buying more than they wanted for investment purposes, and whose pressure to realise lowered the price of the parent shares ½ to 3 5/16. Americans to 21s. 9d., and Canadians to half-a-guinea. Something of a bull account had been built up in Marconi, and reaction is the inevitable sequel to an overdose of buying followed by any kind of disappointing news that affects business generally.

Nothing has occurred to encourage Home Railway stocks, and prices once more display a tendency to sag. Metropolitan shed ¼ to 23½, and the other Undergrounds are heavy in tendency. There is a mild agitation afoot, calling upon the Government to increase the dividends upon the stocks of the controlled lines at the next payment-time, but we imagine that those who most ardently advocate it cannot seriously suppose the Government will take notice, effective notice,

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend		Price Oct. 30, 1917.	Rise or fall this week.	Yield p.c.
	1915.	1916.			
Brompton Ordinary	10	9	6½	—	£6 18 6
Charing Cross Ordinary ..	5	5	4	—	6 5 0
do. do. do. 4½ Pref. ..	4½	4½	8½	—	6 13 4
Chelsea	4	4	22	—	6 9 1
City of London	8	8	19	—	6 3 1
do. do. 6 per cent. Pref. ..	6	6	10½	—	6 18 6
County of London	7	7	11	—	6 7 8
do. do. 6 per cent. Pref. ..	6	6	10	—	6 0 0
Kensington Ordinary	7	6	5½	—	6 14 4
London Electric	8	8	1	—	Nil
do. do. 6 per cent. Pref. ..	6	4	8½	—	5 6 6
Metropolitan	8	8	8½	—	4 12 4
do. 4½ per cent. Pref. ..	4½	4½	8½	—	7 4 4
St. James' and Pall Mall ..	8	8	7	—	5 14 6
South London	5	5	3	—	6 13 4
South Metropolitan Pref. ..	7	7	21/6	—	10 6 6
Westminster Ordinary	7	7	6½	—	5 8 8

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	8	8	98xd	—	6 2 6
do. do.	8½/8	1½	28½	—	6 9 0
Chile Telephone	8	8	7½	—	5 11 4
Cuba Sub. Ord.	5	7	8½	—	5 0 0
Eastern Extension	8	8	14½	—	6 7 7
Eastern Tel. Ord.	8	8	149½	—	6 7 0
Globe Tel. and T. Ord. ..	7	7	18½	—	5 5 8
do. do. Pref.	6	6	10½	—	5 15 8
Great Northern Tel.	22	24	89	—	6 8 1
Indo-European	18	18	62½xd	—	6 8 10
Marconi	10	15	3½	—	4 11 0
Oriental Telephone Ord. ..	10	10	8½	—	3 2 6
United R. Plate Tel.	8	8	6½xd	—	5 18 6
West India and Pan.	6d.	6d.	1½	—	3 9 6
Western Telegraph	7	6	15	—	6 6 8

HOME RAILS.

Central London, Ord. Assented	4	4	60½	—	6 12 8
Metropolitan	1	1	28½	—	4 5 1
do. do. District	Nil	Nil	16	—	Nil
Underground Electric Ordinary	Nil	Nil	1½	—	Nil
do. do. "A"	Nil	Nil	6/8	—	Nil
do. do. Income	6	4	81	—	4 15 8

FOREIGN TRAMS, &c.

	Dividend				
	1915.	1916.			
Adelaide Sup. 6 per cent. Pref.	6	6	4½	—	6 8 1
Anglo-Arg. Trams, First Pref.	5½	5½	8	—	9 8 4
do. do. 2nd Pref.	5½	—	2½	—	—
do. do. 5 Deb.	5	5	67½	—	7 8 8
Brazil Traction	4	4	41	—	—
Bombay Electric Pref.	8	8	9½	—	8 4 8
British Columbia Elec. Rly. Pice.	5	5	40½	—	12 8 10
do. do. Preferred	Nil	Nil	30	—	Nil
do. do. Deferred	Nil	Nil	27½	—	Nil
do. do. Deb.	4½	4½	51	—	8 6 8
Mexico Trams 5 per cent. Bonds	Nil	Nil	45½	—	Nil
do. do. 6 per cent. Bonds ..	Nil	Nil	89	—	Nil
Mexican Light Commoo	Nil	Nil	52½	—	Nil
do. do. Pref.	Nil	Nil	35	—	Nil
do. do. 1st Bonds	Nil	Nil	45½	—	—

MANUFACTURING COMPANIES.

Babcock & Wilcox	15	15	8½	—	4 16 0
British Aluminium Ord. ..	7	10	13	—	8 8 1
British Insulated Ord. ..	17½	20	8	—	6 13 4
British Westinghouse Pref.	7½	7½	21½	—	6 2 0
Callenders	20	20	14½xd	—	6 18 0
do. do. 5 Pref.	5	5	4½	—	6 1 6
Castor-Kellner	22	22	8½	—	8 8 0
Edison Swan, fully paid ..	—	—	2½	—	Nil
do. do. 4 per cent. Deb. ..	4	4	7½	—	5 7 5
Electric Construction	7½	7½	1	—	7 10 0
Gen. Elec. Pref.	6	6	10½	—	5 14 3
do. do. Ord.	10	10	18	—	5 11 6
Henley	25	25	15½	—	7 14 8
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	14	—	7 2 10
Telegraph Con.	20	20	40	—	6 0 8

* Dividends paid free of income-tax.

Exports and Imports of Electrical Goods during July, August and September, 1917.

THE official returns of electrical exports and imports for the months of July, August and September, which we publish below, show, as regards the exports, totals of £394,339, £393,882 and £288,956 respectively, which compare with the three preceding months as follows: April, £308,511; May, £316,317; and June, £367,520. It will be noted that the values have been well maintained, except as regards September, when machinery, telegraphic and telephonic values fell off considerably.

Electrical machinery exports had up to September shown an upward tendency for some months, the values recorded being well up to last year's average values, despite the difficult conditions introduced by the war: the August exports of telegraphic material included some £15,500 worth of submarine cable. The electrical import values for the three months under review were: July,

£218,741; August, £179,994, and September, £210,237, which compare with totals of £235,985 in April, £236,799 in May, and £186,888 in June, and show, if anything, a falling-off in value. It will be noted that lamp imports attained only small values during the months referred to, but battery imports have shown a considerable advance in value.

The re-exports of foreign and colonial electrical material fluctuate considerably in value, and attained a fairly high level in September. The figures for the past seven months, up to and including September, have been as follows:

March, £17,795; April, £13,262; May, £17,403; June, £14,927; July, £13,757; August, £13,851, and September, £27,522. These figures compare with a monthly average of, roughly, £16,000 during the years 1915 and 1916.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS AND MACHINERY, JULY, AUGUST AND SEPTEMBER, 1917.

	July.			August.			September.		
	Exports.	Imports.	Re-exports.	Exports.	Imports.	Re-exports.	Exports.	Imports.	Re-exports.
Electrical goods and apparatus unenumerated	£34,225	£19,896	£2,775	£78,942	£11,938	£1,466	£71,300	£52,407	£1,335
Insulated wire and cable (not telegraphic or telephonic) ...	24,349	4,022	5,681	34,381	3,327	3,662	21,138	1,429	14,629
Electric glow lamps ...	10,101	3,035	1,337	11,324	805	233	9,638	160	116
Arc lamps and parts (not carbons) ...	15,256	5,484	68	15,123	17,231	2,334	17,449	5,600	—
Meters and instruments ...	17,406	5,540	645	13,556	790	175	7,115	2,913	146
Electrical machinery (including switchboards and transformers) ...	155,615	119,207	2,430	148,108	82,676	2,180	110,938	115,694	1,053
Batteries ...	6,008	24,048	47	15,106	23,886	20	11,911	20,128	—
Carbons ...	1,190	2,294	136	4,292	3,203	63	700	8,323	—
Telegraph and telephone wire and apparatus...	130,189	5,215	638	73,050	3,135	418	38,767	3,583	10,243
Totals ...	£394,339	£218,741	£13,757	£393,882	£179,994	£13,851	£288,956	£210,237	£27,522

THE HIGH-TENSION MAGNETO.*

(Concluded from page 406.)

THE DESIGN OF AEROPLANE MAGNETOS.

Reliability.—In the case of an aeroplane magneto, this is a consideration of primary importance, because failure of the magneto may mean sudden destruction of the machine and pilot. An aeroplane type of magneto should be most carefully and rigorously tested before it leaves the manufacturer. During this test the strain put upon the machine, both mechanical and electrical, should be greatly in excess of the maximum strain likely to obtain under abnormal working conditions. These fundamental considerations were carefully borne in mind when arranging the series of tests to be imposed upon the type "A" magneto.

In the case of the armature, extraordinary precautions were taken—first, by carefully inspecting all the insulating material and each reel of enamelled wire, and secondly, by subjecting the finished armature to a prolonged electrical test with the secondary discharging at 9,500 volts between electrodes. In addition to this, the armature is inspected several times at various stages of the winding and finishing process.

Every magneto is subjected to running tests as follows:—

1. Run for 20 hours at 2,500 R.P.M. at air temperature, with each distributor terminal connected to a spark gap adjusted to discharge at 7,500 volts.
2. Completely dismantled and the various metal parts cleaned in petrol. Magneto then reassembled and adjustments made where necessary.
3. After re-magnetising, magneto run for four hours at 2,500 R.P.M., with spark gaps as under (1), in a hot box with air at 100 deg. F.
4. At the end of this final run the magneto is tested at low speeds to ensure that the sparking characteristics are satisfactory.
5. Before shipment, the magneto is inspected in every detail, all adjustments are carefully checked, and screws tightened and locked where necessary.

Weight.—It is obviously desirable to keep the total weight of an aeroplane type magneto as low as possible. To do this, it is first necessary to develop a design that requires a minimum volume of material, and secondly, to use, if possible, aluminium castings. Special steels should also be used wherever possible, so that the required strength can be achieved with a minimum weight of material.

The castings made of an aluminium-copper alloy containing no zinc are to be preferred to sand castings, because the general appearance of the magneto is enhanced thereby, and the amount of machining that has to be performed on the parts is very considerably reduced. Furthermore, the metal is much tougher, and the threads in tapped holes are not so likely to become stripped when the screws are securely tightened.

Elimination of Fire Risk.—This is of vital importance, because any sparking within the magneto may, under operating

conditions, be the means of initiating a fire by igniting a mixture of air and petrol in the surrounding medium. Tests were carried out by the N.P.L. in the early days of the war to determine the extent of this danger. A number of different types of pre-war Bosch magnetos were run in a chamber that could be filled with an explosive mixture of air and petrol. Generally speaking, it was found that explosions were likely to occur as a result of:—

- (1) A succession of sparks at the safety gap.
- (2) Sparks between distributor segments or other high-tension parts, and the frame of the magneto.
- (3) Sparks at the contact-breaker points.

Trouble is most likely to arise from cause (1), although this was eliminated by enclosing the safety spark gap in a fine mesh gauze casing on the principle of the Day safety lamp, so as to prevent any explosion in the immediate vicinity of the safety gap electrodes being propagated in the surrounding medium.

Trouble due to causes (2) and (3) can be eliminated by careful attention to the design of the magneto to prevent any wasteful sparking of this nature. In the type "A" magneto this is done, whilst the safety spark gap is contained in a separate gas-tight chamber fixed underneath the distributor and provided with a ventilation hole covered with a piece of very fine mesh gauze. As a "spark-gap" type of distributor is used, it is necessary to provide some form of ventilation, so that the products of ionisation can escape. Here again the ventilation hole in the front of the distributor is covered with a piece of fine mesh gauze, and the whole combination is thus perfectly safe. Very severe tests carried out on this particular machine, by introducing an explosive mixture of coal-gas and air into the contact-breaker housing, safety-spark-gap chamber, and distributor, have quite confirmed this view that the risk of fire under operating conditions has been entirely eliminated.

In the 12-cylinder polar inductor magneto previously described, the safety spark gap rotates with the distributor brush. This is a distinct improvement upon the stationary form of spark gap generally adopted, because the products of ionisation are churned up and quickly expelled through the ventilation window provided in the front of the distributor. This window is covered with gauze, as in the type "A" machine, which makes the magneto fireproof.

Variable Timing.—Several thousand type "A" eight-cylinder aeroplane magnetos with fixed ignition have been supplied, so presumably on certain types of engines variable ignition is not required.

When starting a petrol engine it is, generally speaking, necessary to retard the ignition so as to prevent the explosive wave in the cylinder being sufficiently propagated before the piston reaches the top of its stroke to produce a backfire.

In the case of an aeroplane engine, the necessity for making such an adjustment should not arise if a hand-starting magneto provided with H.T. switch is used. In view of the fact that the hand starters now being used in this country are not fitted with this special cut-out switch, it seems necessary that some provision should be made either inside the magneto or in the outside drive for an adjustment of this nature. The method of obtaining adjustment of the timing, adopted

* Abstract of paper read by Mr. A. P. YOUNG, A.M.I.E.E., before the AERONAUTICAL SOCIETY.

by the Bosch Co. in their pre-war rotating armature type magnetos, was to make provision for rocking the contact-breaker cam housing through a definite angle ranging between 16 deg. and 35 deg. Obviously, any angular displacement of this housing will cause the spark to occur either earlier or later in each cylinder.

The primary current curves clearly prove that at low speeds—when the necessity for retarding the ignition is greatest—any retarding of the spark will greatly weaken its intensity. At high speeds, on the other hand, the reverse is true, and the spark becomes stronger as the timing lever is retarded.

The inherent defect of a H.T. magneto, as ordinarily constructed, can be overcome by providing special sliding poles, which are mechanically connected to the timing lever, so that their position is changed at each adjustment of the timing. A design of this kind is used on one of the Bosch Co.'s latest magnetos, developed since the outbreak of war, and it ensures that when the primary circuit is broken, the armature always bears a definite relation to the pole pieces, regardless of the position of the timing lever. In consequence, the current I_b for any given speed will remain constant, and the intensity of the spark will be the same for all adjustments of the timing.

Having overcome one inherent difficulty, the other one associated with the distributor still remains. If we assume that when the timing lever is fully advanced the contact-breaker points close just before the carbon brush leaves the distributor segment—and at very high speeds the H.T. spark will persist until the contacts close—it is clear that with the lever fully retarded the carbon brush will be some distance off the segment when the spark ends. In other words, sparking between carbon and segment will result, which must tend to burn the brush track. This difficulty can only be overcome by designing the contact-breaker cams to give a very short period of open circuit (θ_1), but from other considerations it is undesirable to make θ_1 too small. The difficulties likely to arise in this connection are more pronounced on a 12-cylinder magneto, where the problem of distribution is very complex.

Taking everything into consideration, therefore, the author holds that in the case of an aeroplane magneto, adjustment of the timing should be made outside the magneto and incorporated in the drive by the engine designer. This enables the magneto designer to work out his design on the basis of fixed ignition, and he is thus enabled to simplify the mechanical construction of the machine and arrange matters so that the magneto will give the very best electrical performance over a wide range of speed.

The problem of devising some mechanical method of adjusting the timing that can be incorporated in the magneto drive is not difficult of solution. For example, some form of sleeve working on a coarse thread and capable of movement in an axial direction can be provided for this purpose. On these lines it is possible to develop a scheme whereby both magnetos (in cases where two-point ignition is adopted) can be adjusted in phase by the movement of a single lever. It is also possible to provide for adjustment through a worm spindle operated by a flexible drive terminating in a hand wheel placed in close proximity to the pilot. This latter method would allow of a remarkably fine adjustment being obtained.

Now that a British magneto industry has been established on a sound foundation, it is vitally important that when the war is over this industry should be supplied with the necessary materials used in the construction of high-tension magnetos from within the British Empire. Only in that manner can we secure a truly British-made magneto. Viewed from the national standpoint only, such a course is absolutely essential, because otherwise, in the event of war, this industry, upon which so many other war industries are dependent, will be handicapped for lack of one or more essential materials.

Varnished paper, silk, and cambric are essential to the manufacture of a satisfactory magneto armature, and although they can be purchased in England at the present moment, the greater portion of this material is imported from America. The very fine mesh silk is woven in Japan, and the varnish manufacturer is at the moment depending on supplies obtained from foreign countries.

At the present moment there are several manufacturers in England who are making moulded insulating material similar to the German stabilite, and recent progress has been most gratifying. There seems absolutely no reason to suppose that the English manufacturers will not eventually be in a position to adequately meet all the demand for this class of moulded material, but co-operation between them and the magneto manufacturers is necessary.

The most satisfactory distributor carbon brushes are at the moment being manufactured in France, although one English manufacturer has certainly made very commendable progress. This is another case where hearty co-operation between the brush manufacturer and the magneto manufacturer is necessary if the best results are to be achieved.

It is hoped that the manufacturers of die castings will take steps to ensure that after the war is over the demand for die castings that will be made upon them by English magneto manufacturers will be fully met. The magneto industry would receive considerable assistance if it were possible to purchase brass die castings in large quantities.

In appendices the author gives a detailed analysis of the working of the battery ignition system, and the derivation of a formula which he has developed for computing the primary current in a magneto at "break."

THE TRAINING OF ENGINEERS.

At the Institution of Civil Engineers on Thursday last week an important meeting was held, as briefly mentioned in our last issue, to form a Central Organisation for improvement in and better co-ordination of engineering training. Sir MAURICE FITZMAURICE, Pres. Inst.C.E., was in the chair, and the audience included some 75 delegates representing all the engineering institutions and societies connected with the engineering industries, British and Irish Universities, technical colleges and schools, technical teachers, the Board of Trade and other Government Departments, the Dominions, and, of course, the Board of Education, though unfortunately Mr. Herbert Fisher, President of the Board, was unavoidably prevented from attendance. There was also a large number of representatives of manufacturing firms, railways, education committees, the technical Press, and other interests concerned in the questions under consideration.

In opening the discussion, the CHAIRMAN expressed the cordial sympathy of the Council of the Institution of Civil Engineers with the movement, and emphasised the great importance of the meeting, which was unprecedented in its representative character. He remarked that no proposal was made to interfere with the existing organisation of any university or society, but he believed that all parties would agree as to the desirability of coming into line with the scheme that would be put forward. The manufacturing industries depended very largely upon engineers, of whom a full supply was necessary; young engineers should be provided with an adequate training, but the means of obtaining the necessary training were not satisfactory at present.

A letter was read from Mr. Fisher, promising the hearty co-operation of the Board of Education in any suitable scheme that the engineering industry might adopt, and Mr. A. E. Berriman, chief engineer of the Daimler Co., who has shared with Mr. A. P. M. Fleming, of the British Westinghouse Co., the preliminary work of organisation, explained in detail the origin and purpose of the proposed organisation, which, he said, must be permanent and representative, must co-operate with the interests concerned, must exert an *active* influence, and, lastly, should be independent of financial assistance from the Government. Mr. Berriman's remarks followed the lines of a memorandum, of which the following is a brief abstract:—

The proposal to form a central organisation originated in an informal conference of engineers and educationists, which held several meetings at the Board of Education during the early months of 1917. It soon became apparent that the amount of useful work to be accomplished was altogether beyond the scope of a temporary conference, and, with the support of the Board of Education, steps were taken to hold a meeting, at which the real need for a Central Organisation might be confirmed and some definite proposal formulated. The broad purpose of the proposed organisation is to provide the engineering industry and profession with a representative brain and articulate voice on educational matters; any such scheme essentially depends on the combined assistance of the various institutions, not only in creating and in helping financially to maintain the organisation, but in enabling it to perform its functions efficiently through the principle of devolution. Primarily, it will co-ordinate things that exist, and bring them together in conference, so as to avoid overlapping of effort.

There are three objects in particular on which the proposed Central Organisation might usefully concentrate its attention:—

The first is the co-ordination of engineering training, including the fostering of apprenticeship as a national institution, and the consideration of means by which the works period of an engineering pupilage may be increased in efficiency, and a wider appreciation secured for the value in industry of education of university rank.

The second is the maintenance of a central bureau, where parents and educationists can obtain accurate and comprehensive information relating to the engineering industry, and the proper course to pursue on behalf of boys who are desirous of making engineering their profession.

The third is the promotion of scholarships, or other equivalent means by which the best talent may be enabled to rise to its proper level under the stimulus of educational opportunity.

With regard to the first of these objects, co-ordination refers primarily to encouraging a proper relationship between school work and shop work for all classes of engineering students. No plan for extended school work, such as the new Education Bill foreshadows, can possibly bear its full fruit unless it is supported by a workshop instruction that is effective in fitting a boy to make the best of his future manhood, and no training for engineering management can hope to be

efficient unless the clear thought that it confers by higher education is coloured with the human sympathy and understanding that is born of personal experience in the shops among the men. Nor is it only a vocational training that has to be considered. It were short-sighted indeed to overlook the citizen and the man in trying to make the mechanic, or to forget the importance of good health and the value of a mind with many interests.

Incidentally, there is a widely recognised need for encouraging lads to become apprentices as distinct from mere members of the vast community of child labour, and this recognition extends also to the need for effecting improvement in the educational value of the works period of engineering training, whether it be for the apprentice who seeks to learn a man's skilled trade, or for the pupil who is qualifying for ultimate positions of management.

That the time is ripe to bring into existence a central organisation to which engineering firms and others could apply for information relating to apprenticeship systems and methods of training that are actually in operation, may be judged from the number of letters in support that have been received from various sources, and as to any further need for an information bureau (the maintenance of which is the second of the specified objects of the organisation), the answering of the daily letter from the perplexed parent whose son is approaching the completion of his last term at school, may in itself seem to be sufficient justification to the many engineers who would be relieved thereby from the onus of replying to this mass of correspondence. As a link by which parents, schools, and universities are enabled to get into direct touch with the engineering industry and profession, the proposed Central Organisation will be performing one of its most important rôles.

The need for making the most of those who do enter engineering is equally vital, and leads logically to the inclusion of the third of the above-mentioned objects of the organisation. Without doubt, much potential talent is prevented from developing either as quickly or as widely as it could through lack of financial assistance, and it would be a worthy endeavour on the part of the engineering world to attempt some improvement in this direction by fostering the establishment of proper scholarships, and forming a new "educational ladder," which many hope to see extend from the bench to the university for those boys, irrespective of social distinction, who are able to climb thus high. Some widening of view is still needed to obtain a general appreciation of the university standard of education as an asset of real value in practical life.

In the course of the discussion which followed, Sir DUGALD CLERK stated that highly trained men were not even yet easily placed in works; employers objected to having men in their works for a time who would go away and carry their information elsewhere. It might be necessary to invoke the aid of legislation to meet this difficulty.

Mr. MICHAEL LONGBRIDGE, Pres. I.Mech.E., expressed the hope that the manufacturing engineer would support the scheme, as its success depended very largely on his attitude towards it. Increased output was the only means of meeting the high working expenses after the war, and could be obtained only by increased efficiency and improved education.

Mr. C. H. WORDINGHAM, Pres. I.E.E., gave whole-hearted support to the proposal, and said that the keynote was co-ordination of existing resources and co-operation of existing institutions. All petty jealousies must be sunk in the effort to achieve success. He believed that the scheme outlined contained the elements of success, and said that if the new organisation could lay down standard methods of training it would accomplish an immense achievement.

Mr. W. H. ELLIS (Master Cutler) said that hitherto apprenticeship had been regarded as a privilege granted to the boy; employers should regard it as a responsibility resting on their shoulders. The ideas now associated with the word "Welfare" embodied his views on the subject.

Mr. H. B. ROWELL, Pres. N.E. Coast Institution of Engineers and Shipbuilders, Mr. W. H. HICHENS, Chairman of Messrs. Cammell, Laird & Co., and Mr. R. T. NUGENT, Director of the Federation of British Industries, gave their support to the scheme.

Prof. W. E. DALBY said that the need of such a scheme was very pressing. Ten years ago he found that in Germany 10,000 well-educated men over 18 were studying engineering, compared with only 900 in this country. The system of training followed by our colleges was as good as any in the world; the main consideration was to build a solid foundation on which any edifice of specialised knowledge could be erected. The pernicious premium-pupil system was dying out; they should pay the apprentice a living wage.

Lieut.-Comdr. C. F. JENKIN said that the scholarships should be provided by the manufacturers, who should take broader views and admit their responsibility for carrying on the education of the boys after they left college.

Sir A. SELBY BIGGE, of the Board of Education, welcomed the scheme, and laid stress on the necessity of co-ordinating the training with the use to which it would be put in after-life.

Sir WILFRID STOKES, President of the British Engineers' Association, gave hearty support to the scheme, which, he pointed out, was evidently approved by the meeting. Out of the 26 members of the proposed committee, he saw that 11

would be manufacturers, and was quite content to leave details to the committee.

Sir JOHN WOLFE BARRY then moved the resolution appointing a committee representative of 21 engineering societies and associations, the Board of Education, the Headmasters' Conference and Association, the Association of Technical Institutes, and Universities and Technical Colleges—26 in all, with power to add to their number—to initiate means to give effect to the principle of a Central Organisation.

Dr. W. H. HADLOW seconded the resolution, which was carried unanimously.

Mr. A. H. D. ACLAND, former Minister of Education, afterwards stated that Mr. Fisher would probably very soon bring in a scheme of Government scholarships as a matter of urgency, involving an annual grant of £100,000 to schools, £100,000 for maintenance scholarships, and a still larger sum for continuation scholarships at the universities.

REVIEWS.

Predetermination of Prices. By FREDERIC A. PARKHURST, M.E. London: Chapman & Hall, Ltd. Price 5s. 6d. net.

The author deals with the fundamental factors which govern the possibility of determining true costs, and his treatise is one of scientific commercial management and research. He describes largely foundry costs, but also deals with his subject generally, and in the preface states that he describes no untried theories, but that each result has been thoroughly tested by actual use, and that nothing unproved has been recorded.

Chapter I emphasises the importance of "absolute control of all sources of information," whether a simple system for a small business, or for one involving many departments and a large variety of products. He states truly that it is of no use to know when the job is finished that it "cost too much," we want to know "the cost in advance." A diagram showing the relation of true costs to profit and selling prices is interesting.

Chapter II is a discussion of elements affecting true costs. The author deals with this in a very lucid manner, and the reviewer is pleased to see the importance he attaches, *inter alia*, to:—(1) Order groups, amongst which he deals with additions or betterments to buildings, plant, &c., or, in other words, increment of capital assets. The importance of this must be acknowledged inasmuch as capital charges and maintenance are increased, therefore there is a corresponding expenditure to account for, a fact that may be overlooked in dealing with hourly rates, especially when capital charges are assessed at their valuation for the previous year ending. (2) Stores keeping and perpetual inventory. This is one of the important items in the managerial control of costing. The author's illustration—"stores card"—shows a perpetual balance, a danger limit, and the prices. The importance of price on a stores quantity card is in very many cases ignored; that it is a factor in true costing will be acknowledged when it is considered that the same class of goods may be purchased at different rates, hence, with the prices on the card, when one lot of goods is issued, the new rate is apparent for the purpose of recording the true cost of the material. (3) Bonus incentive. The author's remarks that the realisation of maximum efficiency should be recognised by a remuneration over and entirely separate from the prevailing rate of wages, will be admitted to be true.

The diagrams are straightforward, but a number of them in this and subsequent chapters are on folded sheets. In the reviewer's opinion this is a mistake, as books of this nature are usually handed round, and folded sheets become torn and parts are eventually lost; it is far better to continue diagrams from page to page until the form is finished, and it is just as easily understood. Further, the reviewer is rather surprised that more advantage is not taken of loose-leaf books for columnar work, as on a single sheet the number of columns is limited, and the book is very often large and unwieldy, whereas with the loose-leaf book columnar work is practically unlimited, and the cross additions can be shown on each page if required, but it is usually only necessary to have total cross additions on the last page of the continued form; moreover, quite a number of relative forms, summaries, &c., suitably sub-divided, can be kept in the one book, thus the data are centralised.

Chapter III describes the elements entering into direct costs, and chapter IV analyses the rather intricate problem of indirect expense, showing the use of various expense symbols in connection therewith, and discussing departmental expense distribution. The section dealing with "distribution of burden" is decidedly interesting. In a section on "Erroneous Methods of Distributing Indirect Expense," the author describes methods adopted that are incorrect, and the curve, fig. 17, graphically illustrates the error existing in a flat-rate method of distributing burden. The concluding chapters are "Recapitulation of Costs," "Estimating," "Profit and Relatively True Selling Prices," all of which the author deals with in a highly instructive manner, and in his closing remarks he states that we no longer associate lowest costs

with least output in wages, but that modern striving for low costs under proper and scientific management pays the highest wage, and has resulted in the improvement in a marked degree of working conditions.

The book will undoubtedly be a valuable addition to the managerial library, and the time taken in the study of this work will be time well spent by all interested in the scientific commercial arrangement of manufacturing undertakings, large or small.—J. C. P.

Hydro-Electric Power. By LAMAR LYNDON. Vol. I, Hydraulic Development and Equipment." London: Hill Publishing Co. Price 21s. net.

The details of hydro-electric power development are treated in a masterly fashion, the data and illustrations referring chiefly to water-power practice in the United States of America.

The volume commences with consideration of the factors which must be investigated before deciding whether a waterfall should be harnessed. The advantages of high-head falls over those of low heads are emphasised.

Formulae are given for the determination of horse power, and it is pointed out that when calculating power it is usual to take the weight of a cubic foot of water at 62½ lb. In tropical countries, however, this is too much, because water at a temperature of 100 deg. F. weighs only 62.06 lb.

It appears that in the States the power companies have two ways of charging. The first, called primary power, is a contract for supply all the year round, regardless of fluctuations of stream flow. The second, called secondary power, is usually guaranteed for only nine months in the year, and the charge for this is, naturally, at a much lower rate.

Diversity factor, defined as the ratio of the maximum connected load to the maximum station output, is stated to range from 1.5 to 2.0.

Pipe Lines.—The diameter of the smallest size pipe to deliver a given amount of power is that in which the loss of head in the pipe is 0.351 of the total head. Under the condition of delivery of maximum power, such a pipe-line would give only 64.9 per cent., which is much too low for any condition, except where only a limited amount of power is required from a fall, and where the pipe line is very long. It is pointed out how a pipe line may collapse inwards by a too rapid opening of the water-wheel gates, allowing the water column in the inclined section to accelerate rapidly and thus cause a separation of the lower portion from the upper and only slightly inclined portion, which cannot accelerate so quickly.

The advantages of wooden stave pipes over steel plate pipes are stated to be:—(a) The low first cost, (b) ability to act as a heat insulator and prevent freezing, (c) not so subject to injury from settling or expansion and contraction, (d) can be quickly repaired with material easily obtained, (e) the friction loss is less than with steel, (f) the loss does not increase with time, (g) the materials of the pipe are light and easily transported. The life of a stave pipe depends more on the durability of the timber than on the bonds. Only in rare instances have bonds failed first.

Dams.—The design and construction of dams are gone into very thoroughly, and they are stated to be of three types:—(1) The gravity dam, in which weight of material resists the water pressure, (2) the hollow dam, having an inclined up-stream face, (3) the arch or cambered dam, which in plan is curved and acts as an arch. In this form the pressure of water is resisted by the arch action, and it is therefore necessary to have unyielding walls at each end to resist the stresses transmitted to them. An illustration is given of the Halligan arched dam, which is 62.3 ft. high at the crest of the spillway section, and 350 ft. long, the chord length being only 334 ft.

Water Wheels.—Under the heading "Impulse Wheel or Pelton Wheel," there is a discussion of various methods of regulation. Where constant speed is required, and changes in power delivered to the wheel must be quickly effected, a combination of needle-nozzle and of jet deflection is sometimes employed. A modification of the deflecting nozzle due to the Allis-Chalmers Co. is shown, this having its moving portion and centre of oscillation near the discharge end of the pipe.

The last chapter deals with speed regulation of water wheels and abnormal penstock pressures, and also gives very valuable information on such matters as (a) time periods of governors, (b) water hammer, (c) relief valves, (d) surge tanks, (e) pipe vents, (f) water wheel governors.

There are occasional repetitions of statements, conclusions, and of the meanings of symbols, but this is done for the purpose of making any single chapter complete in itself. Books of this character are seldom read through consecutively, and it wastes the reader's time and patience to search through other parts of a book for meanings.—E. K. S.

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

- 14,884. "Magnetophones and alternating-current electric generators with oscillating fields." F. T. CHAPMAN. October 15th.
- 14,893. "Portable electric grinder." A. H. SNEED & L. W. WATSON. October 15th.
- 14,896. "Sparkign plugs." W. H. PEASE. October 15th.
- 14,899. "Sparkign plugs." A. E. LAMKIN. October 15th.
- 14,908. "Electromagnetic friction clutches for driving and change-speed gear for motor vehicles, &c." MEXCO-ELWA SYNTHICAE & G. POLLARD. October 15th.
- 14,918. "Electric lamp fittings." A. J. BONNELLA. October 15th.
- 14,932. "Electrically-heated steel furnaces." J. L. DIXON. October 15th. (U.S.A., October 14th, 1916.)
- 14,933. "Electric steel furnaces." J. L. DIXON. October 15th. (U.S.A., October 14th, 1916.)
- 14,936. "Electric switches, &c." P. L. TEED. October 15th.
- 14,969. "Magnetically-operated devices for contact making, indicating, or registering." P. W. PAUL. October 16th.
- 14,976. "Controlling X-ray tubes." F. D. OWEN-KING & G. PEARCE. October 16th.
- 14,981. "Continuous-current dynamos." F. KESSELING. October 16th.
- 14,991. "Electric accumulators." H. F. JOEL. October 16th.
- 14,992. "Troughs for electric cables, &c." CALLENDER'S CABLE & CONSTRUCTION CO. AND F. E. WORDSWORTH. October 16th.
- 14,999. "Protective devices for electrical cables or cable systems." F. F. P. BISCHOP AND MERZ & MCELLENN. October 16th.
- 15,010. "Sparkign-plugs." J. E. BARROWS. October 17th.
- 15,040. "Electric adapters, &c." N. MCLEAN. October 17th.
- 15,069. "Sparkign plugs for internal-combustion engines." L. S. CLARKE. October 17th.
- 15,076. "Grids for storage batteries." E. F. ABLITT & A. J. ADAMS, AND B. DE Q. QUINCY. October 17th.
- 15,097. "Electric furnaces for smelting and refining steel." J. S. ROMANES. October 18th.
- 15,111. "Boxes and switches of electrical fuses." G. O. DONOVAN, E. W. DONOVAN & L. F. DOUGLASS. October 18th.
- 15,172. "Electric lamp." S. CLIFFORD. October 19th.
- 15,176. "Insulations for high-tension electric instrument transformers, also applicable to electric-circuit protective gears." C. S. SARKAR. October 19th.
- 15,204. "Machine switching telephone system." F. R. McBERTY, L. POLINKOWSKY & WESTERN ELECTRIC CO. October 19th.
- 15,205. "Electric connections." W. H. EDWARDS & H. LUCAS. October 19th.
- 15,210. "Electrically-heated soldering iron." E. CARETTA. October 19th.
- 15,213. "Sparkign plugs for internal-combustion engines." F. L. VARTY. October 19th.
- 15,214. "Electric lamps." W. A. S. HELLVIG. October 19th.
- 15,219. "Electric fittings." L. MILSE. October 19th.
- 15,228. "Electric time relays." A. ENGELHARD & SOC. AUTOMATISME ET APPAREILLAGE. October 19th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

- 5,319. CONSTRUCTION OF SPARKING PLUGS. V. PONS. May 14th, 1915. (109,482.)
- 9,172. DIFFERENTIAL LEVEL GEARING FOR USE IN ELECTROMECHANICAL VARIABLE-SPEED MECHANISMS. J. G. P. THOMAS & THOMAS TRANSMISSION, LTD. June 29th, 1916. (109,816.)
- 9,263. ELECTRIC REGULATORS OR RHEOSTATS. VICKERS, LTD., & R. L. HALSTEAD. June 30th, 1916. (109,818.)
- 13,429. ELECTRIC GENERATOR LAMPS. H. R. VAN DAVENIER. September 21st, 1916. (109,826.)
- 13,488. AUTOMATIC TELEPHONE SYSTEMS. Relay Automatic Telephone Co. and B. B. JOHNSON. September 22nd, 1916. (109,829.)
- 13,489. AUTOMATIC TELEPHONE SYSTEMS. Relay Automatic Telephone Co., F. M. WARD, L. C. BYGRAVE & H. J. HENRIK. September 22nd, 1916. (Patent of addition not granted.) (109,830.)
- 13,725. COMBINED SWITCH AND PLUG BOXES FOR ELECTRIC CIRCUITS. J. SCOTT. September 27th, 1916. (109,842.)
- 13,754. ELECTRIC COOKING AND LIKE HEATING APPARATUS. A. F. BERRY. September 27th, 1916. (109,844.)
- 13,812. ELECTROMAGNETIC ENGINE. F. RACHLETT. September 28th, 1916. (109,847.)
- 14,029. MAGNETIC SEPARATORS. A. F. HALLIMOND & W. G. FLETCHER. October 14th, 1916. (Cognate application, 5,054 17.) (109,857.)
- 15,213. MINE SIGNALING APPARATUS. R. W. HALL & D. PEARSE. October 26th, 1916. (109,862.)
- 15,097. ELECTRIC FUSES. H. H. BAKER. November 1st, 1916. (109,867.)
- 15,688. WIRE STRECHING DEVICES. J. S. WITHERS (C. J. H. PENNING). November 2nd, 1916. (109,869.)
- 15,692. COMPOSITIONS OF MATTER, AND PROCESSES FOR MAKING SAME. A. J. LECHMANN. November 2nd, 1916. (109,870.)
- 15,781. PROTECTIVE DEVICES FOR ELECTRIC CIRCUITS. British Thomson-Houston Co. (General Electric Co., U.S.A.) November 4th, 1916. (109,871.)
- 16,095. ELECTRIC SIGNALING. H. GREEN. November 22nd, 1916. (109,886.)
- 16,969. ELECTRICALLY-OPERATED BELLS. Sterling Telephone & Electric Co. and F. G. BOLL. November 27th, 1916. (109,889.)
- 17,011. CONTROLLING APPARATUS FOR ELECTRIC MOTORS. H. V. JAMES. November 27th, 1916. (109,890.)
- 17,838. BULKHEAD GLAND. R. W. SAMBRIDGE. December 12th, 1916. (109,897.)
- 18,324. DISTRIBUTION BOARDS FOR AUTOMOBILE VEHICLES. Soc. Anon. pour l'Éclairage Électrique des Véhicules. January 21st, 1916. (109,643.)
- 18,460. PORTABLE ELECTRIC HOISTING GEAR FOR DISCHARGING BASKETS FROM SHIPS, AND FOR ANALOGOUS PURPOSES. R. J. DAVIES-COLLEY. December 27th, 1916. (109,904.)

1917.

- 502. ELECTRIC CONTROLLERS. British Thomson-Houston Co. (General Electric Co., U.S.A.) January 10th, 1917. (109,910.)
- 2,940. TRANSMISSION OF SOUND OR LIKE IMPULSES. R. A. FESSENDEN. May 12th, 1916. (106,268.)
- 6,952. CONVERSION OF ELECTRIC CURRENTS BY MEANS OF METAL VAPOUR RECTIFIERS FED WITH POLYPHASE CURRENTS. BROWN, BOVERI & Cie, Akt. Ges. May 18th, 1916. (106,299.)
- 7,357. ELECTRIC SPARK-GAP PROTECTIVE DEVICES. G. GILES. June 26th, 1916. (108,467.)

New South Wales Collieries.—The Government of New South Wales has commandeered all the coal mines in the State; 10 mines are being worked and have been manned through the National Service Bureau, which was opened for the enrolment of voluntary labour at the end of August.

THE ELECTRICAL REVIEW.

VOL. LXXXI.

NOVEMBER 9, 1917.

No. 2,085.

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CO-OPERATIVE TRADE ABROAD.

We have on several occasions referred to the inquiry that was made a short time ago by the American Federal Trade Commission into the subject of co-operation in the American export trade. Some of the evidence given was distinctly interesting from the electrical standpoint, inasmuch as it set out somewhat fully the measures taken by present enemy industrial organisations for working their way into foreign markets by fair means or by foul. It will be remembered that the anti-trust legislation of the States was held to bar the way to co-operative action by American manufacturers in such a matter. It is hardly likely that this handicap will be allowed long to continue, and proposals for removing it have, we believe, already exercised the minds of American legislators. A complete copy of the report of the Commission is now in possession of the British Department of Commercial Intelligence, and we have no doubt that our electrical manufacturers and those representing their organised associations will find it politic to study the document.

It is recognised that the United States is becoming less and less an agricultural country, and more and more an industrial one, and in order to be prepared to take a larger place in industrial exportation it is necessary that the world situation, and the organised and other practices of other exporting peoples, should be comprehensively studied. This is done in detail in the report. The competitive conditions as they have prevailed in the past, and up against which American traders have found themselves, are examined, and naturally a good deal of attention is devoted to the German Cartels, and the big financial and industrial organisations of Germany and other countries which are found to have assisted their efforts to secure foreign trade receive a good deal of attention. Not without special reason the competitive conditions in South American trade, vast potential markets for decades to come, where German influence, once fostered with such characteristic measures of "penetration," is now on the wane, and where naturally the United States' traders hope for greater things than have been hitherto experienced, have, of course, not been overlooked. But the report goes further than this, for it deals with a number of special industries individually, and discusses the operations of foreign combinations established by them, and the possibility of forming American export combinations to assist these particular industries. Among these specialised lines are electrical manufactures, machinery and rolling stock, blast furnace and rolling-mill products, chemicals, textiles, and so forth. The principal conclusion that is arrived at seems to be that legislative measures must be passed clearing away effectively the present doubts concerning the legality of co-operation abroad on the part of American firms. When this has been effected, it is believed, American exporters will be enabled to compete in foreign markets on more nearly equal terms with foreign competitors.

There is no reason to doubt that after the war the States will be a larger sharer in the export business of the world. For some years undoubtedly there will be ample room for us all, so immense is the mountain of arrears that is accumulating everywhere, and so vast will be the needs for reconstruction or rehabilitation, but we all recognise that a great change has come over the face of industrial manufacturing throughout the entire world. That

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Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 6d.; Canada, £1 8s. 10d. (\$5.80). To all other countries, £1 10s.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.

AUCKLAND, N.Z.: Gordon & Gotch, Albert Street; The Mining and Engineering Review, 91A, Strand Arcade, Queen Street.

BRISBANE: Gordon & Gotch, Queen St.

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MILAN: Fratelli Treves.

NEW YORK: D. Van Nostrand, 25, Park Place.

PARIS: Boyveau & Chevillet, 22, Rue de la Banque.

PERTH, W.A.: Gordon & Gotch, William Street.

ROME: Loescher & Co., Corso Umberto I° 307.

SYDNEY: The Mining & Engineering Review, 273, George Street; Gordon and Gotch, Pitt Street.

TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.

WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

THE "ELECTRICAL REVIEW'S"

ELECTRICAL & ALLIED TRADES DIRECTORY

(THE RED BOOK),

1917 EDITION.

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4, Ludgate Hill, London, E.C. 4.

being so, we hope that the conclusions of the American Federal Commission, made after so complete a study of the whole subject, in favour of co-operative action will be regarded as an additional signpost for the attention of the British manufacturer. The disposition among our firms to come together, consolidating scattered smaller forces, unifying, and thus making more economical and efficient, their selling organisations, is a very satisfactory feature of the industry to-day. Such measures are necessary in order that our means may be in readiness for immediate operation directly the more propitious times are upon us. We publish on another page to-day some information concerning consolidation efforts made during the war in Germany, though we know that there has been a strong feeling among traders in some departments of industry there is opposition to the movement. Yet we must recognise such consolidation as an accomplished fact, and that these organisations will endeavour for all they are worth, probably with some of the familiar methods of the past, and with others which they consider more suited to enable them to surmount the difficulties consequent upon the antipathy of the greater part of the world, to secure a position of strength. As manufacturing peoples, no doubt they will have their place to fill in world economy. What is needed is that, while there is time, British manufacturers shall take far-sighted action to secure their own position when they come up against the organisations of other countries. Representatives of our Department of Commercial Intelligence have spoken with no uncertain voice on the subject at recently-held meetings at Birmingham, and on Tuesday last at the Engineers' Club at Manchester. We do not know how they could conscientiously do otherwise in presence of all the information that is in their possession in American and German reports.

The merchants have uttered protests, but possibly they have not had an opportunity of considering the facts of this important changing world situation. As we have said before, they will still have their own place to fill as importers and exporters; for many things they cannot be dispensed with now any more than in the past, but they must recognise that with the shaping of new industrial policy, the merchant interest cannot prevent the crying necessity for manufacturers to adopt large specialised measures for bringing into British manufacturing works the business that the world has to offer. Much of such trade, in the engineering world at any rate, may fall away from us if the manufacturer who knows his goods and can best approach his technical buyer is to restrict his co-operative or combination efforts in order to allow the merchants too free a field for action. We have no desire to question the patriotism of merchants as a class—they have done vast good for British trade; but we must not shut our eyes to the changes that have overcome, and are overcoming, industrial affairs in practically all countries. If the merchant were to become as purely British as he can be, and were to act in co-operation with the manufacturers in some way, we do not see why advantage should not be taken of his lengthy and specialised experience of the world markets. Is it impossible for these two valuable forces to run in harness for the industrial benefit of the nation, assisting the nation back to prosperity, and finding work for millions?

The manufacturers in the future will undoubtedly be out to get business for themselves far more than they have been in the past, and, if the Government sees that the world-wide co-operative movement is the right way in which they can be better prepared effectively to meet the coming situation, we do not see why its spokesmen should not say so emphatically, and at so important a British manufacturing centre as Birmingham. Were

they to remain silent in the presence of so many very clear signs on their horizon, they would merit the condemnation of industry, however much they received the commendation of the merchant. Is the duty of the Government trade representatives to be limited to the collection of information, and are they to be precluded from drawing inferences from that information? Heaven forbid! We have preached co-operative effort in these pages too long to regard the Government policy as a mistake. Our counsel has rested upon a good foundation, as present-day movements fully prove. Objections based upon personal and selfish interests, legitimate as those interests are in business, will hardly carry weight with a Government which is laying its plans for future prosperity, any more than they do with us.

THE recent report of the Sub-Committee of the Conjoint Board of Scientific Societies on the application of Science to Agriculture is

a most welcome indication of the extended interest which is being taken in this very important subject. It may be remembered that the Conjoint Board of Scientific Societies was formed last year at the instance of the Council of the Royal Society, mainly with a view to promoting the application of science to industry; its membership includes representatives of 27 prominent societies, which the President of the Royal Society as *ex officio* Chairman. Needless to add, it is a matter for congratulation that amongst the very numerous matters which might claim the attention of the Board, the pressing—nay, vital necessity of reorganising British agricultural methods on scientific lines, has received immediate attention.

The Sub-Committee was constituted specifically "to inquire into and report upon the work at present in progress on the application of science to agriculture, and to make such recommendations as they think fit, with a view to promoting the application of engineering to this subject," and its report, which we reprint elsewhere in our pages, will make pleasant reading for electrical engineers. It is noteworthy that the report is apparently the work of an engineering sub-committee, comprising Sir John Snell, Messrs. A. E. L. Chorlton, F. S. Courtney, and J. Nugent Harris, appointed by the parent Sub-Committee.

The Sub-Committee found—as we ourselves and others have also done—that certain fundamental data were lacking, and "that there appeared to be no Government Department or organisation which possessed this information"; but with the assistance of the Agricultural Organisation Society, it is now in a fair way to secure "valuable data on which to build practical estimates of the power required and costs of operation, and to compare the relative advantages and costs of steam or internal combustion machines and electrically-operated machines." The Sub-Committee states its emphatic belief in the great future which awaits the development of electrical applications to agriculture in this country; its belief that electric power can be distributed to farms at prices which would pay the farmer; its appreciation of the simplicity of electric propulsion for ploughing and other operations, and of utilising a form of power whose source does not involve importation of fuel, &c. The subject of electroculture receives a passing reference, and, finally, it is recommended that an electric tractor, and possibly other agricultural machines, should be designed, constructed, and tested by experienced agricultural and electrical engineers; to this end the Conjoint Board last month unanimously recommended the Board of Agriculture to grant the necessary funds, and to appoint its Agricultural Sub-Committee as an Executive Committee to superintend the work. So

much for the report, the findings of which amply confirm opinions expressed by ourselves in these columns during the past few years, and are the more interesting because the Sub-Committee is representative of "engineering" as distinguished from electricity supply.

An independent and essentially advisory body such as the Conjoint Board of Scientific Societies can render inestimable service in shaping the future of British agriculture along economic lines. With all due respect to our agricultural experts, it is abundantly evident that the basic question of making the land produce the nation's food at the cheapest possible cost has still to be answered, and the general policy to be pursued in regard thereto to be defined. This this may involve a complete transformation of agricultural methods is a foregone conclusion, for if farming is to be no more a hobby, as in the past, but is to become in truth the master-key industry that it should be, then the co-operation of the engineer, the chemist, and the business organiser will be indispensable, efficiency will necessarily be the order of the day, and efficiency means machinery and, if necessary, methods adapted to the use of machinery, instead of the reverse. A general survey and pronouncement on the primary factors essential to the development of our agricultural industry to meet the needs of the nation is badly needed, and would lay the foundation for successful progress; and, having in view the necessarily scientific nature of such development, it appears to us that the Conjoint Board, with its independent standing, could well undertake this work, which would in effect co-ordinate the various efforts towards the industrial reconstruction of agriculture.

The problem is no mean one; it amounts roughly to the trebling—if that be possible—of the output of our farms with the minimum of additional labour, and, of course, presupposes the use of machinery wherever possible. It is mainly an engineering problem.

RESEARCH ORGANISATION.

By D. ROSS KENNEDY.

There seems to be room in the industrial world for three methods of financing research. There is research which the individual firm finds it remunerative to undertake at its own expense. Secondly, there is research which is financed on a co-operative basis; and, lastly, there is research which must be financed by the State if it is to be done at all.

Is any distinction in kind to be drawn between these three classes of research which would justify this difference of treatment? (Page 16.)

We have given considerable thought during this year to the question of encouraging inventors. The problem is undoubtedly one of great importance, but it is also one of great difficulty. (Page 42.)

(Report of the Advisory Council on Scientific and Industrial Research, 1916-17.)

For the answer to the question in the first quotation, the Advisory Council has sought in the correct direction, and concludes that the third class is to be identified by the fundamental character of its results; and, in keeping with the general tenor of the report, it is fundamental scientific research which is to be so distinguished.

But if *practical research* be substituted for scientific research, then a much more appropriate distinction will be provided, and, at the same time, a solution will be given to the difficult problem in the second quotation. Practical research is the one which should form the third class, and is one which requires State aid to a far greater degree than any other class of research work.

The neglect of practical research in the proposed research organisation is to be explained by the fact that the organisers believe that

It has been the co-operation of progressive industry with science which has led to the practical application of the results obtained in the laboratories of scientific men.

This is not the case; at least, not in the engineering industry, where the practical application of the results of

scientific research is due to practical research, which forms the true link between science and industry.

When the scientific research has been successfully accomplished, it still remains to devise means whereby the results of the investigation may be usefully employed for the benefit of civilisation, and so the inventor takes up the task, and by means of practical research guides the issue of scientific research into a channel of industrial utility. And it is by practical research that the industrial design of an invention is evolved and the lines are indicated along which the industrial production must proceed to be commercially efficient. Before "progressive industry" will consider the merits of an invention, in a great many cases the inventor has to carry through this work.

The Trade Research Associations advocated in the Report will be of very little help to the individual inventor. Large engineering establishments have, as a rule, inventors on their staffs, and although facilities exist for conducting practical research to the highest degree, these are, unfortunately, utilised on a small scale only for improvements in design. Manufacturers have the reputation, and not without cause, of discouraging inventors with fundamental revolutionary ideas. There is some reason, however, for this reactionary attitude from the point of view of the manufacturer who has sunk large sums of money in the development and production of a standard article, which to a great extent would be lost if drastic changes were effected.

There is little need to enumerate the many engineering inventions which have helped to build up our civilisation, and which were due to the tenacity of purpose of a private inventor struggling against adverse circumstances of a nature quite apart from the problems of practical research, on which his every effort should have been concentrated. Having proved the worth of his invention, the inventor sinks into obscurity, whilst the organisers of industry reap the benefit. On the other hand, successful workers in scientific research have their labours amply rewarded, and their fame lives for ever in the text-books.

Scientific research has always been the child of fortune, reared in the elaborate laboratory of an educational institution; its development carefully fostered by indulgent professors, free from mental distractions caused by financial embarrassments, and with numerous assistants paying for the honour of participating in the work. And now scientific research is provided with an affluent State apartment, wears a massive gold Albert, and has industry for its valet.

Practical research has never been a favourite in the educational institution—due, no doubt, to the fact that practical experience and technical skill are necessary to its development. The garret, cellar, or outhouse has been its normal environment, and it has only enjoyed spasmodic opulence when adopted by wealthy experimenters or inventors with adequate financial support, exceptions which only go to prove to what extent the inherent strength of practical research could be developed if it enjoyed the same, or even a part of the prosperity that is thrust upon scientific research.

If the private inventor is still to struggle on with the scope for practical research restricted, and its growth stunted, for lack of suitable nourishment, then the period which elapses between successful scientific research and its practical application to industry will still be unnecessarily prolonged. Instances could be multiplied where well-known present-day productions of the engineering industry have been years in the process of practical research, whereas if similar facilities had existed as for scientific research their beneficial effects would have been enjoyed much earlier.

Is the internal-combustion turbine to languish for years like the steam turbine, until the accidental advent of an inventor possessed of the rare combination of engineering genius, independent financial means, and enthusiasm for work, proves its practicability?

If less time be lost between the completion of the scientific investigation and the ultimate development of an industrial production through practical research, then, instead of labour waiting on industry, industry would be seeking labour, wherein lies the solution of some perplexing problems facing labour and finance.

In the light of an experience of upwards of ten years in practical research work, electrical and mechanical, the suggestion cannot be accepted that the industrial research for

which facilities are being provided is synonymous with practical research. Truly, on page 13 of the Report, an indirect reference is made to practical research:—

In suitable cases the Department are also prepared to consider applications for assistance towards researches necessary to perfect for commercial use patented or protected inventions or processes.

But where is the organisation necessary for efficiently applying the assistance?

To the practical research worker, the experimental workshop is the equivalent to the scientific research-worker's laboratory. Scientific laboratories abound throughout the country. The organisation for practical research should provide for the establishment of experimental workshops in suitable centres. Where training workshops exist in technical colleges and universities, they should be thrown open to the practical research worker, and organised as much for his benefit as for the scholars'. The worker in practical research would then enjoy the same opportunities as the professors, and could command free assistance from students, whilst the practical experience the students would obtain would be a valuable addition to their technical training.

The organisation of experimental workshops would also require to include paid assistance, and for this purpose it would not be feasible to employ the staff which has been organised for scientific research. It is only in exceptional cases that scientific abilities are combined with engineering skill. The ability to produce scientific research of a high character is seldom accompanied by the training, skill, and engineering insight, coupled with genius for design, which successful practical research calls for.

The investigator who works alone on practical research must be highly accomplished in the mechanical arts. He must have the combined experience of the designer, pattern maker, turner, fitter, and tester, and he must also have experience in adapting existing material to the construction of apparatus for making preliminary tests, and be capable of appreciating the results of these tests. The scheme for scientific research indicates that provision is to be made to include the worker in the organisation, but, from the above, it will be seen that practical research affords the better opportunities for the co-operation of skilled labour. The skilled workman can understand and appreciate practical investigation, but how would a worker, say, with experience in constructing electric generators, participate beneficially in the scientific investigation of the hysteresis loss in magnetic material and the determination of the magnetisation curves? On the other hand, the co-operation of this worker would be invaluable in practical research work such as is necessary to develop, say, the homopolar electric generator. In the organisation of the experimental workshop the necessary skilled labour would be included as paid assistance.

In addition to financial assistance and the establishment of experimental workshops, a central technical advisory office is essential to practical research organisation. Many inventions are delayed in development, and others lost altogether, through the inventor's lack of technical training, and often the practical research fails for want of correct design. A properly organised technical advisory office would afford assistance in the necessary calculations and design for experimental models, and thus, in many cases, relieve practical research from the burden of an injurious handicap.

When the organisation of the present scheme is extended to include some such organisation for practical research as outlined above, then the results of scientific investigation will be systematically analysed and tested for their industrial destination with a minimum of delay, and then organised research will achieve its object and its innovation be justified.

BRITISH STANDARDS FOR ELECTRICAL MACHINERY.

THE revised "British Standardisation Rules for Electrical Machinery" (excluding motors for traction purposes), No. 72—1917, issued by the British Engineering Standards Committee, and dated September, 1917, present several interesting departures from what has been the Committee's standard practice. The new format of the rules—octavo,

printed on both sides of the paper—will at once commend itself to those who have occasion to consult its pages, whose numbers, moreover, will be greatly increased by the welcome reduction of the price from 10s. 6d. to 1s., made possible by the Government contribution to the funds of the Committee. The announcements that all the specifications will in future be issued in this form and at this price, and that translations into foreign languages will shortly be ready for issue, are also very satisfactory, and bear witness to the progressive spirit by which the Committee is animated.

In our issues of December 10th and 24th, 1915, we reviewed at some length the specification No. 72 dated October, 1915, of which the present issue is the first revision. We, therefore, need only refer to the changes which have been made, as the result of a conference with the Standards Committee of the American Institute of Electrical Engineers in March, 1916, at which the British Committee was represented by Mr. le Maistre, the secretary.

An introduction has been provided setting forth the object of the Rules and explaining their use, and the Appendix giving instructions as to the information that should be furnished when inquiring about or ordering electrical machines has been made Section I.

The standard pressures for motors are now placed with the standard frequency and phases in Section III, and include 460 volts. The "types" of generators and motors have been revised, "open" being replaced by "open pedestal" and "open end-bracket," "protected" being more fully defined, and "enclosed ventilated" being substituted for "semi-enclosed," while the maximum area of the apertures in the perforated covers is increased from $\frac{1}{4}$ to $\frac{1}{2}$ sq. in. The next noteworthy alteration is the permission (Clause 68, formerly Clause 57) to ascertain the temperature of shunt or separately-excited field coils by thermometer if it can be shown that the temperature as determined by the resistance method would not have exceeded the permissible limit—subject, as before, to a penalty of 5° C. A large part of Section IX (now Section X) dealing with the use of embedded temperature detectors is cut out, without materially affecting the requirements.

Considerable changes have been made in Section XIII on "Excess Current and Torque Tests" (formerly Section XII, "Tests for Mechanical Strength and Stalling Torque"). The excess current test for machines with "continuous" rating is reduced from 100 to 50 per cent. The stalling-torque test for induction motors so rated is not to apply to machines of abnormally low speeds or high frequencies, and consequently low power factor. Shunt motors for intermittent service are exempted from the requirement that they shall exert a starting torque on test 100 per cent. in excess of the value corresponding to their rating.

The table of high-pressure tests on dielectrics has been radically amended; all machines above 1 H.P. are to be tested with twice rated pressure + 1,000 volts. For separately excited rotating field windings the maximum test pressure is fixed at 3,500 volts. A special test (Clause 96) is prescribed for a machine which has been out of service for some time—namely, 75 per cent. of the pressure applied to a new machine. Current and pressure transformers are omitted from the table, being covered in another Specification. The stipulation that the insulation resistance shall not be less than 1 megohm is removed. The complicated alternative "Duration of High-Pressure Test" (old Clause 83) has been dropped, leaving one minute's electrification as the only standard; old Clause 84, relating to "Discharge During Test," has also gone.

A new item to be stated on the rating plate of an induction motor is the rotor current.

We may add that in many places verbal alterations have been made, which clarify the style without affecting the sense of the text. It is interesting to note that the rather ugly I.E.C. symbol for kilowatt (kW) employed in the previous edition has been replaced by the form KW. As a whole, the new style of specification represents a very marked improvement on its predecessors, which, owing to the mode of binding, the large pages, and the comparatively enormous bulk and weight, were by no means convenient to handle. The new edition weighs 3½ oz.—the old one, 17 oz.

ASSOCIATION OF MUNICIPAL ELECTRICAL ENGINEERS (UNION OF SOUTH AFRICA).

THE second annual Convention of the Association of Municipal Electrical Engineers (Union of South Africa) was held at Durban from August 27th to September 1st, and was attended by members and Councillors from the various parts of the Union.

An official welcome was given to the Association on the opening day by the Mayor of Durban, after which the annual general meeting was held for the election of officers and the transaction of business.

Mr. John Roberts (Durban) was elected president, and Mr. B. Sankey (Port Elizabeth) vice-president.

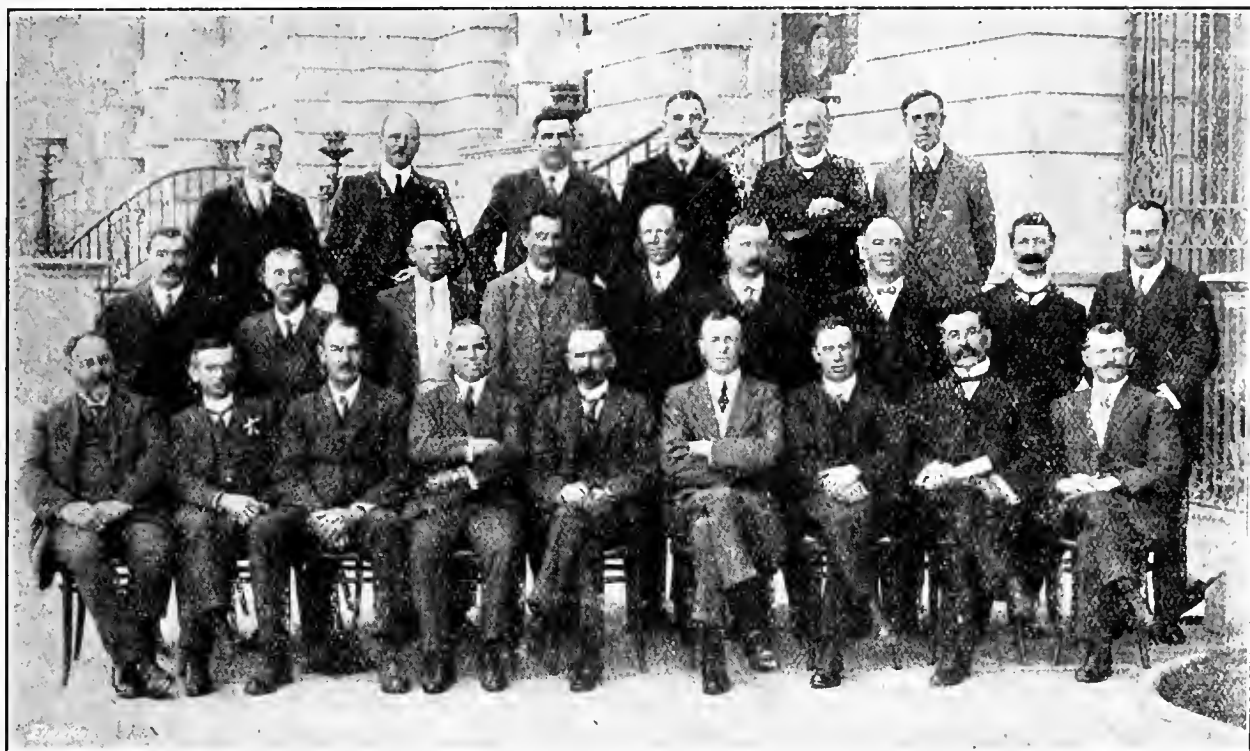
The members of Council elected were:—Col. Dobson, D.S.O. (Johannesburg), past president; Mr. T. Wolley-Dodd (Pretoria), Mr. W. Bellad-Ellis (Queenstown), Mr. T. Jagger (Ladysmith), and Mr. G. A. Stewart (Bloemfontein).

On Wednesday a visit was paid to Pietermaritzburg, where, at the invitation of the Mayor, members were entertained to lunch. A very interesting lecture was given during the day by Mr. J. W. Kirkland, of Johannesburg, on "Railway Electrification"; the basis of the lecture was the Chicago, Milwaukee and St. Paul Railway of America, the aim of the lecture being to show how electrification could be advantageously adopted in South Africa.

On Thursday a paper on "Standardisation" was read by Mr. John Roberts, and the discussion led to some important recommendations being arrived at for submission to the South African Standards Committee now sitting in Johannesburg.

In the evening, on the invitation of the engineering section of the Natal Society for the Advancement of Science and Art, the members of the Convention attended the first annual dinner of that society, and there were about one hundred present.

On Friday further discussion took place on "Tariffs."



A. S. Munro (Pietermaritzburg).		R. A. Stoker (Kroonstad).		G. H. Swingler (Cape Town).		C. J. Everatt (Johannesburg).		Councillor Hopper (Cape Town).		P. J. Gold (Benoni).	
Member of Council.											
T. Miller (Harrismith).		Councillor Gilbert (Harrismith).		H. Brittle (Cradock).		T. Jagger (Ladysmith).		Councillor Francis (Bethlehem).		Councillor Hudson (Port Elizabeth).	
M. McDonough (Bethlehem).		G. A. Stewart (Bloemfontein).		Councillor Payne (Durban).							
Hon. Sec. & Treas. E. Poole (Durban).		Mem. of Council. T. Wolley-Dodd (Pretoria).		Mem. of Council. Col. Dobson, D.S.O. (Johannesburg).		President. John Roberts (Durban).		Vice-president. B. Sankey (Port Elizabeth).		Mem. of Council. W. Bellad-Ellis (Queenstown).	
Coun. Crawford (Bloemfontein).		Coun. Birschoff (Pretoria).		W. H. Blatchford (Greytown).							

MEMBERS AND DELEGATES AT THE SECOND ANNUAL CONVENTION OF THE ASSOCIATION OF MUNICIPAL ELECTRICAL ENGINEERS (S.A.E.) HELD AT DURBAN, AUGUST 27TH TO SEPTEMBER 1ST, 1917.

Mr. E. Poole (Durban) was elected secretary and treasurer. It was resolved to hold the next Convention at Port Elizabeth.

At the conclusion of the business meeting, the Mayor gave an official luncheon to the members at the Royal Hotel, and in the afternoon a visit was paid to the soap works of Messrs. Lever Bros.

On Tuesday the president delivered his address, after which an interesting discussion took place on Mr. John Roberts's paper on "Tariffs," which was held over from the previous Convention. In the afternoon visits were paid to the electric power station at Durban, the tramway department, and the municipal telephone exchange. In the evening, by invitation of the engineering section of the Natal Society for the Advancement of Science and Art, members attended a meeting at which a paper on "Municipal Electrical Undertakings in South Africa" was given by Mr. E. Poole, assistant electrical engineer to the Durban Corporation.*

* Abstracted in the ELECTRICAL REVIEW, October 5th and 12th, 1917.

and important resolutions were adopted for circulation amongst all South African municipalities. The appropriation of net profits from undertakings for the relief of rates was very strongly condemned.

The next paper was by Mr. E. J. Hamlin on "The Design, Operation and Management of Small Electric Power Stations."

The Convention closed with appreciative remarks by the various Councillors of the municipalities represented, who spoke of the great help the Convention had been to them.

Address by Mr. John Roberts, President.

(Abstract.)

We must place on record the satisfaction we must all feel at the very worthy part played in the sphere of military affairs by our past president, Lieut.-Col. Dobson, who 15 months ago left for German East Africa in charge of a regiment of pioneers of his own raising, and who, after about six months' service in the field, returned crowned with honours and his present high rank. It must reflect credit on us as his colleagues that our past president should have

demonstrated so well the usefulness of the electrical engineer in modern warfare, and we thank him accordingly, and congratulate him heartily on an achievement which he will probably rank higher during the rest of his career than any thing else he has done.

When the war is over the engineer, and particularly the electrical engineer, will be looked to to perform the many and much-needed tasks of reconstruction to make good the fearful devastation which has been brought about. New schemes of development, particularly in the Colonies, are completely arrested until the war is over. In our own country the Rand Water Board has postponed a gigantic scheme to carry water from the Vaal to the Rand. The Johannesburg municipal electrical scheme has two large turbines to install which cannot be delivered. The Capetown Municipality has a large water as well as a sewerage scheme in abeyance. Pietermaritzburg has hung up large extensions to its electricity undertaking. In Durban large projects for the establishment of industries, such as cement and soap making, were postponed when war broke out.

A committee of technical experts has been appointed to study the possibilities of new industries in South Africa, with Mr. Bernard Price, chief engineer of the Victoria Falls Power Co., as the chairman. I am sure that great good will result from that committee's labours, for the possibilities are tremendous.

The work of the electrical engineer is bound to be intimately associated with the development of South Africa. The day is not far distant in England when the generation of power will be done in mammoth stations, and the small towns will give up their small, inefficient stations. But in South Africa it will be many years before the towns will be linked together into one common network, though it is bound to come one day, and for some time yet every town must be responsible for the supply of current within and around its borders.

Knowing, as we all do, the stimulation to industry which a good local supply of electricity brings about, it follows that municipal electrical engineers must wake up to their responsibilities to local industries, and place themselves in a position to meet any reasonable demand for power which may be suggested in their territory. By such a policy they may be able to promote local industries which otherwise may be driven to larger centres of population where a supply of current can be secured.

Wattle-bark, up to the breaking out of war, was exported as it was stripped from the tree. It would be much more sensible to export the extract instead of the bark, thus saving considerably in freight and yielding the tanning product locally, which would undoubtedly tend to the quicker establishment of an industry to turn our hides into leather. Such an extraction plant will soon be in operation near Durban. But why not up-country, where the bark is grown? It will rest greatly with municipal electrical engineers to induce manufacturers to manufacture as near the seat of agriculture as possible, instead of railing the raw material to the large towns to be manufactured there. Other cases could be quoted.

It is not out of place, therefore, to call your attention to the necessity of a careful study of the possibilities of the establishment of local industries in your respective territories. In many cases you will have to study the manufacturing conditions closely in order to put yourselves in a position to advise as to the best way to apply electricity. Usually the owner is not acquainted with the electric drive, and one has to know sufficient of his work to demonstrate not only how to solve the power problem, but to show in what way electricity will be superior to steam. In Durban, we have found it necessary to get some acquaintance with a number of widely different industries.

As we municipal electrical engineers stand as the exponents of electrical enterprise, we must keep before the farmer the advantages of electricity, especially in irrigation work, and should make ourselves acquainted with the immense work done in this direction in the Western United States, where vast tracts of arid deserts have been made to blossom by water pumped by electric power. And everyone in his territory must be a missionary spreading the doctrine of "electricity for the farmer." One's efforts should not be confined to those within reach of the mains; one may recommend a farmer to put in his own little plant, and then, when his example has been followed by his neighbours, a demand for current will be created sufficient to warrant taking lines out to shut up the isolated plants.

As a result of the great progress the farmer is making in cattle raising, the meat industry is looming up, and there can be no doubt that our limitless veldt will produce meat in quantities comparable with what the Argentine is doing. A large export of meat will bring with it the possibilities of many new industries, and every live electrical engineer must get into a position to cater for demands for power which may arise in connection with these. The number of mills for crushing and milling maize is likely to increase, and a flour mill should be an excellent customer for power. Frequently they run for 24 hours per day, and preferential terms could be offered.

The small station should be so designed as to be able to deal with demands for power at moderate charges. The total cost in the small undertaking is high in most cases because the standing charges are excessive, due to the small produc-

tion, but this cost would automatically fall if the output could be brought up, for instance, by the addition of a good power load. But in some cases the variable costs, principally fuel, are also high, and this high figure per unit will not go down much with addition of load. The aim must be to lower fuel and repairs cost to the minimum, so that by increasing the output the total cost will not increase much, due, of course, to the standing charges remaining fixed. To secure such a state of things it is useless to run a plant with non-condensing steam engines, even where coal is cheap.

I do not think that the Diesel engine is the right solution. The fact that one has to depend on fuel from overseas is sufficient to condemn it. I am surprised that the gas engine has received such comparatively small support from the municipal electrical engineer of the small town.

Standardisation is in the air all over the world, and the need of more uniformity in all branches of engineering than now exists is really very pressing. We shall place the electrical industry under a debt of gratitude to us if we can do something to reduce the great and unnecessary variety of plant and apparatus which now has to be stocked. We happen to have a great opportunity before us at the present time. A few months ago the Natal Engineering Society made representations to the South African Institute of Electrical Engineers in regard to general engineering standardisation. It then appeared that a Standardisation Committee had been in existence in Johannesburg for many years past, but for some time its activities had been suspended. The representations we made roused considerable interest, and the outcome was that a new committee was got together, in Johannesburg in May last, and Mr. F. W. Mills, chief railway electrical engineer, was appointed chairman. I trust that at our convention we shall have time to give the matter of standardisation, both of systems and supplies, considerable attention.

This important question is brought into prominence at the present time owing to a most interesting development in the railway policy of South Africa which is foreshadowed by the general manager, Sir Wm. Hoy, in his last annual report. That progressive administrator is thoroughly alive to the benefits which the large railway system he controls would derive by the introduction of electricity instead of steam as the motive power not only for suburban but for main-line trains.

We are closely interested in the subject because the South African railways have (under the advice of Mr. F. W. Mills) given up generating current for themselves, and now in all the principal towns of the country take their supplies of electricity from the local municipal plants. It follows that when the time comes, as I believe it will at no distant date, when the administration must consider supplies of electricity on a large scale for railway power, the municipalities will be given an opportunity of submitting propositions for such a supply. Within the next few years, therefore, some understanding between the municipalities should be come to as to the terms which should be offered, class of current supplied, &c.

Many of us are carrying out our work under arduous conditions in these trying war times. The ranks of engineering artisans have been depleted more than those of most businesses owing to the great demands for engineers made by the war, and the war has indirectly brought about great engineering activity in peaceful employments because we have been called on to make locally many things we used to import, owing to shipping difficulties and prohibitions on export.

In Durban, owing to local supplies of cement the cost of concrete has not advanced much, and we have adopted in certain instances concrete poles in place of steel or cast-iron.

Distribution lines and cables are one of the most difficult class of supplies. We have gone over our distribution plans very carefully to discover where copper is in excess, and have taken down one long overhead high-tension line and made up from it three shorter lines to feed the central district, and are recovering a good deal of underground cable, which will come in for low-tension distribution. We are also taking down ground wires which we regularly employed above all high and low-tension overhead conductors, as we are doubtful if these are of the value we used to think they were. This will yield us considerable quantities of bare copper wire for small extensions of our lines. Fortunately, the new demands from large consumers of power are not coming in fast, as such consumers cannot obtain machinery for new enterprises.

Meters at the present time are very difficult to obtain, and we are putting into service a number of old types of meters we took down as being obsolete, but which we kept in reserve for unforeseen emergencies; they are coming in very useful now.

We have had to do quite a lot of constructional work both in the power station and outside, and owing to the high price of steel sections of all kinds we have very largely used old steel tram-rails for all kinds of work—generally in combination with concrete. We have built up switchboards with these rails as a framework, using asbestos "Eternit" or similar sheeting as coverings and as partitions. Latterly we have been bringing in old boiler tubes as uprights for switchboard panels. Though the general appearance is not so good, it must not be thought that the results so far as reliability goes are any worse; in fact, we have aimed at doing better work than usual now, as it is important to reduce maintenance costs on account of the shortage of skilled attendance.

We have planned to build a new condensing water pipe line of reinforced concrete pipes 21 in. in diameter. The local cement, though slow in setting qualities, gives quite satisfactory reinforced concrete results. Speaking generally, it is wonderful what can be done when one is thrown on one's own resources. Scrap heaps should be carefully sorted over and the materials classified, and much old stuff which it would not have been profitable to use before is now worth money.

We are using old short lengths of trolley wire, bound together, as switchboard bus-bars, and in some cases are putting this up in place of heavy bus-bars, which can thus be taken down and used elsewhere. It is a great satisfaction to know that porcelain insulators are now made in the Transvaal.

Enclosing globes for street lighting are very scarce, but we are discarding these in some cases, and do not find much disadvantage.

At the convention resolutions were adopted stating that all charges arising between different departments of a municipality should be based on standard tariff charges where such exist, and in the absence of such standard charges, should be based on the net cost of services given or received; that in the opinion of the Convention it is unsound policy, as militating against the successful financial operation of municipally-owned electricity undertakings, to allocate net surplus profits for the relief of rates or for municipal funds, or to make indirect charges so as to unfairly reduce net surplus profits; that the rapid introduction of new and improved machinery for the production of electricity renders it imperative that every electricity undertaking shall set aside out of its net surplus profits an adequate amount to write off obsolete plant; and that the only legitimate outlets for net surplus profits are the building-up of an ample obsolescence fund, and the reduction of the charges to the consumer in order to encourage the use of electricity.

On the suggestion of Mr. Poole, it was resolved that the various municipalities be invited to furnish the secretary with a schedule of obsolete electrical stocks, with a view to such stocks being exchanged or bought where a demand exists, the prices of such stocks to be those existing before the outbreak of war.

The following important recommendations were made in regard to standards, and were transmitted to the South African Standards Committee sitting in Johannesburg:—

STANDARDS AGREED.

1. Current ... Alternating.
2. Periodicity ... 50 cycles per second.
3. Number of phases ... Three.
4. Generating pressures ... 415, 3,300, and 6,600 volts.
5. Supply pressures ... 240 and 480 volts three-wire, 240 and 415 A.C. four-wire.
6. System of distribution ... Four-wire, three-phase.
7. Transmission pressures ... 3,300, 6,600, and 11,000 volts.

Bare Conductors for Overhead Lines.—Nos. 12, 10, 8, 6 S.W.G., and beyond these sizes, the same sizes laid down by the British Engineering Standards Committee, but with the deletion of the following sizes:—.125, .25, .35, leaving .05, .075, .1, .15, .2, .3, .4, and .5 sq. in.

Underground Mains.—On the types of cables, it was decided to recommend that the system of protection adopted be uniform, viz., that the cables should be armoured suitable for laying direct in the ground, the sizes of conductors to be similar to those recommended by the British Engineering Standards Committee, with the deletion of the same sizes referred to in the bare conductors for overhead mains, leaving the sizes for adoption as follows:—.05, .075, .1, .15, .2, .3, .4, and .5 sq. in.

It was also resolved to recommend that, as it was desirable that the various kinds of mains in use should be readily distinguishable from the outside without cutting the cable, makers should be asked for suggestions in regard to this matter, such as by varying the width of the standard tapes, or by introducing a steel wire or wires in the jute serving, commonly used over the armouring.

Meters.—That two two-wire meters be adopted for use on low-tension supplies in preference to three-wire meters. Sizes:—3, 5, 10, 25, 50, and 100 amperes.

Plugs for Heating and other Circuits.—This matter was referred to the Council to decide upon certain standards as regards sizes, dimensions, &c.

An Electric War Boat.—The Secretary of the Admiralty on Saturday issued the following statement:—

"An attack was made to-day on our vessels patrolling the Belgian coast by an electrically-controlled high-speed boat. The attack was defeated, and the boat destroyed."

Various methods of controlling boats, aircraft, &c., from a distance by wireless transmission, or by sound waves, have been described in our pages; none of them advanced beyond the experimental stage, but perhaps the Germans are trying to develop some such system on a practical scale.

The *Times* states that four such boats have already been destroyed; they are propelled by petrol engines, electrically controlled from the shore, and conveyed by aeroplanes. The Admiralty regards them as "freak vessels."

THE ENGINEER AND AGRICULTURE.

The report of the Sub-Committee of the Conjoint Board of Scientific Societies on the Application of Science to Agriculture, which has been recently issued, reads as follows:

This Sub-Committee was constituted "to inquire into and report upon the work at present in progress on the application of science to agriculture, and to make such recommendations as they think fit with a view to promoting the application of engineering to this subject."

The Sub-Committee comprised the following members: Lord Portsmouth (chairman and convener), Mr. A. E. L. Chorlton, Mr. A. D. Hall, and Sir John Snell. To these names the Executive Committee added Dr. J. A. Voelcker and Captain J. Bell White, R.N.R., the representatives of the Agricultural Society, and the Agricultural Organisation Society nominated the Rt. Hon. F. Dyke Acland and Mr. J. Nugent Harris. The Sub-Committee has held three meetings, and has co-opted Mr. F. S. Courtney to assist it in relation to engineering problems.

The Sub-Committee decided that certain fundamental data were required, and that there appeared to be no Government department or organisation which possessed this information.

A sub-committee was therefore appointed consisting of Sir John Snell, Messrs. Courtney, Chorlton, and Nugent Harris, to obtain the necessary information. A series of questions has been issued to various experienced authorities, and some most valuable and comprehensive replies have been returned.

Through the help of the Agricultural Organisation Society a careful census is now being taken in districts where there are various classes of agriculture. The object is to ascertain the amount of produce sent out from, and the raw materials conveyed to, these districts, and the times when such transport is effected; also the times occupied in seasonal operations on the land, whether ploughing, harrowing and cultivating, or reaping and threshing, and certain stationary operations. It is hoped from this detailed information to obtain valuable data on which to build practical estimates of the power required and costs of operation, and to compare the relative advantages and costs of steam or internal combustion machines and electrically-operated machines.

It is proposed also to report on the methods of transit and transport, possible co-operation, especially in the establishment of necessary repair sheds, tools, and skilled mechanics, and to endeavour to suggest practical standards of machines of various kinds.

Such an investigation must, from its nature, take some considerable time, but the Committee hopes to progress rapidly once the fundamental information and seasonal diagrams are available.

The Engineering Sub-Committee, after careful deliberation, has come to the conclusion that it cannot help effectively in the development of internal combustion engine-driven tractors, and for this reason: The Government have already put in hand many thousands of tractors, and practical application of so many various types of tractor must inevitably lead, by a process of trial and error, to a speedy evolution of types most suitable for the various conditions of soil and climate. Reasonable standardisation must also follow as a matter of course.

The Sub-Committee, however, emphatically believes that a great future awaits the development of electrical applications to agriculture in this country. While, on the one hand, in Germany enormous developments have taken place in agricultural districts, and farmers have increasingly utilised electric power, not only for stationary motor purposes, such as threshing, grist mills, and cream separation, but also for ploughing, cultivating, and hoeing; on the other hand, in this country, it must unhappily be said that no applications of electricity to agricultural purposes beyond that of the farmstead have been made. This position, no doubt, largely arises from the fact that practically no electricity has been as yet distributed in agricultural districts.

A Departmental Committee of the Board of Trade on Electric Power Supply has been sitting for some months past, and it is probable that wider powers of distribution will be granted in the near future, and that cheap power will be available for transmission, not only to industrial districts, but also, should the demand arise, to agricultural districts.

In the Report to the Board of Agriculture on "Agricultural Credit and Agricultural Co-operation in Germany" (Cd. 6,626) it is stated that in 1913, electrical power was already being utilised by large landowners to a remarkable extent, and that its use had been stimulated by the marked increase in the employment of both large and small agricultural machinery. Electricity was then extensively employed, especially for driving threshing machinery, hoes and cultivators, grist mills, cream separators, &c., and it was anticipated that electrically-driven ploughs would increase considerably in number. There are already several different designs of electric ploughs in use, but they are said to be expensive in first cost, and in Germany, on this account, they were then only considered profitable for farming areas of about 1,500 acres and over, and were only procurable by large owners or combinations of small owners. The report says that electrical ploughs "are stated to be more advantageous than steam ploughs, and that the use of machinery has been

stimulated by the dearth of farm hands, and not only has the introduction of electrically-driven machinery partially met this need, but it has also made the task of very small farmers less strenuous."

The report also says that "apart from the advantage of saving or replacing labour, electricity is advantageous to farmers through the low cost of maintenance of the electrical apparatus, the absence of running expense when not being utilised, the rapidity with which it can be put in operation, its simplicity for handling, the facility with which the motor can be applied to the working of several machines simultaneously, its precision, its cleanliness, its freedom from

THE TEMPERATURE CONTROL SYSTEM IN THE CHARING CROSS HOSPITAL.

THE necessity of maintaining an equable temperature in hospital wards will immediately be recognised, and any method of accurately and conveniently measuring the temperatures of the various wards throughout the building is of importance as a means to this end.

A short description of the system of temperature control employed in the Charing Cross Hospital will therefore be of interest. In this hospital the thermometers fixed in the wards each consist of a coil of platinum wire, suitably protected, forming the bulb of a platinum



FIG. 1. GEORGE DRUMMOND WARD, CHARING CROSS HOSPITAL.



FIG. 2. SWITCHBOARD IN KITCHEN.

danger of fire, and, under normal conditions, its comparative cheapness."

The Sub-Committee believes that electric power can be distributed to farms at prices which would pay the farmer. There is no question as to the economy of electric motors for stationary purposes, and the important matter which requires practical experiment and proof is the application of electricity to ploughing and cultivation, reaping and binding, &c.

An electrically-propelled plough or other agricultural machine would be both simpler in construction and easier to handle, inspect, and repair than an oil-driven machine. There would be no need for the source of power (i.e., coal or the change of speed and speed control is greatly easier, and the protection of motors and reduction gear from dust and dirt can be made absolute.

A national advantage would lie in the use of electrically worked implements as the source of power (i.e., coal or water) is in the country, whereas oil would generally have to be imported for the larger internal-combustion motors.

Electricity may also be used for intensive cultivation. Experiments have already been made on a reasonably extensive scale which go to show that, *ceteris paribus*, there is an increased yield when high-pressure electricity is discharged above the cultivated area. Further research is required in this important matter.

The Engineering Sub-Committee recommends that arrangements should be made with an experienced agricultural implement manufacturer, and an experienced electrical plant manufacturer to design, construct, and test practically an electrical tractor, and possibly other agricultural machines.

A resolution of the Conjoint Board was made unanimously on October 10th, 1917, as under:—

"The Conjoint Board recommend that the Board of Agriculture be asked to grant the necessary funds for designing, constructing, and testing practically an electrical tractor and certain other agricultural machines, and to appoint the Agricultural Sub-Committee (for some of its members) as an Executive Committee, to superintend the designing, building, and testing of such plant, and to prepare a report thereon."

resistance thermometer and connected by ordinary copper leads to a indicating switchboard erected in the engineer's office. One of these thermometers is indicated by an arrow in fig. 1. All the thermometers from the various wards are wired to a single switchboard, and by means of a plug connection any required thermometer can be connected to the indicator, which is calibrated to give direct readings of temperature. By this means the tempera-

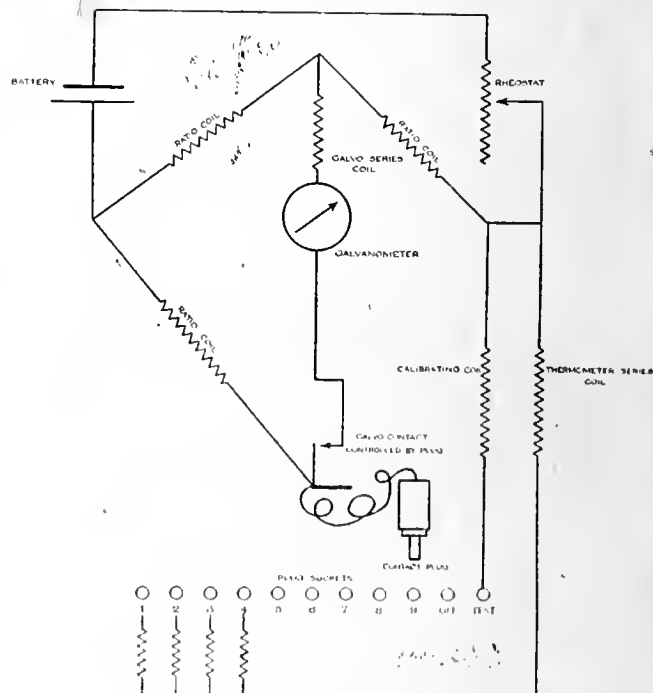


FIG. 3. DIAGRAM OF CONNECTIONS.

tures in all the wards are easily determined at regular intervals, and the saving in time and labour effected by such a centralised system is obvious.

In the kitchen of the hospital a similar installation of thermometers is employed for measuring the temperatures in milk sterilisers and gas ovens. Fig. 2 illustrates the switchboard belonging to the kitchen installation.

As will be seen from the diagram of connections given in fig. 3, the instruments operate on the Wheatstone bridge principle, the bridge being balanced at the zero position of the indicator and the

The Electrical Sterilisation of Milk.—The process by which milk is efficiently sterilised with the aid of alternating current, without affecting its taste, composition, or nutritive qualities, at one of the milk depots of the Liverpool Corporation, under the supervision of Prof. J. M. Beattie, was described in a recent issue of the *Practitioner*. As we have received inquiries lately on this subject, we may mention that a full illustrated description of the process appeared in our issue of July 31st, 1914.

deflections being caused by the current which passes through the galvanometer coil when a change in the temperature of the thermometer throws the bridge out of balance. The current necessary to operate the thermometers is supplied by a 1-volt accumulator. In addition to the various thermometer switches on the board, there is a switch marked "test," and when the plug is inserted in this switch the pointer of the indicator is deflected to a certain position marked on the scale if the instrument is in correct adjustment. A means is provided of readily compensating for any variations caused by a fall in the voltage of the accumulator.

In addition to the two sets of electrical thermometers, the Charing Cross Hospital has also installed a number of H. and M. mercury-in-steel recording thermometers for giving continuous records of water, steam, and flue-gas temperatures at various points in the heating system. One of the instruments also serves to record

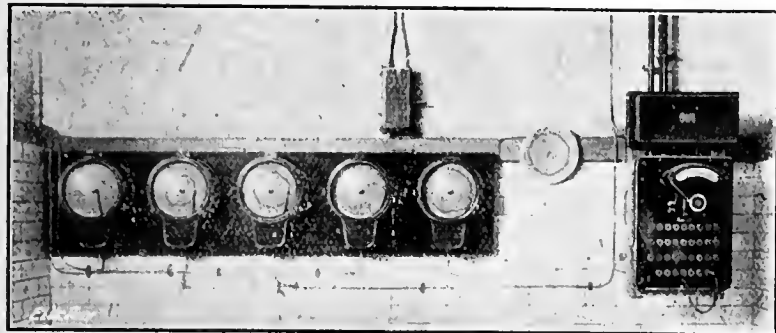


FIG. 4. TEMPERATURE AND PRESSURE RECORDERS, AND THERMOMETER SWITCHBOARD.

the steam pressure in this system. A view of these temperature and pressure recorders, together with the distance thermometer switchboard for taking ward temperatures, is given in fig. 4. The recording thermometers have each a steel bulb placed at the point where the temperature is to be determined and connected by the requisite length of steel capillary tubing to a Bourdon spiral fixed behind the dial of the recorder. The bulb, capillary tubing and spiral are filled with mercury, and changes of temperature in the bulb give rise to corresponding changes of pressure inside the instrument, these being magnified and recorded on a circular chart calibrated in degrees of temperature, by means of the usual pen mechanism in connection with the Bourdon spiral.

The thermometer installations at the Charing Cross Hospital were carried out by the Cambridge Scientific Instrument Co., Ltd., Cambridge, under instructions from Mr. A. H. Barker, Wh.Sc., consulting engineer.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The E.T.U. or the A.E.S.E.?

It is interesting to read the mass of correspondence served up by the respective Secretaries of the E.T.U. in the frantic endeavour to bolster up their claim to represent the electrical station engineer.

Unfortunately for the E.T.U., the letter from the St. Pancras B.C. is obviously an answer to an inquiry, and offers no proof that the E.T.U. had anything to do in the matter of war bonus and wages.

Regarding the letter from the North Metropolitan Electric Power Supply Co., the managing director distinctly states that "the arrangement only applies to weekly or hourly-paid men," which, of course, rules out the engineers-in-charge at the power stations.

It is evident to the least initiated that the electricity supply chief engineers, being clever and far-seeing men, will be quite approachable and considerate in the matter of war bonus, in order that the efficiency of their undertakings shall not suffer owing to having assistants who are harassed by pecuniary troubles. It is, therefore, up to the A.E.S.E. to see that the E.T.U.'s aggressive methods do not get the credit for all justice meted out to the electrical station engineers.

I certainly hope "W. F. K." is a member of the E.T.U.

C. B. T., A.M.I.E.E.

The letter of "W. F. K." in your last week's issue is amusingly satirical, but volubly incoherent. No useful purpose is served by shelving the problem or obscuring issues by an indiscriminate application of a gift for cynical asperity—except, perhaps, to provide a little harmless amusement.

A remembrance still lingers of a casual acquaintance with the Euclid of our studious youth—how each proposition was clearly

set out and the proof arrived at by the test of logic. It should not be a serious matter to apply that test to our present proposition.

Upon what are Associations based?

The hand of precedent here guides us. The world is an Association of nationalities; nations are Associations of races; races, Associations of individuals. Each way we look, there we find Associations, companies, societies, unions, federations, and the like. They are in, and of, science, industry, commerce, literature, religion, the drama, art, philosophy, and entertainment. But why? Because there exists a common denominator. That is fundamental to every nation, race, or association—it is the essence of collectivism.

Testing our conclusion, we find innumerable examples in the history of associations where, with the loss of that common denominator, collectivism sub-divides or dissolves into individualism.

Leaving generalities and applying ourselves to the specific case in hand—an Association of Station Engineers—we may set it down as sound theory, if an incorrect statement of practice, that all station engineers have identical training and qualifications. Assuming this, we conclude a common denominator—viz., identical training and qualifications.

Did we carry investigation no further, then surely here are all the elements of Association.

Our investigation, however, is incomplete; there is another possible common denominator—viz., degree of administration. All presumably are administrative: the difference is one of degree, and herein lies our problem.

If the common denominator is theoretical equality of engineering training it must be an invariable, and an association so founded would be stable.

If the common denominator is degree of administration, then it is a variable, and an association so founded would be unstable. But it is neither the one nor the other; it is one qualified by the other.

We are forced, then, to the conclusion that an association would only be stable between the limits of the purely administrative and the wholly operative.

Exactly who is between these limits is a matter for individual decision; classifications and designations are misleading.

The need for an association exists beyond doubt, but the crisis that makes clear such need is not necessarily a common denominator upon which to found an association.

Confusion of thought only leads to recrimination: so soon as it is clear that economic pressure is the cause, and not the common denominator, every section will sort itself out on the basis of the common denominator.

London, S.W.

H. W. Healy.

It would be interesting to know how it comes about that correspondence between this Association and a Government Department finds its way into the hands of the Electrical Trades Union. In case, however, the reply made by this Association to the letter from the Chief Industrial Commissioner's Department, sent to you by Mr. W. J. Webb, has not already been brought to his notice, I enclose a copy for publication.

W. Arthur Jones,

Hon. Sec., Association of Electrical Station Engineers of London,

Leytonstone, November 5th, 1917.

[COPY.]

October 19th, 1917.

"Sir George Askwith.

"Chief Industrial Commissioner's Department.

"Ministry of Labour, Whitehall.

"Dear Sir,—Yours of yesterday to hand. I note your suggestion with regard to communicating with Mr. W. J. Webb, of the Electrical Trades Union.

"This suggestion is evidently based upon a misconception of the true situation, and the following facts should make this clear. This is not a quarrel between two sets of Trade Union officials as to which Union can claim the greater membership. This Association has no paid officials—its acting officers are engineers engaged in power stations, and have, therefore, a fully developed sense of their responsibilities.

"The London power stations are, at this moment, vital key industries directly controlling the output of war material. The suggestion that the highly trained engineers in control of this important section of national industry should become absorbed by the Electrical Trades Union (which is essentially a wireman's Union, and has only recently taken advantage of dissatisfaction amongst sub-station men—mostly L.C.C. men—to embrace them, and thus claim to represent engineers-in-charge), is unquestionably opposed to national interests.

"No section of men have been more loyal or patriotic than power station engineers, and I suggest that it is vital to preserve their entity.

"As your letter is in no way a reply to my communication of the 17th inst., I shall be glad to receive either a negative or affirmative concerning representation at the impending conference between the A.M.E.E. and E.T.U.

"The fact that this Association has in its membership practically every engineer-in-charge at the 30 London Council stations cited by the E.T.U. should in itself be sufficient evidence of the grotesque nature of the claim made by the E.T.U. to represent power station engineers."

"In view of the urgent nature of the matter, I shall be glad to have an early reply in order to place the matter before the Executive Committee."

"Yours faithfully,

"(Signed) W. ARTHUR JONES, A.M.I.E.E."

The following is taken from the "Branch Notes" of the *Electrical Trades Journal* dated September, 1917:—

"Our slogan should continue to be that membership of our Union carries with it exemption from military service. Nothing else will satisfy us; anything less—well, there is trouble for someone."

Earlier in the same note attention is drawn to the increasing membership of the Union, and before the Chief Industrial Commissioner, on September 5th, emphasis is again given to this feature. A not unnatural inference from this would be that there is some connection between the increasing membership of this Union and the claim of exemption from military service for its members, but such an inference would be altogether wrong, because of the members already serving with H.M. Forces and because of those willing to serve when required to do so.

So far as is known, the E.T.U. is the only one claiming for its members exemption from military service. It cannot be that the majority of the members of this Union are willingly supporting their officials in such a claim, but that through ignorance of one of the objects, they are supporting through their Union a principle which is altogether foreign to their own real feelings.

J. R. W. Gralnge.

London, W., November 1st, 1917.

[The passage quoted may represent the policy only of a particular branch of the Union; we hope that it is not endorsed by the Union officially. Perhaps Mr. Webb will clear up this point, the importance of which cannot be denied.—EDS. ELEC. REV.]

With your kind permission, I should like to state my experience whilst a member of the A.E.S.E. I joined the A.E.S.E. soon after the Manchester Branch opened. At that time anyone was eligible to become a member provided he worked in an electrical station. The cleaners, better known as "assistants," were admitted to membership. There was no distinction. Personally, I thought that a good kick-off for social reform. The majority of the members, I feel sure, very sensibly advocated Trade Union principles, referred to by "Status" as "agitators." The other section, better known as "Status Engineers," did not desire to associate themselves with such an unhealthy system for fear of losing the respect of their chief, who is slowly grinding them down.

These are Trade Union methods: "Peaceful persuasion first"; if this is not effective, and it rarely is, then strike. Chief engineers and employers of labour do not like to be forced against their will, hence you lose their respect and good feeling; on the other hand, you gain the coppers. "Status" evidently prefers the respect!

"Status" also says, "If the A.E.S.E. joined the E.T.U. there would be a division in their ranks." It is evident that they have not yet lost their agitators.

The E.T.U. are anxious to welcome these so-called agitators. They want to better their conditions, and they can do it. Let "Status" remember that the A.E.S.E. was allowing us to struggle on with a starvation wage. We are told to be patriotic because we are at war, but patriotism evidently is not in the category of the profiteer. Let the capitalist satisfy his greed while we continue to be patriotic. This appears to be the motto of the A.E.S.E.

Alpha.

In the current issue of the *ELECTRICAL REVIEW*, under the above heading, Mr. H. H. Morton makes certain statements which cannot be allowed to pass unchallenged.

He states that among the employees of the North Metropolitan Electric Power Supply Co. the E.T.U. have a membership of over 50, which may be correct, but read in conjunction with the previous paragraph it might be inferred that the 50 members include the supervising grades of power-station charge engineers. I challenge Mr. Morton to give the name of one member of the staff—that is to say, a technically-trained engineer in responsible charge of a watch in any of the company's power houses—who is enrolled in the E.T.U. The membership of 50 does embrace sub-station attendants and various lower grades down to and including trimmers and yardmen.

I hold no brief for the A.E.S.E., but, in common with my colleagues, I strongly object to the action of the E.T.U., which purports to speak for a class of men who are not, and do not wish to be, in any way associated with them.

With regard to the imputation of misrepresentation which Mr. Morton accuses the A.E.S.E. of making, I make no comment, as this matter will probably be dealt with by correspondents more conversant with the facts than I am. I do, however, charge Mr. Morton with direct misrepresentation when he states that the E.T.U. obtained the Engineering Award for "our North Metropolitan members."

As one of the principal assistants in the company, I am in a position to know that the question of making further increases in the rates or bonuses already paid was being considered before any

sort of action was taken by the E.T.U. It is not too much to say that the action of the Electrical Trades Union had, if anything, the effect of delaying the increase rather than of assisting the employees.

F. D. Napier,

Resident Engineer.

Willesden Power House,

November 6th, 1917.

The Teaching of "Electrical Installation Work."

A practical man, who has evidently been a student also, comments (in the current issue of one of your contemporaries)* on his experience of the unsatisfactory nature of the treatment of the above subject.

He mentions a class of 12 students where the workshop equipment consisted of "one saw, two screwdrivers, one pair of pliers, wood casing, and a few pieces of scrap wire." If it be assumed that he has omitted some items—such as jointing materials—he makes it clear that there was "no conduit, and no distribution boards, cut-outs, bells, or fire alarms."

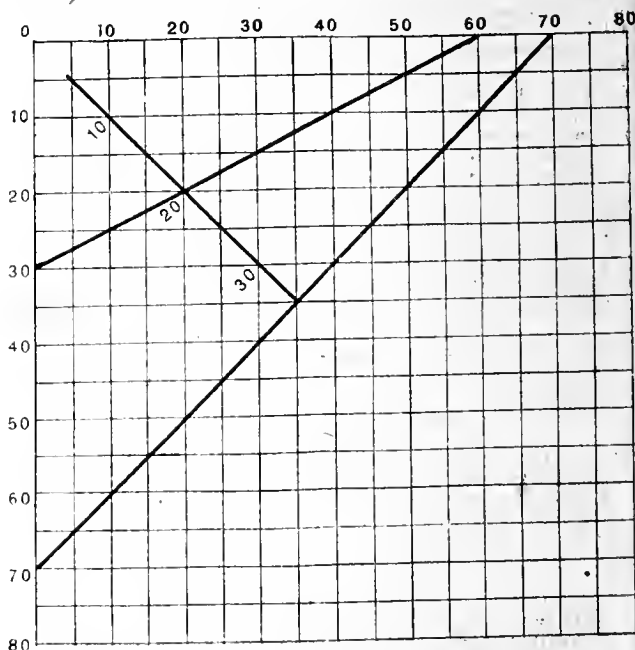
There is much more in the letter, pointing to utterly inadequate and unsuitable methods of instruction; and we mention it here as it bears out what we have said many times in your columns.

A. P. Lundberg & Sons.

London, N., October 29th, 1917.

A Graphic Method of Calculating the Resistance of two Circuits in Parallel.

In your issue of January 24th, 1913, and since in a later issue was described a method for calculating the resistance of two or more circuits in parallel. Having had a number of calculations to make, I thought the simple way in which a "shunt calculator" may be made might be of interest to your readers. All that is necessary is a



piece of cross-sectioned paper on which the abscissa and ordinates are marked off in equal dimensions from 0 to 100 to any convenient scale, say, 2 cm. = 10 ohms, starting from the top left-hand corner. The diagonal is now drawn as shown. It will be seen that the diagonal division = $\sqrt{2}$, or 1.414 times a division on the sides.

Hence, if we put a straight edge on 30 ω and 60 ω , it crosses the diagonal at 20 ω , which is the joint resistance.

L. O. Meyer.

Belford, October 29th, 1917.

Dublin Electricians' Wages.—Some time ago the Dublin Electrical Trades Union and the Master Contractors' Association failed to come to an agreement as to an award of 15s. increased wages, passed by the Committee of Production, and the Union men ceased work. Ultimately the masters made an offer, which was accepted unconditionally and without prejudice to any demand in the future. The old rate of payment was 9d., with 2s. 1d. war bonus, equal to 10d. per hour (50 hours); the new rate is 1s. per hour (50 hours), and a special rate of 3s. per week for those engaged on war work.

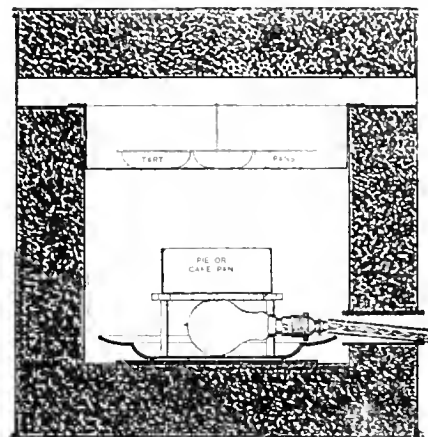
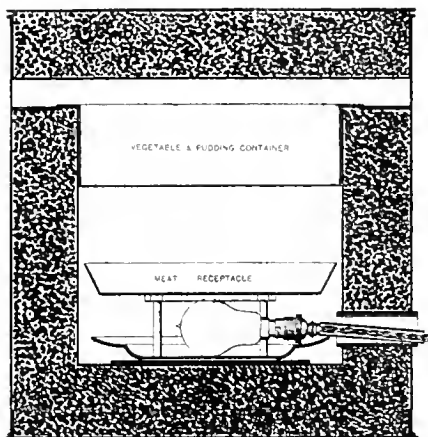
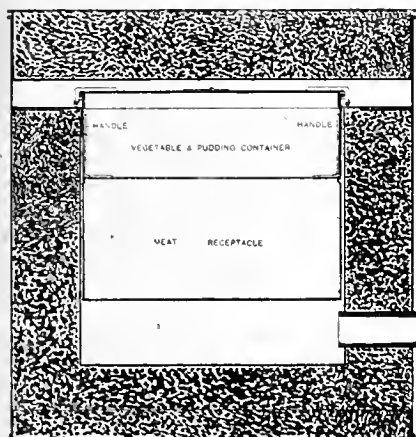
A PORTABLE ELECTRIC-LAMP COOKING BOX.

MR. LEOLINE EDWARDS, of 81, St. Margaret's Road, Twickenham, has brought to our notice an ingenious device calculated to bring electric cooking within the reach of everyone who has an electricity supply. It consists essentially of an improved "hay-box" provided with a heating element to maintain the temperature necessary for cooking, thus getting over the inherent defect of the plain hay-box. The heating element is nothing more elaborate than an ordinary 32-c.p. carbon lamp, attached to a length of flexible, which can be connected to any lampholder with the aid of an adapter. The construction of the box is shown in the accompanying figures. It consists of two iron cases, thermally insulated from one another by "Quidos" expanded cork—a material originally produced by the inventor for other purposes, but admirably adapted for heat insulation, as the granulated cork is put through a treatment which expands the air cells to twice their normal size, resulting in a light, resilient, and sanitary material, which cannot become sordid with water and is very durable. Its thermal conductivity is stated to be 0.041. A hole is provided near the base of the box, through which the lampholder is passed, the lamp being inserted from the inside; the loss of heat through the hole is trifling, and the faint light which escapes affords an indication that the lamp is alight. The inner case is specially designed for convenience in use, and handy stands are provided which enable several dishes to be cooked simultaneously; the ordinary hay-box must on no account be opened after the hot dish has been placed inside it, but the electric hay-box can be opened for inspection or removal of the dishes without affecting its functions, as the temperature is soon restored by the lamp to the proper value. The maximum power consumed is 120 watts, and the cooker can be left unattended for hours without risk; it can also be used in any room where current is available, being perfectly portable.

Mr. Edwards has tested the cooker repeatedly in steaming and stewing foods, roasting and stewing simultaneously, and in baking

scheme for providing Russian agricultural prisoners with simple machines to take back with them to their villages, with the promise of a commission on any they can sell. This should help to make us fully alive to the sort of competition we must be ready to face." *Financial Times*.

Book Notices.—*Terms of Industrial Peace.* By Alex. Ramsay. London: Constable & Co., Ltd. 3s. net. The author of this very readable contribution to what is really one of the most pressing subjects of the times, considers the relation, in the industrial equation, of the two factors, Capital and Labour, and endeavours to suggest a means by which the two may be brought into co-operation for their mutual interest and the good of the community. The main question at issue is that of wages; but wage is a relative term, and its value depends upon the commodities that can be purchased with what is earned. Employers must adopt improved production methods in order to carry the inevitable additional labour charges; they will need to show discernment and sympathy, and workmen must agree to abandon their attitude of hostility and suspicion and promote a willingness to co-operate in the extension of a system which will make it possible for Labour to prosper and Capital to get a fair return. Following a general statement along these lines, Mr. Ramsay devotes following chapters to the following matters, which have an important bearing on the whole subject:—The growing power and the immediate demands of Labour; how employers can increase production; the American example (manufacturing methods and the relations of employers and employed in relation thereto); education and environment; the mind of Labour; the machinery of arbitration; the control of food prices; the limitation of profits; and moral responsibility. The author covers a very wide ground, and touches upon many of the social conditions which in reality lie at the very root of the whole tree of discontent with life, and which, unless they are removed or ameliorated, will always prevent the full fruit of permanent industrial peace being achieved. We are all eager for millennial conditions to prevail in industry. It is right to



SECTIONS OF THE PORTABLE ELECTRIC-LAMP COOKING BOX.

pies, cakes and pastry. Hot water put into the cooker can be kept hot for use at any time, a convenience at night in case of illness: if the water is put in cold (50° F.), the lamp will heat 12 pints to 200° F. in seven hours, with an expenditure of less than one unit.

The cooker was designed to deal with small quantities of food, and thus does not compete with the more ambitious types of electric cooking apparatus. Actual experience shows that a dinner for three persons, consisting of 3 lb. of beef, roasted with potatoes, steamed turnips, beans, rice, and prunes, was done in 3½ hours; the cost, including electrical energy for the lamp, the renewal of the lamp, and gas for previously bringing to the boil four saucepans containing the vegetables, rice, and prunes, was three farthings. The apparatus, which will soon be on the market, can be seen and tested at any time by appointment. It measures 18 in. in diameter and 20 in. in height, and weighs 30 lb. Provisional protection has been applied for.

BUSINESS NOTES.

German Designs on Russian Trade.—An illustration of the vigour with which Germany is preparing to carry on the economic war after the military campaign is over is furnished by what she is preparing to do in regard to Russia. It is stated from reliable sources that the enemy has already established classes in which discharged soldiers are being trained as commercial travellers for that country. They are taught the Russian language, Russian history and Russian methods of business, and are otherwise prepared for the work which is supposed to lie before them. Moreover, a considerable number of women—some 40,000, it is believed—are also being taught Russian, so that they may be able to conduct correspondence and replace the sadly depleted ranks of male clerks. Yet another idea that is being developed is a

have a high ideal in the matter, but we live in a very human world surrounded with all sorts of limitations hindering the success of our high endeavour. The future of the Labour and industrial world in all countries may be very different from the past, but we must not suppose that a new Heaven and a new Earth are going to be brought Phoenix-like from the ashes of a horrible war. Nevertheless, a proper study of the subject of industrial peace is everybody's duty, and Mr. Ramsay, who claims to know both sides of the case from experience, succeeds in stimulating helpful thinking.

"Proceedings of the American Institute of Electrical Engineers." Vol. XXXVI. No. 10. New York: The Institute. Price 81.

"Alternating-Current Electricity and its Applications to Industry." By W. H. Timbie and H. H. Bigbie. London: Chapman & Hall, Ltd. Price 13s. 6d. net.

"Elements of Electrical Engineering." Vol. I. D. and A.C. Machines and Systems. By W. S. Franklin. London: Macmillan and Co., Ltd. Price 84.50.

"Scientific Papers of the Bureau of Standards." No. 306. An experimental study of the Fahy permeameter. Washington: Government Printing Office. Price 10 cents.

Storage Battery Manufacture.—La Société des Accumulateurs Electriques (Anciens Etablissements Alfred Dinin) is the name of a new company which has lately been formed at Nanterre, with a capital of £60,000, to acquire and carry on the Dinin accumulator business.

Dissolutions and Liquidations.—MEA MAGNETO CO., LTD.—Mr. C. R. Beeby, the controller, has applied for his release.

STEEL'S ELECTRIC AND ENGINEERING CO., LTD., 206, East India Dock Road, Poplar.—In this matter (a winding-up order was made last July) accounts have been lodged showing total liabilities £1,054 (unsecured £664), assets £11, and a deficiency of £655 as regards contributories. Mr. W. J. Warley, Official Receiver and Liquidator, reports that the company is a private company promoted by T. G. Steel, S. F. Hastings and E. Lee. It was registered on August 23rd, 1916, with a nominal capital of £3,000, and was

formed to take over as a going concern the business of Steel Bros., and to carry on the business of electricians, mechanical engineers, &c. The failure of the company is attributed by Geo. Steel and S. F. Hastings to want of capital and pressure of creditors.

Moonshine.—MESSRS. C. A. VANDERVELL & CO., LTD., of Acton, have issued in the form of a picture postcard a useful November moon-chart which has been compiled by Mr. A. H. Midgley, their chief engineer.

Catalogues and Lists.—BRITISH THOMSON-HOUSTON CO., LTD., 77, Upper Thames Street, London, E.C.—There has been issued by the Lamp and Wiring Supplies Department a waistcoat-pocket card calendar for a year from last July. Supplies, over-printed with name and address of contractors and dealers, can be obtained on application to the Publication Department.

MESSRS. BROOM & WADE, LTD., High Wycombe, Bucks.—Folder giving general particulars respecting Hyatt flexible roller bearings.

MR. JOHN PHILLIPS, 166, Walworth Road, London, S.E. 17.—Illustrated leaflets showing new designs of his motor-driven commutator grinders.

The British Industries Fair, 1918.—Next year's British Industries Fair, for which application forms for exhibiting space, are now being issued by the Board of Trade, will be considerably larger than those of previous years. The last two Fairs were held in the Victoria and Albert Museum and the Imperial Institute, and the space available was not sufficient to meet the demands of the exhibitors. In many cases, in fact, exhibitors' applications for space had to be cut down by as much as 60 per cent., and the fact of the Fair being in two buildings caused some inconvenience. The 1918 Fair, which will open on Monday, February 25th, and remain open for a fortnight, is to be held in premises which the Port of London Authority have placed at the disposal of the Board of Trade, and it is hoped that the available space will be sufficient to meet exhibitors' requirements, at any rate for the coming year, as the Fair will, owing to the war, again be restricted to the following trades:—Earthenware and china trade; glass trade; fancy goods trade; paper, stationery, and printing trades; toy and games trade.

The 1918 building contains about twice as much space as was available this year. It is more conveniently situated for business men, being near the Tower Bridge, and is a large roof-lighted warehouse on one floor. Firms who are anxious to exhibit should send their applications for space to the Director, British Industries Fair, 10, Basinghall Street, London, E.C. 2, at the earliest possible moment.

Bankruptcy Proceedings.—SAMUEL STEPHEN COSTER, electrical engineer, &c., 14, Gladstone Road, West Ham Park, trading as S. S. Coster & Co.—Under this failure, accounts have been lodged at the London Bankruptcy Court showing liabilities £670, and assets "bad book debts of £490." According to the observations of the Official Receiver, the debtor, in August, 1908, with £150 capital, became a partner in the business of electrical and mechanical engineer carried on at 114, Bishopsgate Street, E.C. That business was not a success, and was abandoned in June, 1909, whereupon the debtor started on his own account, and in his own name, at 78, Amity Road, West Ham Park, removing to Gladstone Road in 1912. Two years ago he adopted the style of S. S. Coster & Co., with a view to his son joining him in the business on his release from the Army. In November, 1916, his stock-in-trade and effects were seized and sold at the instance of a creditor, and very little business has since been transacted. The debtor attributes his insolvency to decline in his business through bad trade, lighting restrictions, and shortage of labour, to bad debts, and to his ill-health, which at times prevented him giving his full attention to the business. A sitting was held last week, before Mr. Registrar Hope, for the debtor's public examination. The Official Receiver reported that the debtor had not filed cash and goods accounts, nor had he attended on the Official Receiver, as required to do. It was a case calling for considerable investigation; there were no books or banking account, and it was impossible to say what the debtor had done with goods advanced on credit and not paid for. His Honour adjourned the examination, and directed the debtor to furnish the accounts, and to attend on the Official Receiver forthwith.

Enemy Samples.—In the new Sample Rooms of the Department of Commercial Intelligence, 73, Basinghall Street, E.C., there is on view for the information of British manufacturers an exhibition of samples of German and Austrian goods, including many recent additions, showing new styles of goods that are being introduced in enemy countries.

Auction Sale.—MESSRS. P. HUDDLESTON & Co. will sell by auction at Hammersmith on Tuesday, November 20th, a quantity of electrical apparatus. Full particulars are given in our advertising pages to-day.

LIGHTING AND POWER NOTES.

Accrington.—The requisite notice is to be given, under the terms of the agreement for the supply of electricity to Haslingden, of intention to terminate such agreement on December 31st, 1918, for review and adjustment.

Australia.—With regard to the question of acquisition of a coal-bearing property by the Sydney Municipal Council, it is

suggested that the Government Geologist, the Chief Inspector of Mines, and Mr. D. A. W. Robertson should consider the offers. A deputation is to wait on the Minister for Labour and Industry in regard to the alleged monopoly in connection with coal supply for electricity supply purposes.

According to the *Times*, restrictions imposed in Australia on October 11th on the use of fuel and power for industrial purposes were to be removed last Monday.

Bootle.—PROPOSED PLANT EXTENSION.—The question of electricity works extensions again came before the T.C. last week; the borough engineer reported that he had received an application from a cold storage firm for a supply of electricity to premises which it is proposed to erect in the district, but that the present generating plant will not permit of this being done. Eight other applications for large supplies had already been refused, and the demand for current was steadily increasing. The Electricity Committee strongly expressed the opinion that it was imperative that additional plant should be provided, and it recommended that the Council should apply to the L.G.B. for sanction for immediate expenditure on works extension and provision of plant, at an estimated cost of £73,500. After a long discussion the matter was referred to a Special Committee for consideration.

Bradford.—WAGES.—The Bradford Corporation Employés' Joint Sub-Committee, which represents nearly 4,000 employés of the municipality, has put in an application for an advance in wages for the members of certain Trade Unions, including the Electrical Trade Union and the Amalgamated Society of Engineers. The demands are for an advance of 100 per cent. on pre-war rates, equal rates for men and women on similar classes of work, and time and a-half for overtime on ordinary working days and double time for Sundays and Bank Holidays. The Special War Wages Committee of the Corporation has already had an application from the tramway workers for an advance of £1 per week on the pre-war rates, and a request for equal treatment of women with men in matters of war bonns.

Bristol.—STREET LIGHTING.—The Sanitary Committee, with the permission of the Chief Constable, has decided to re-light all the arc and half-watt lamps and the electric incandescent lamps; the top halves of the lamps will be painted a dark colour, and the bottom halves with one coat of white paint. In the event of an air raid over Bristol the supply will be cut off at the power station for these lamps, together with all other electric lighting in the city. The number of arc and half-watt lamps at present unlighted is 258, and of incandescent lamps 937.—*Bristol Times and Mirror*.

Burnley.—The electrical engineer reports that he has informed the Tadmorden authorities that the supply of electricity in bulk to the latter town was not feasible at the present time.

The Electricity Committee has sent a resolution of protest to the Coal Controller on the unfairness of making the recent advance in the price of coal retrospective.

Burton-on-Trent.—PRICE INCREASE.—The price of current is to be increased by 10 per cent. from the quarter ending December 31st.

Canada.—According to the financial Press, the Ontario Hydro-Electric Commission, which recently bought out the Ontario Power Co., is also seeking to purchase the Electrical Development Co. and the Canadian Niagara Co., the other generating companies on the Canadian side of Niagara River. Such a purchase would also involve the acquisition and operation of the Toronto Railway Co. and the Toronto Electric Light Co. in the one case and similar utilities in the city of Buffalo. It is suggested that even the purchase of these undertakings would not enable a sufficient margin of power to be obtained to meet the requirements of the Ontario Commission's customers.

Carlisle.—A supply is to be given to the works of Messrs. T. Brown & Co., and, subject to sanction, a loan is to be applied for to cover the cost of cables.

Continental.—SWEDEN.—According to a recent statement in the Swedish Press, the Stockholm Waterfall Board has asked the Government for a grant of 4,000,000 kroner, of which amount 3,000,000 kroner are to be used for the power station on the Lulea River, and 1,000,000 kroner for regulating the water supply in certain lakes.—*Board of Trade Journal*.

Edinburgh.—The annual inspection of the Corporation electric generating stations took place last week, the North British Rubber Co.'s works being also visited. At the subsequent dinner, the convener stated that if there were no lighting restrictions they would be running dangerously near the limit of their plant capacity; they were anxious as to the new Portobello station, without which they could not supply a tramway load. It has been decided to recommend an increase of 3d. per unit in the lighting rate, making 33d. per unit.

Greasborough.—PROV. ORDER.—The U.D.C. has given notice of its intention to apply for a prov. order to supply electricity in the area for lighting and power purposes.

Halifax.—PROV. ORDERS.—A special meeting of the T.C. is to be called to authorise an application for prov. orders to enable supply to be given in the urban districts of Mytholmroyd and Luddenden Foot.

Hebden Bridge.—At a Council meeting, last week, it was stated that arrangements were nearly complete for the supply of electricity from Halifax to supplement the local production.

Holmfirth.—The U.D.C. has considered a report by its electrical engineer, and a Sub-Committee has been appointed to consider an extension to Somersfield.

Kingston-on-Thames.—At a recent meeting of the T.C., a recommendation of the Lighting Committee to increase the salary of the chief assistant electrical engineer, met with considerable opposition, one reason being the financial position of the undertaking.

The electricity accounts for the past year show a net loss of £6,790, which is equivalent to an 8d. rate.

Leeds.—Industrial workers—especially women—are demanding, through the Trades and Labour Council, better street lighting, and a deputation has been appointed to wait upon the Chief Constable.

Leicester.—NEW POWER STATION.—The T.C. has unanimously adopted a report by the Electricity Committee, recommending that an application be made to the B. of T. for a provisional order authorising the purchase of 36 acres of land on the Aylestone Road for the construction of a new generating station, together with buildings, plant, &c., as may be necessary. Ald. Flint, in moving the adoption of this report, said their generating plant was working at its full capacity, and it was necessary to take the earliest opportunity of meeting the growing demand for electricity. It was probably well known that outside interests were waiting to come into Leicester, and if the Council did not take advantage of the opportunity which presented itself, it might be lost in the future. He did not anticipate any opposition from the Gas Committee, seeing that the Electricity Committee would probably become its best customer.

Mr. C. H. Wordingham, who has reported on the matter to the Council, addressed the latter, pointing out the desirability of commencing the work as soon as possible, and the advantage of co-operation between the electricity and gas undertakings in the interests of fuel economy. He pointed out the necessity of unifying the present diverse systems of supply, and the advantages of a single power station for all purposes.

Lewes.—STREET LIGHTING.—The T.C. has sealed an agreement with the Electric Supply Co. for the supply of current for street lighting.

London.—MARYLEBONE.—The general manager's report on the working of the electricity department for the June quarter shows that 3,598,200 units were sold, representing a net increase of 13.25 per cent. over June, 1916. The net revenue from the sale of electricity and meter rentals amounted to £33,730, being an increase over that of last June of £1,782. The total expenditure for the quarter amounted to £19,093, an increase as compared with the June quarter, 1916, of £1,812. The total average costs per unit sold were 1.274d., as against 1.305d. for the previous June quarter. The net results of the quarter's trading is that the surplus realised towards the payment of the capital charges amounted to £17,522, compared with £17,945 at June 30th, 1916, a decrease of £423; but as these charges for the current year are estimated at £1,400 less than last year, the position is well in hand and the estimates have been more than realised.

HAMPSTEAD.—Electric indicators to give air warnings, showing "take cover" and "all clear," have been attached to certain lamp standards, these being operated from a central control point.

Manchester.—Preliminary notice of a further increase in electricity charges has been given. It is expected that the new prices will become operative from next December quarter-day.

Marsden.—PROV. ORDER.—The U.D.C. has decided that consent be given to the granting by the B. of T. of a prov. order authorising the Electrical Distribution of Yorkshire, Ltd., to supply electricity within the urban district, subject to a clause being inserted having regard to prices to be charged to consumers, the laying of cables underground, and a time limit for having the supply available.

Rochdale.—PRICE INCREASE.—The T.C., last week, decided to advance the charges for electricity from November 14th as follows:—Lighting 33½ per cent., instead of the existing 25 per cent.; power over 15-kw. demand, advance of 0.4d. per unit, under 15-kw. demand advance of ¼d. per unit, instead of 3d. per unit; tramways, advance of 25d. per unit in place of the existing 15d. per unit. Councillor Walker stated that the additional cost of coal of 2s. 6d. per ton and the increased wages of employés, made an extra amount required of £3,512, and the advanced charges are expected to realise £2,964, leaving a deficiency of £600.

Rotherham.—LINKING-UP.—At the Electric Lighting Committee, it was reported that a conference had been held with representatives of the Sheffield Corporation to discuss the question of linking-up the power stations at Sheffield and Rotherham as desired by the Ministry of Munitions. The conference decided to recommend to each authority the desirability of linking-up the two power stations, and instructed the respective engineers to meet and endeavour to agree to a tentative scheme to carry this into effect, such scheme when arranged to be submitted to the respective Electricity Committees for consideration.

Spenborough.—BULK SUPPLY.—The Electricity Committee has decided to recommend that an agreement be entered into with the Yorkshire Electric Power Co. for a supplementary supply of current from its system, subject to the sanction of the B. of T. to the necessary expenditure on a transforming plant.

Stafford.—The Electricity Committee reports an increase last year of 21½ per cent. in the output of electricity.

Todmorden.—PRICE INCREASE.—The Electricity Committee has decided to increase all charges 10 per cent., with a flat rate of 5d. per unit for lighting.

Wakefield.—PRICE INCREASE.—As from December 1st next, the price of electricity for power purposes will be advanced 25 per cent. over the current prices, and for lighting purposes 12½ per cent. over the current prices.

York.—PRICE INCREASE.—The Electricity Committee has decided to increase the charges for power to consumers by 10 per cent. from January 1st next year.

TRAMWAY AND RAILWAY NOTES.

Belfast.—TRAFFIC FIGURES.—The total revenue of the tramways for the six months ending September 30th was £166,571, as against £151,981 for the corresponding period last year, an increase of £14,590. The expenditure reached the alarming total of £107,070, as against £89,723, an increase of £17,347. As a result, the gross profit was reduced to the extent of £2,757, or to £59,501, as against £62,258. Net revenue and appropriation charges totalling £59,186 reduced the gross profit to the figure of £316, or £3,567 less than the surplus, £3,883, for the first six months of last year. The increased expenditure on revenue account was:—Traffic, £9,142; repairs and maintenance, £3,573; power, £1,512; and general expenses, £90. The first item was chiefly attributable to increased wages, the second to the same and cost of materials, and the third to the high price of electricity.

Birmingham.—The Corporation has decided to promote a Bill in Parliament for, among other things, the construction of a short length of tramway from Longbridge to Rubery, on the outskirts of the city, where there has been great industrial development.

Dudley.—ACCIDENT.—A serious accident, which happily did not result in any loss of life, occurred last week. A fully loaded car was proceeding down the Bath Hill when the driver, who was a learner, lost control, the vehicle running away and colliding at the bottom with another car. Both cars were very badly damaged.

Hebden Bridge.—At last week's Council meeting, the clerk reported the willingness of Halifax and Todmorden Corporations and the Hebden Bridge Rural Council to confer with the District Council on the subject of the possibility of joining up the existing tramway system from Halifax to the motor-bus system at Todmorden, over a mile and a-half of road, which has at present no service, and he was instructed to call a conference at Hebden Bridge.

London.—The London United Tramways Co. has intimated to the districts through which its lines pass that it is going to apply to Parliament for an Act asking to be relieved from the restrictions imposed on the company with regard to fares, so that it can raise them, and also for power to abandon some portions of its lines in Middlesex and Surrey.

Manchester.—FARE REVISION.—The City Council has instructed the Tramways Committee to immediately consider the revision of fares. At its last meeting the Tramways Committee decided to leave the matter over pending the report from the Trading Profits Committee as to the amount expected from the undertaking towards the rates. Councillor Fox strongly opposed the increase of fares until it was known what was expected from the department, and said that when the Committee was convinced the undertaking was not paying its way it would be prepared to raise fares, providing it was assured that the money would go into the department concerned, to make up its losses, and not go to saving the rates.

New Zealand.—The report of Mr. C. F. Alexander, manager of the Dunedin City Tramways Department, for the year ended March, 1917, contains the following information:—Total revenue, £79,928; working expenses, £43,514, leaving a gross profit of £36,414; loan and special charges, &c., amounted to £30,460, leaving a net surplus of £5,954, as compared with £4,840 the previous year. The car-mileage was 1,295,988, a slight reduction on last year's figures. The passengers numbered 15,135,567, an increase of 285,816.—*Commonwealth Engineer.*

Salford.—FARE REVISION.—Ald. Linsley, speaking at the Council meeting, said the recent award to tramway workers by the Committee on Production had added to the working expenses of the tramways £140 a week to working employés, and £85 to those serving with the Colours. The Committee was already paying in war bonus awards £434 and £184 respectively, and it was also paying £210 a week to soldiers' dependents, making a total weekly payment of £1,053, or £54,756 per annum. The increased fares were justified, but even if the receipts continued to be satisfactory, and no further burdens were placed on the department, it might not be possible to place any contribution to the reserve and renewals fund, and it might be necessary to ask for help from the rates for the repair of the permanent way.

Wallasey.—**YEAR'S WORKING.**—The Corporation tramways had a record year, according to the annual report just issued. The receipts were £78,756, an increase of £4,135; the passengers numbered 15,125,000, an increase of 819,000; and the car-mile earnings were 1358d. against 1292d. The additional war bonuses absorbed £1,050, and £2,719 was paid in war allowances. A sum of £8,500 was allocated to the rates, equal to 1d. in the £, and the highest amount yet handed over.

Wigan.—**ACCIDENT CLAIMS.**—Arising out of the accident on the Corporation tramways in July of last year, 17 cases came before the Registrar of the Wigan County Court, in which passengers claimed damages from the Corporation. A test case had already been brought, in which £45 damages was awarded. Ten of the claims were settled, the total payments accepted being £290, as against £410 claimed. In the contested cases the aggregate damages awarded were £490, compared with a total of £642 claimed. A claim of £500 damages was brought before the Under-Sheriff at Liverpool, last week, by another passenger, and it was stated that the Corporation admitted liability. A verdict for £325, and costs, was given.

The T.C. has decided to purchase a number of L.C.C. tramway cars, if suitable. Alderman Fletcher referred to the abnormal demands made by the traffic at week-ends, and said the Committee would pay almost any price for new cars, if such were to be had; 20 months ago they gave an order for some gear and pinion wheels, but they had not yet been supplied.

Wolverhampton.—The Tramways Committee states, in its annual report, that there is an approximate increase per annum of £7,700 for wages and war bonus, £2,000 for petrol, and £2,400 for electricity. The increased cost of running is having careful attention, and, if these high costs are maintained, it will be necessary to raise fares in due course.

TELEGRAPH AND TELEPHONE NOTES.

Telephone Time Service in Switzerland.—Immediately after the outbreak of the European war, the Government of Switzerland suspended the operation of private wireless stations throughout that country. One result of this step was to prevent the receipt of the daily wireless time signals from the Eiffel Tower, in Paris, to the considerable inconvenience of the Swiss watch and clock makers, as well as many other persons who had been in the habit of receiving these signals. In order to remedy this situation, the Federal telegraph and telephone service installed at Berne automatic apparatus, designed by E. Nussbaum, whereby the wireless time signal received by the official station at that place from Paris is conveyed over the telephone lines to telephone subscribers who desire it. This plan has been in operation since May, 1916, and astronomical observations made at the Federal observatory in Zurich show that the accidental errors involved in the transmission of the signal rarely exceed a tenth of a second.—*Telephone Engineer.*

United States.—The U.S. Government has prohibited the exportation of wireless apparatus from the country except under special permit.

CONTRACTS OPEN AND CLOSED.

OPEN.

Aberdeen.—November 19th. G.N. of Scotland Railway. Telegraph material for six or twelve months. Stores Superintendent, 80, Guild Street.

Australia.—PERTH.—December 5th. Deputy P.M.G. Telegraph and telephone instruments and parts, also battery material, according to schedule and conditions, a copy of which may be seen at the offices of the ELECTRICAL REVIEW, or at the Commonwealth Offices, Australia House, W.C.

December 12th. Deputy Postmaster-General. Switchboards, telephone parts, as per schedule, a copy of which, as well as the contract conditions, may be seen at the offices of the ELECTRICAL REVIEW, or at the Commonwealth Offices, Australia House, W.C.

Beckenham.—November 12th. U.D.C. Three months' supply of coal for the electricity works. See "Official Notices" November 2nd.

Bradford.—November 24th. General stores for tramway department for one year. Particulars from Tramway Offices, 7, Hall Ings.

Enniskillen.—December 1st. Sligo, Leitrim & Northern Counties Railway Co. Telegraph material for 12 months. Mr. J. Duff Secretary, Enniskillen.

South Africa.—November 12th. S. African Railways. 1466 train-lighting cells. Secretary, Tender Board, S.A. Railway Headquarters, Johannesburg. Specifications may be seen at the Department of Commercial Intelligence, 73, Basinghall Street, London, E.C.2.

Wakefield.—November 17th. Coal for electricity works at Calder Vale for one year. City Electrical Engineer, Old Town Hall.

CLOSED.

Halifax.—The Electricity Committee has accepted the offer of Messrs. Bayliss, Jones & Bayliss, Ltd., to purchase the 750-kw. direct-coupled Belliss engine and the E.C.C. dynamo at the electricity works, Halifax, subject to the firm being able to obtain the sanction of the Ministry of Munitions to such purchase, for £2,500.

London.—**Marlyebone.**—The Electricity Committee recommends that the offer of the B.I. and Helsby Cables, Ltd., to extend their contract for a further period of six months subject to an increase of 10 per cent. on the prices contained therein, be accepted.

STEPNEY.—The Electricity Committee has accepted the offer of Messrs. W. H. Bowater, Ltd., to store at Griffith's wharf 2,000 tons of nutty slack, at 25s. 6d. plus rent for storage, 1d. per ton per week, the Council to insure against fire.

Pipe & Co., covering at Limehouse Station:—

Hobdell Way & Co., Ltd., accepted, £80.

Reid McFarlane & Co., £98.

Thermofelt, Ltd., £127.

Sheffield.—**Town Council.** Accepted tenders in connection with the erection of the emergency power house at Blackburn Meadows:—

John Greenwood, Buildings.

Gilbert, Heathcote & Co., Structural steelwork.

Clarke, Chapman & Co., Ltd., Electric capstans.

Crompton & Co., Ltd., Boosting sets.

Wolverhampton.—Corporation Electricity Committee:—

Ferranti, Ltd., H.T. switch cell for Sunbeam sub-station, £130.

Electric Construction Co., Ltd., Seven motors and switchgear for driving fans and auxiliary plant, £938.

Melville Dundas and Whitson, Second half of boiler house structure and other buildings, also reinforced concrete hopper for additional telegraph plant, £3,500.

Felt & Farrant Manufacturing Co., Ltd., Comptometer type calculating machine, £73.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, November 9th. At 8 o'clock, at 30, Victoria Street, S.W., paper on "Precision Gauges," by Mr. H. J. Rickwood.

Physical Society of London.—Friday, November 9th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Ordinary meeting.

Institution of Electrical Engineers, (Birmingham Local Section).—Wednesday, November 14th. At 7 p.m. At the University, Edmund Street. Chairman's inaugural address.

(**Western Local Section.**)—Monday, November 12th. At 7 p.m. At the South Wales Institute of Engineers, Park Place, Cardiff. Chairman's inaugural address.

(**Manchester Local Section.**)—Tuesday, November 13th. At 7 p.m., at the Engineers' Club. Chairman's inaugural address.

(**Scottish Local Section.**)—Tuesday, November 13th. At 7.30 p.m. At 207, Bath Street, Glasgow. Chairman's inaugural address.

Greenock Electrical Society.—Thursday, November 15th. At 7.45 p.m. At 22, West Stewart Street. Paper on "Telephone Switchboard Multiple," by Mr. A. Pick.

Institution of Mechanical Engineers.—Friday, November 16th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Paper on "Some Notes on Air Lift Pumping," by Mr. A. W. Purchas.

Electro-Harmonic Society.—Friday, November 16th. At 6.15 p.m. At the Holborn Restaurant (Venetian Chamber). Concert (ladies' night).

NOTES.

Volunteer Notes.—**COUNTY OF LONDON VOLUNTEER ENGINEERS (FIELD COMPANIES).**—Headquarters, Balderton Street, Oxford Street, W. 1.

Orders for the week, by Lieut.-Colonel C. B. Clay, V.D., commanding:—

Officer for the Week.—Second Lieut. E. A. Ullmann.

Drills.—Week ending Saturday, November 17th, 1917:—

Monday.—No. 3 Company, Left Half. Recruits, signalling, 6.30.

Tuesday.—Physical drill and bayonet exercise, 7.30.

Wednesday.—No. 1 Company, 6.30.

Thursday.—No. 2 Company, 6; signalling, ambulance, 6.30.

Friday.—No. 3 Company, Right Half. Recruits, 6.30.

Saturday.—Inspection of N.C.O.'s and men in Sections A, B, and C by a Staff Officer from G.O.C. All N.C.O.'s and men in these sections are required to parade at Headquarters at 2.30 p.m. Uniform.

Note.—The Medical Officer will attend for examination of recruits, &c., on Thursday, at 6.

All channelled cap badges must be returned to the Quarter-Master Sergeant without delay.

Unless otherwise indicated, all drills will take place at Headquarters.

(By order) MACLEOD YEARSLEY, Capt. and Adjutant.

Appointments Vacant.—Charge engineer for the Farnworth (Bolton) U.D.C. Electricity Works; instructor in electrical engineering in connection with the training of discharged disabled sailors and soldiers for the County of Barnsley Education Committee Technical School; engineer for testing and calibrating switchboard instruments for the L.C.C. Tramways Department; shift engineer (70s.) station attendant (47s.), for the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board; two charge engineers for the City of Worcester Electricity Works; assistant mains superintendent (50s.) for the Borough of Rochdale Electricity Department. See our advertising pages to-day.

Educational.—**STOKE-ON-TRENT.**—The Corporation has appointed for the Central School of Science and Technology a principal of electrical and mechanical engineering, at a salary of £750 per annum. The directors of the Shelton Iron, Steel and Coal Co. have offered to contribute £100 towards a fund for research work.

Institution and Lecture Notes.—Greenock Electrical Society.

The programme of the Society for the coming session is as follows:—

October 18th.—Social and whist drive.
 November 1st.—Discussion on "Modern Generation and Distribution Systems," by Messrs. Angus and Macdonald.
 November 3rd.—Visit to Coplawhill Tramway Works.
 November 15th.—"Telephone Switchboard Multiple," by A. Pick.
 November 20th.—Open night for discussion.
 December 6th.—"Wireless Installation," by G. Reid.
 December 15th.—Visit to Glasgow Central Station.
 December 20th.—Discussion on "Fuses and Circuit Breakers," Messrs. McDougall and Toppin.
 January 10th, 1918.—"Small Private Plants," by G. T. Morrison.
 January 15th.—Visit Globe Sugar Refinery.
 January 24th.—"D.C. Machine Faults," by J. A. Kinnaird.
 February 7th.—"Armature Winding," by W. R. Scott.
 February 21st.—"Notes on Electric Furnaces," by F. H. Whysall.
 February 23rd.—Visit to Merino Mill.
 March 7th.—Juniors' night.
 March 21st.—"Production of Iron and Steel," by A. Norwell.
 March 28th.—General meeting.
 March 30th.—Visit M'Alpine's Lead Works, Govan.

Institution of Electrical Engineers. The first ordinary meeting of the session of the WESTERN LOCAL SECTION will be held at Cardiff, on Monday, November 12th, when the chairman, Mr. R. Howard Fletcher, will deliver his inaugural address. The annual general meeting is provisionally fixed for March 11th, at Bristol, and it is proposed to invite Messrs. P. N. Bireham and I. Jorgensen to read a paper on "Electroculture" on that occasion. The advance programme of the session of the SCOTTISH LOCAL SECTION, so far as decided, is as follows:—

November 13th (Glasgow).—Chairman's inaugural address, Mr. A. Page.
 December 11th (Glasgow).—"Gas-Firing Boilers," by T. M. Hunter.
 January 8th (Edinburgh).—"Electric Cooking as Applied to Large Kitchens," by W. A. Gillott.
 February 12th (Glasgow).—Kelvin Lecture. "Kelvin as a Teacher," by Prof. Magnus Maclean.
 March 12th (Edinburgh).
 April 9th (Glasgow).

The opening meeting of the session of the MANCHESTER LOCAL SECTION will be held next Tuesday, at 7 o'clock, at the Engineers' Club, Albert Square, when Mr. C. J. Beaver (the chairman) will deliver his address. Other arrangements for the session are as under:—

November 27th.—"Gas-Firing Boilers," by T. M. Hunter.
 December 11th.—"Electrical Cooking as Applied to Large Kitchens," by W. A. Gillott.
 January 15th, 1918.—"Electrical Signalling and Control on Railways," by C. M. Jacobs.
 Other meeting dates are:—January 20th, February 12th and 26th, March 12th and 26th, and April 9th.

Junior Institution of Engineers.—The annual general meeting is to be held at the offices, 39, Victoria Street, London, S.W., on Monday, November 26th, at 7.30 p.m. A paper by Mr. D. C. Boyd on "Die Making, Press Tools, and Tin-box Manufacture" will follow.

The report of the Council for the past year shows that the membership at September 30th was 1,306, a decrease of 23. Of the members serving with the Forces, 19 have been killed in action; 257 are in service. In the November issue of the *Journal*, an illustrated paper on "Mechanical Artificial Arms," by Mr. E. W. Hobbs, is printed.

Institution of Mechanical Engineers.—The Thomas Hawksley Lecture on "Heat Engines," by Captain H. Riall Sankey, C.B., R.E., will be delivered on Friday, November 30th, at 6 p.m., at the Institution of Civil Engineers.

Royal Society.—The following have been recommended by the president and Council of the Royal Society for election at the anniversary meeting on November 30th:—President, Sir Joseph Thomson; treasurer, Sir Alfred Kempe; secretaries, Prof. A. Schuster and Mr. W. B. Hardy; foreign secretary, Prof. W. A. Herdman.

Röntgen Society.—The subject of Capt. G. W. C. Kaye's presidential address delivered on Tuesday evening was "The Part Played by X-rays in the War."

To-morrow, at the Swansea Public Library, Mr. A. J. Stanton, A.M.I.E.E., is giving an address, with lantern demonstrations, on "Organised Effort."

The Effect of the War on Municipal Engineering and Public Health.—In association with the Chadwick Departments of Municipal Engineering and Hygiene, an introductory lecture was given at University College, London, by Mr. H. Percy Boulnois, M.Iust.C.E., on this subject. Mr. Boulnois said it was doubtful whether the general public fully appreciated the important bearing which municipal engineering had upon their daily life and health. The war had, perforce, stopped a number of municipal works which were in process of construction, but all the obligations arising out of the war had been in nearly all cases satisfactorily settled without recourse to the Law Courts. That was entirely due to the good feeling which existed between the contractor and the local authority owing to the crisis into which this country had been plunged. With regard to any detrimental effect upon public health, he did not think so far as he could ascertain, that up to the present time there had been any such effect due to the compulsory closing down of these works. He doubted if the general public realised the amount of quiet and unostentatious work that had been carried out for their benefit owing to the momentous changes produced by the war. Nor must it be forgotten that this work had been carried out with greatly depleted staffs. With regard to street lighting, the lecturer said there was now more light thrown on the surface of the streets without showing more light upwards, by means of more scientific darkening of the lanterns, and by reducing the candle-power of the burners. He thought the darkening of our streets

would lead to a much more scientific arrangement with regard to street lighting. Street lighting was, as a rule, unscientifically considered. "You want," he said, "to diffuse light. Now you have a diffused light—just what is really wanted." On the question of housing, Mr. Boulnois decried State aid as contrary to the principles of political economy, and advocated the promotion of some form of legislation to compel all employers to provide accommodation for their employes, if no other means were available.

Sir Maurice Fitzmaurice, in proposing a vote of thanks to Mr. Boulnois, said the subject with which the lecturer had dealt was really almost a part of the very important subject of Reconstruction. He thought there were very few who really realised what the great extent and cost of reconstruction was going to be after the war. Let them consider the reconstruction which would be necessary on the railways in this country, the Overseas Dominions, and all foreign countries, the roads, water supply, drainage, housing, new works for electric lighting and power, development of our agriculture and of all our natural resources—all these things were going to cost money. Particularly in municipal matters it would be very important that we should make up for lost time. London, perhaps, was better off than most municipalities in that way, but, to mention only one glaring thing in London, their supply of electric current for lighting and power, split up, he thought, among 28 different stations, was, in his view, a perfect scandal to the country.

Empire Trade Organisation: the Australian Scheme.—The London newspapers have published dispatches from Australia summarising a scheme unfolded by Mr. Hughes, the Australian Prime Minister, on Monday last, for organising industry in readiness for after-the-war operations and competition. Mr. Hughes sees that there will be a great economic struggle between the nations, and that industrial upheavals—possibly financial chaos—will result, with vital effects for the British Empire. It is therefore essential for the nation to organise, so as to bear the burdens imposed by the war and so as to deal with the many inevitable and complex problems. The speaker gave in outline his proposals for setting up a great national organisation for Australia. Each industry must have its own organisation, and there must be a general Council of Commerce composed of representatives of these separate Associations. Other parts of the scheme include the appointment of a Minister of Commerce, the setting up of a permanent Science and Industry Bureau, also a Department of Trade, and the appointment of trade representatives in the Overseas markets. There would thus be one Federal Department which would overlook such matters as scientific production and would study possible markets. Even at a cost of £250,000 per annum such an organisation would be well worth while. He emphasised the need for collective action in place of our past individualist policy.

Engineers' Wages.—The Committee of Production has issued an award giving a further advance of wages to all grades of workmen engaged with members of the Engineering Employers' Federation, bringing up the total war-time increase to 20s. per week.

Electrical Rain-Making in Australia.—According to the *Sydney Sunday Times*, the first official news of the success of Mr. Balsillie's efforts to induce rainfall was given to the public by the Minister for Works and Railways (Mr. Watt) on his return to Melbourne from a trip along the route of the Transcontinental Railway. In a brief statement which he made to the Press, the Minister said that after a visit to Bookaloo, and an examination of the records obtained, he was much struck with the results of the experiments, and was satisfied that the tests should be taken further. He had, therefore, decided to install two other stations, one in New South Wales and one in Victoria.

What the Minister learned on his visit to the plant at Bookaloo was that the rainfall was 50 to 70 per cent. above that of the surrounding country, and the area affected by the operation of the plant appeared to be approximately 350 sq. miles.

While Mr. Watt, by reason of his position as a Minister of the Commonwealth, has to take a conservative view of the experiments, others who have only themselves to please in the matter have expressed themselves satisfied with the results obtained by Mr. Balsillie, and have given him orders to install rain-making plants on their stations in the arid districts of Australia. Mr. Balsillie has entered into a contract that he is only to be paid by results. The more rain there is over the average yearly fall, the bigger will be the cheque at the end of the term.

The scheme has been protected in every country in the world, with the exception of Germany and the nations allied with her.

Careful research showed the inventor that in fine weather there was a charge of positive electricity in the higher regions of the air, and that when it rained negative electricity predominated. He was studying the effects of mountains on rainfall, and came to the conclusion that hills acted as conductors of the negative electrical energy with which the earth's surface is charged. He argued that all that was necessary, therefore, to give flat plains the same advantage as regards rainfall as hilly country, was the free passage of the negative electricity to the higher regions of the air. His rain-making plant now consists of a set of two or three kites, which are let up on galvanised flexible wire to an altitude of between 4,000 and 6,000 ft. The negative current is taken from the earth by means of a terminal, which is well grounded. Of course, the first essential in the business is wind. In his tests at Bookaloo and elsewhere, Mr. Balsillie has found that rain invariably falls after the kites have been in the air for from six to ten hours.

In addition to the testing station on the Transcontinental Railway line, another station is being established in the Northern Territory for Government experimental work.

Patent Law.—At the opening meeting of the London Section of the Society of Chemical Industry on Monday, a paper on patent law and British chemical industry was read by Dr. F. W. Hay, patent expert of British Dyes, Ltd., who expressed the view that the novelty of all inventions to be protected by patents should be investigated by the Patent Office by means of a general system of examination, covering all prior British and foreign publications. He further proposed that the public should be allowed five years within which the patent could be revoked on various grounds, and the validity of the patent should then no longer be open to attack in Court, so as to give greater serenity to any new manufacture depending on patent rights. He also suggested that all actions connected with infringement of patent rights should be tried in the presence of a technical jury consisting of experts engaged in the industry or science to which the action related, the Judge being required to submit the issue of infringement to the jury.—*Morning Post*.

Wages of Australian Tramway Men: Arbitration.

Australian papers just to hand show that in August last arbitration proceedings were commenced by Mr. Justice Higgins respecting the claim of the Australian Tramway Employés' Association against tramway companies and others in the various States seeking increased wages and better conditions of work. The respondents who put in an appearance were the Prahran & Malvern Tramway Trust, the Hawthorn Tramway Trust, the Melbourne, Brunswick & Coburg Tramway Trust, the Hobart Council and the Kalgoorlie Electric Tramways, Ltd. It was announced that agreements had been signed and the plaint withdrawn as against the Melbourne Tramways Board, the North Melbourne Electric Tramway & Light Co., the Electric Supply Co. of Victoria, the Northcote Council, the Fremantle (W.A.) Municipal Tramway & Electric Light & Power Co., which were amongst the original respondents. The Association made the following claims, amongst others, for wages:—Shunters, dray drivers, orderlies, lavatory men, office porters, and labourers, the basic rate of 11s. a day; horse car drivers, 11s. 6d. a day; conductors, tramcar drivers, signalmen, 12s. 6d.; signalmen in charge of levers, 13s.; engine drivers, 13s. to 17s.; firemen 13s. to 13s. 6d.; trimmers, boiler cleaners, 12s.; and other classes of workers from 12s. to 15s. a day. Employés at Kalgoorlie asked for 15 per cent. above these rates. A 44-hour week was asked for in the plaint, but it was stated that the employés would consent to a 48-hour week. Annual leave was asked for by the employés of 21 days each year on full pay. It was stated that agreements had been come to with many of the respondents in respect to various conditions of work to be performed by the employés, and that understandings on other points might follow. In answer to his Honour, several of the respondents declined to admit that there was a dispute extending beyond the limit of one State, and it was intimated that this matter would have to be determined latter on in High Court jurisdiction.

The taking of evidence was commenced.

Technical and Commercial Libraries.—The interim report of the Council of the Library Association on the Provision of Technical and Commercial Libraries has been issued, and includes the following recommendations, which have been laid before the Department of Scientific and Industrial Research:—

(a) The removal of the existing limit to the library rate, so that local authorities may be free in future to expend upon their libraries the sums necessary for their greater efficiency.

(b) A closer union between State and Copyright Libraries on the one hand and Municipal Libraries on the other, so that the resources of the former may directly or indirectly be made available for scientific and technical students in the provinces.

(c) That funds should be provided for some State-supported library, such as the Science Library of South Kensington, or a library controlled by the Department of Scientific and Industrial Research, to purchase books required for research, and to make them available for loan to public libraries.

The Association is of opinion that it is of urgent national importance to increase the supply of scientific and technical books and periodicals as suggested in paragraph (c), and that local authorities should afford more generous support to public libraries for the provision of scientific and technical literature. Commercial departments should also be established in libraries in trading and industrial centres, and special collections of books brought together and classified. The co-operation of the B. of T. Commercial Intelligence Branch to this end is suggested, and the valuable services rendered to American commerce by the Philadelphia Commercial Library, which answers inquiries on trade matters by telephone and correspondence, are cited as an example of what should be done here. But Library Committees must be prepared to pay higher salaries to assistants capable of doing such work. We are glad to see that the Association holds such advanced opinions, with which we cordially agree, and it is taking steps towards realising the proposals above described.

Storage of Coal (in Bulk).—The British Fire Prevention Committee has issued a special "Warning" (No. 31) with regard to the storage of coal in bulk, with especial reference to spontaneous combustion. The following are some of the precautions that should be taken:

(a) Stacks should not be higher than 10 ft.

(b) Iron perforated pipes 3 or 4 in. in diameter, or, failing these, either suitable earthenware pipes or ducts formed of incombustible material should be inserted vertically in the stacks as they are built up. The lower ends of these pipes or ducts should be at different heights from the ground throughout the stacks. There should be one pipe or duct to about every 300 sq. ft. of surface.

(c) A thermometer should be lowered occasionally through these pipes or ducts to ascertain the temperature at the centre of the stack.

(d) If wet, very small, very soft, or impure coal is received, it should be dumped around the edges of the stack, or in some location where the air can get to it freely, and where other coal will not be packed on top of it.

Matches should always be used carefully, and should not be thrown down until extinguished. Safety matches are preferable to any others. The funnels of steam lorries, &c., should be fitted with spark arresters, and similarly the flue pipes to any stoves near the coal stacks.

When a coal yard is working at pressure, more than ordinary care should be taken to keep the premises clean, and to see that there is no accumulation of waste or rubbish. Oily rags from lorries especially should be placed in iron or metal-lined receptacles, and removed every night. Particular care should be taken to guard against any hot ashes from steam lorries, or accumulation of petrol or oil drippings from motor vehicles generally.

Fire appliances should be installed, and properly overhauled weekly by a competent employé or watchman, and kept ready for instant use. Additional fire appliances above the usual supply should be provided where the pressure of work is exceptional. In large yards hydrants with an ample supply of hose to cover the whole of the premises should be provided. Particular care should be taken in frosty weather to prevent mains, hydrants, or hand fire appliances being affected.

Coal should not be stacked against buildings, boundary walls, or wood fences, &c., as the pressure may be considerable, and such structures collapse with serious results.

Buckets of water should always be available, also buckets or bins of dry sand with scoops where oil or spirit is used.

Copies of the notice can be obtained on application in writing to the Registrar at the offices of the Committee, 8, Waterloo Place, Pall Mall, London, S.W. 1. enclosing a stamped addressed foolscap envelope.

Electro-Harmonic Society (Season 1917-1918).—The next Concert (Ladies' Night) will be held at the Holborn Restaurant, in the Venetian Chamber, on Friday next, November 16th, at 6.15 p.m. Colonel A. M. J. Ogilvie, C.B., will preside. The list of artistes is as follows:—Miss Annie Rees, soprano; Miss Dorothy George, contralto; Mr. Thomas Howell, baritone; Mr. Walter Churcher, humorous recitals; Mr. Arthur Brough, ventriloquist and child mimic; Miss Rene Haslam and Mr. Fred Rome, cameo conversations; Mr. Ernest Hastings, entertainer at the piano; Mr. Bernard Flanders, A.R.A.M., pianoforte solo and accompanist.

Automatic Railway Sub-Stations.—A recent article in the *Electric Railway Journal* mentioned that a dozen or more automatic sub-station equipments have been installed by seven different electric railways in America, and some 30 other equipments are under construction by a single manufacturer. The apparatus is designed to do the work of the operator, and, in addition, automatically to limit the amount of current taken from the machine.

This portion of the equipment consists of a load-limiting resistor, which is automatically inserted between the machine and station bus when excessive peaks occur by reason of high acceleration, &c.; where individual feeder protection is required, a portion of the resistance is inserted in the outgoing feeders. Equipments are under construction for automatic stations ranging from 200 to 1,500 kw. It is calculated that in the case of a hypothetical line having four sub-stations of 300 kw. capacity each, and operating a car service on a 2-hour headway, the total saving per year would amount to \$6,608 (£1,321), comprising \$1,680 (£936) wages and \$1,928 (£386) energy. One day and one night inspector only would be required to supervise the equipments; in the case of the Des Moines City Railway it is considered that these two officials will have ample time to look after the operation of the 16 automatic converter stations eventually to be installed, which, in view of labour shortage, should be especially attractive to the company.

Causes of German Coal Shortage.—The *Labour Gazette* states that the chief causes of the present inadequate output of coal in Germany are discussed in an article in *Die Konjunktur* of August 30th:—"Among those given are the underfeeding of the miners, their lack of experience and training, the unsatisfactory terms of the collective piecework contracts, lack of zeal in the workers, defective ventilation, poor blasting materials, defective tram lines, and general shortage of trams, timber and other materials. By way of illustrating the decline in the standard of efficiency of the mining staffs, the following figures are given: At the outbreak of war the Prussian mines had at their disposal a total of 767,175 fairly well-trained workers, of whom 7,205 were women and 31,290 were lads under 16. In the first quarter of 1917 the total number of workers in the Prussian mines (exclusive of prisoners of war) was 593,722, of whom 40,842 were women and 11,197 lads under 16. Thus the percentage of women and lads had risen from 5.02 to 13.82. During the second quarter of 1917 the total number of workers has increased somewhat, and if prisoners of war be included, it falls but little short of the peace-time number. Thus there is quantity, but not quality. At the present time quite one-sixth of all employed in and about the mines are made up of women and lads, lacking both in physical strength and in training. But even among the men a large proportion are unskilled people, recruited from every conceivable vocation. If the prisoners of war be included, the effect is to reduce the average efficiency of the mass still further."

Co-operation in Export Trade.—The club dinner of the Engineers' Club, Manchester, held on Tuesday last, was followed by a debate on "Co-operation in Export Trade." Captain L. E. Mather presided, and the debate was opened by Mr. L. A. Paish, of the Department of Commercial Intelligence, who recently addressed the Birmingham Brass Masters on the subject of trading combinations.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station Officials.—Mr. HOWARD FOULDS, having accepted an appointment with an electrical company in London, has resigned the secretaryship of the Birmingham Corporation electricity supply department. The Committee has appointed a sub-committee to consider the appointment of a successor as from the beginning of the New Year. Mr. Howard Foulds has been secretary of the undertaking for the past seven years. The Committee adopted, at its last meeting, a resolution expressing regret at Mr. Foulds's severance from the work in Birmingham, and its high appreciation of his services to the department.

West Ham E.L. Committee recommends that the under-mentioned officers be granted an increase of 15 per cent. on their pre-war salaries as under (less any merit increases which have been granted since the commencement of the war), to date from October 1st, 1917:—Mr. J. Allan, station superintendent, £400; Mr. F. Farndon, sales manager, £400; Mr. W. A. Gilbert, mains engineer, £325; Mr. W. E. Edgerton, assistant sales manager and meter superintendent, £285; Mr. H. Smith, departmental accounts clerk, £240; Mr. H. B. Johnson, chief clerk, £220; Mr. E. Tombs, stores manager, £200 (increased since the war to £220); Mr. G. D. Bendix, assistant station superintendent, £250; Mr. W. Whitney, assistant mains engineer, £215 (increased since the war to £240); Mr. W. S. Cobb, station foreman, £208 (increased since the war to £221). It is further recommended that the following increases be given:—Mr. R. Snell, assistant meter superintendent, from £3 12s. 9d. to £4 2s. 9d.; Mr. H. P. Irons, installation inspector, from £3 2s. 6d. to £3 12s. 6d.; Mr. A. H. Gibbs, jun., assistant timekeeper, from £2 9s. to £2 14s.

Committees of Sheffield City Council favour the following increases in salaries:—Mr. A. R. Fearnley, general manager, tramways and motor department, present salary of £1,000 a year to be raised by two annual increments of £100 each; that the maximum salaries of shift engineers in the electric supply department be increased to £220 per annum; and that the salaries of the following shift engineers be raised by £20 per annum in each case:—Mr. H. Price, present salary £170; Mr. W. H. Smith, present salary £160; Mr. T. Roberts, present salary, £150.

General.—LORD CARMICHAEL, G.C.I.E., K.C.M.G., has accepted a seat on the board of the British Thomson-Houston Co., Ltd.

Mr. J. N. JARDINE, who has taken up a Government appointment abroad, has been presented by the electrical department of Messrs. Bean & Son, Dudley, with a pair of field glasses in leather case.

On the occasion of resigning his position as electrical engineer with the Banknock Coal Co., Stirlingshire, to take up a position in England, Mr. ANDREW WALKER was presented with a Gladstone bag and a wallet containing Treasury Notes as a parting gift from the employés.

From a recent minute of the Sydney Municipal Council it appears that Mr. J. DAVIS, Director-General of Public Works, is about to retire from his present position, with the intention to practise privately as a civil engineer in London. Mr. Davis has served the State for many years. The State Government has arranged with him to inspect and arrange for the importation of machinery and other articles required in connection with the public service of the State, and in respect of his services in this connection payment will be made by commission. The Lord Mayor suggests that the Municipal Council would be well advised to retain Mr. Davis as its representative in Great Britain. The Council at the present time has as its consulting and inspecting engineers for the electricity supply department Messrs. Preece, Cardew, Snell and Rider, and it is not proposed to make any change in this connection. In addition to opening an office in London, Mr. Davis will have assistants in the centres of industry in Great Britain and a representative in the United States, whose services will also be placed at the disposal of the Council.

Mr. J. E. DOBSON, late Scottish representative of Messrs. Bruce Peebles & Co., Ltd., Edinburgh, has been appointed London office manager to the company, in place of the late Mr. R. W. Ganttlett, and has now taken up his new duties at Hastings House, Norfolk Street, Strand. Mr. Dobson's many friends, both in Scotland and elsewhere, will wish him success in his new appointment.

Roll of Honour.—Lieutenant E. G. BAKER, Loyal North Lancs. Regiment, who has been wounded in the head, and is lying in the 2nd Southern General Hospital, Southmead, Bristol, was employed at the Morecambe electricity works.

Sapper A. J. WILLIAMS, R.E., who has fallen in action, was engaged at the works of Messrs. Siemens Bros., Stafford.

Private C. W. TEW, Grenadier Guards, who was engaged in the winding shop at the Stafford works of Messrs. Siemens Bros., has been killed by a shell.

Sapper P. COBB, R.E., who has died from wounds, was in the dynamo shop at the Queen's Engineering Works, Bedford.

Corporal G. H. TOMPKINS, Oxford and Bucks. Light Infantry, who has died of wounds and the effects of gas, was in the Coventry works of the B.T.H. Co.

Lance-Corporal H. L. TENNANT, Lancashire Fusiliers, who has been killed, was employed by Messrs. Davenport, Sparrow and Co., electrical contractors, Manchester.

Private W. E. G. STANLEY, Lancs. Fusiliers, reported killed, was employed at the British Westinghouse Works, Trafford Park.

Private D. GREGORY, Border Regiment, killed in action, was employed by Messrs. W. T. Glover & Co., Ltd., Trafford Park.

Driver J. WARD, R.F.A., killed in action, was employed in the generating station of the Stalybridge Joint Tramways and Electricity Board.

The funeral took place at Darwen Cemetery, on November 1st, of Lance-Corporal J. POOLE, K.O.R.L. Prior to enlistment he was employed at the Blackburn electricity works. The funeral was attended by a firing party of 18 men from Preston. Included in the floral tributes was one from deceased's fellow employés at the electricity works.

Private G. WATSON, of the Australian Force, who has been killed in action, was employed in Australia as an electrician.

Private W. W. HOLEY, Royal Warwickshire Regiment, who has been mortally wounded while serving as a stretcher-bearer, was an electrical engineer, of Whitby.

The following honours have been awarded to the employés of the Stepney B.C. Electricity Committee:—Lieut.-Col. G. G. Ewer (sales engineer), D.S.O.; Lance-Corporal H. O. Hendry (clerk), Military Medal; Sapper E. Jones (showroom assistant), Military Medal. It is feared that Lance-Corporal Hendry has been killed. The Committee has conveyed its congratulations to Lieut.-Col. Ewer and Sapper Jones, and to the father of Lance-Corporal Hendry.

Private J. ANDERSON, formerly an apprentice in the Glasgow Corporation electricity department, has been killed in action.

Private J. S. WEAVER, formerly engaged in the Leeds tramways accounts department, has been wounded.

Corporal J. HYLAND (20), South Lancashire Regiment, has fallen in action. He was employed by Mr. H. Barber, electrical engineer, Birmingham.

Mr. R. H. Dickinson, chief engineer to the Birmingham Corporation tramways, has received official information of the death of his eldest son, the Rev. HARRY DICKINSON, Chaplain to the Artists' Rifles, Vicar of St. Stephen's, Birmingham.

Obituary.—MR. WILLIAM DU BOIS DUDDELL.—It is with the deepest regret that we record the death of Mr. W. Duddell, which took place on November 4th, after a long illness, at the early age of 45. Mr. Duddell was one of our most brilliant and successful investigators, and stood in the foremost rank of British scientific engineers, a position which he won before he was 30. A thoroughly practical engineer and expert mechanic, he designed and made the first successful oscillograph, and thus opened the way to a new mode of observation which has proved of priceless value to the electrical industry. He also studied the physics of the A.C. arc to excellent purpose, and laid the foundation on which the continuous-wave system of wireless telegraphy and telephony was built up. In conjunction with Prof. Mather, he perfected a standard wattmeter, and he devised thermally-operated ammeters of extraordinary delicacy and ingenuity for measuring minute antenna high-frequency currents, &c. His researches in wireless telegraphy were no less brilliant than his other work. Following Dr. Ferranti, Mr. Duddell for two years occupied the chair of President of the Institution of Electrical Engineers; he was past-president of the Röntgen Society, and was appointed a member of the Admiralty Board of Invention and Research, as well as of the Inventions Board of the Ministry of Munitions. He was made a Commander of the Order of the British Empire in August last, and five years ago he was awarded the Hughes Medal of the Royal Society, of which he was a Fellow. He was a member of the Advisory Council for Industrial Research. The full extent of his services to the Institution of Electrical Engineers will never be known except to those who collaborated with him, and during the war he had been engaged upon work of the first importance to the nation. Further particulars of his career will be found in our issue of November 8th, 1912, together with his portrait. By his early decease the electrical profession has suffered a heavy blow; his friends are no less grieved at the loss of his engaging personality and charming courtesy.

MR. W. NOBLE.—Mr. Wilson Noble, formerly M.P. for Hastings, who has died at the aged of 63, was interested in electrical research, and for nine years acted as President of the Röntgen Society of London.

NEW COMPANIES REGISTERED.

Agence Havas (1,621r).—Particulars filed October 15th, 1917. Incorporated in France, July 17th, 1879. News and advertising agency. London addresses:—(Telegraphic information) 24, Old Jewry, E.C., (advertising department) 105, Cheapside, E.C. Directors: J. C. M. Lefebvre, H. L. Houssage, J. B. Faivre, C. E. C. A. Houssage, C. A. O. Guistiniani, A. C. Meynet, J. M. Laffite, F. J. E. Barbier, and E. Lebey, all of Paris. Gustave Hirsch de la Mar, 24, Old Jewry, E.C., and Gaston Poinant, 105, Cheapside, E.C., are authorised to accept service.

Lo-Thermo Patents, Ltd. (148,701).—Private company. Registered October 18th. Capital, £1,000 in £1 shares. To acquire from Electromotors, Ltd., B. Longbottom, and E. Greenhalgh the benefit of certain inventions relating to dynamo-electric machinery, and to carry on the business of electrical engineers and contractors, manufacturers of, and dealers in, railway, tramway, electric, magnetic, galvanic, and other apparatus, &c. The subscribers (each with one share) are:—B. Longbottom, Thornville, Alderley Edge, managing director; E. Greenhalgh, Harewood, Birchfield Road, Rusholme, Manchester, electrical engineer. The first directors are:—W. T. Stubbs, B. Longbottom, and E. Greenhalgh. Registered office: 61, Brown Street, Manchester.

Lincolnshire Motor & Electric Traction Co., Ltd. (148,735).—Private company. Registered October 24th. Capital, £5,000 in £1 shares. Objects, as indicated by the title. The subscribers (each with one share) are:—S. A. Fuller, 13, Abbey Drive East, Grimsby, electrical engineer; C. A. B. Turner, 11, Hainton Avenue, Grimsby, farmer and engineer; N. Green, Holbeck Manor, Horncastle, steam trawler owner. The first directors are:—S. A. Fuller, C. A. B. Turner, and N. Green. Registered office: 5, Wellowgate, Grimsby.

Supply Association Among Metallurgists and Machine Makers (C.A.M.M.) (1,624r).—Particulars filed October 24th, 1917. Registered in Italy. Objects: The direct purchase of raw materials on behalf of associates in Italy and abroad, &c. Capital unlimited. Shares are of lire 100 each nominal value. British address: 26, Portugal Street, W.C.2, where J. H. Pearson, London manager, is authorised to accept service.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Dublin United Tramways Co. (1896), Ltd.—Particulars of £2,600 debenture bonds created August 7th, 1917, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The undertaking of the company, and all the tolls and sums of money arising by virtue of the Dublin United Tramways Acts, 1881 and 1905. No trustees. Registered October 20th, 1917.

Direct West India Cable Co., Ltd. (53,956).—Capital, £120,000 in £5 shares. Return dated October 11th, 1917. 12,000 shares taken up; £3 15s. per share called up. £45,000 paid. Mortgages and charges: Nil.

Electric Supply Corporation, Ltd. (52,036).—Capital, £250,000 in £5 shares. Return dated July 19th, 1917. 42,500 shares taken up; £175,000 paid on 35,000 shares; £35,000 considered as paid on 7,000. Mortgages and charges: £154,914.

Exchange Telegraph Co., Ltd. (6,152).—Capital, £96,430 in 8,023 "A" shares of £10 each and 16,200 "B" shares of £1 each. Return dated August 10th, 1917. All shares taken up; £64,046 paid, being £10 per share on 6,000 "A" and £2 per share on 2,023 "A"; £32,384 considered as paid, being £1 per share on 16,200 "B" and £8 per share on 2,023 "A." Mortgages and charges: Nil.

Bombay Electric Supply & Tramway Co., Ltd.—Capital, £1,320,000 in 72,000 ord. and 60,000 pref. shares of £10 each. Return dated April 25th, filed October 9th, 1917. 72,000 ord. and 60,000 pref. shares taken up; £10 per share called up on 60,000 pref. and 45,000 ord.; £1,049,956 paid, leaving £36 in arrears; £270,000 considered as paid on 12,000 ord. and 15,000 pref. Mortgages and charges: £723,000.

Llangollen and District Electric Light & Power Co., Ltd.—Capital, £66,000 in 3,500 ord. and 2,500 pref. shares. Return dated October 8th, 1917. 2,114 shares taken up; £1 per share called up on 2,114; £2,110 15s. paid, leaving £3 5s. in arrears. Mortgages and charges: £3,000.

Fors Accumulator Foreign Patents, Ltd.—Capital, £3,000 in 952 pref. and 2,048 ord. shares of £1 each. Return dated January 11th (filed August 8th), 1917. 584 pref. and 2,048 ord. shares taken up; £132 paid on 132 pref.; £2,500 considered as paid on 452 pref. and 2,048 ord. Mortgages and charges: £125.

Dublin United Tramway Co. (1896), Ltd.—Particulars of £3,200 mortgage bonds redeemable September 29th, 1922, created August 7th, 1917, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The undertaking of the company, and all the tolls and sums of money arising by virtue of the Dublin United Tramways Acts, 1881 and 1905. No trustees. Registered October 20th, 1917.

Harry H. Gardam & Co., Ltd.—Mortgage dated October 24th, 1917, to secure £2,500, charged on freehold land and hereditaments at Staines. Holder: J. Ashby, J.P., D.L.

Gavan Inrig, Ltd.—Particulars of £200 debentures created October 11th, 1917, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including unclaimed capital. No trustees.

Milton Manufacturing Co., Ltd.—Memorandum of satisfaction in full on October 10th, 1917, of mortgage and Land Registry Charge dated December 20th, 1916, securing £2,000, has been filed.

CITY NOTES.

The directors report that frequent interruptions occurred in 1916, some of which were at great depths. Six interruptions took place in the cable from Brest to Saint Pierre, two in the case of the Brest-Cap Cod cable, and even a simultaneous interruption in the two cables for 15 days was recorded. During the fine weather it was possible to remove

from the Brest-Cap Cod cable a fault which had prevailed at great depths for some years past, and a second existed which still interfered with the handling of the traffic. Notwithstanding these facts, the traffic receipts on the trans-Atlantic cables were higher than those in 1915. In the net work in the West Indies the receipts increased in 1915 by 28 per cent. over those in 1914, and in 1916 the augmentation was 20 per cent. over 1915, and 54 per cent. as compared with 1914. The reasons were to be found in the general situation which had caused an expansion in messages, and in the restrictions imposed on the use of codes. In Venezuela, in particular, the receipts experienced a material increase, and the service between that country with external countries was certain and regular, thanks to the new cable between San Domingo and Porto Rico, which had permitted of the doubling of the land line from San Domingo to Puerto Plata, Venezuela, and the Greater Antilles.

The receipts from the land network in the Dominican Republic were slightly less than in 1915, when they were exceptionally high. In this connection, the United States military authorities, who were in occupation of the country, had undertaken the working for their own account of the wireless station at San Domingo, and also for private messages. The company had succeeded, however, through representations made by official circles, in securing the use of the station to be limited solely to the requirements of the military authorities. The company's claims for indemnities arising from the injury caused during the revolutionary troubles in the course of recent years were to be investigated, together with other French claims, by a commission who were appointed this year (1917). The receipts from the cable between New Caledonia and Australia experienced a slight increase, whilst the subsidies and guarantees reached £25,800, as against £25,900 in 1915. The subsidy from Dutch Guyana continued to be received, but great difficulties were met with in obtaining the subsidy due from the Government of Hayti, which was under the financial control of the United States as a result of an agreement concluded in 1915. The arrangement made with the French Minister for the Colonies in regard to the litigation concerning the subsidies of the French Guyana, the Martinique and Guadeloupe, was in course of execution, and the company had received a considerable amount of the subsidies which were in dispute.

The financial benefit derived by the French Government from the free transmission of official messages, which was represented by £37,000 in 1915, rose to £57,000 last year, whilst terminal and transit charges and taxes and other charges yielded a further sum of £29,000 to the State. If the gratuitous forwarding of State messages results in a considerable saving to the Government, the directors recall the fact that the service at the same time increases the company's working expenses and diminishes the capability of transmitting paying traffic. The net profits are returned at £144,000, which sum has permitted of the repayment to the State of £70,000 arising from the debt incurred under the Government guarantee, and the distribution among the shareholders of a dividend of 11.08 fcs. per share, or a total of £23,800 among 53,702 shares of £10 each, the total ordinary share capital being £537,020.

The Zurich Bank for Electrical Undertakings.

The report of the Bank für Elektrische Unternehmungen, of Zurich, which deals with the year ended on June 30th, 1917, states that the difficulties caused by the war placed an increasingly oppressive burden both on belligerent and neutral countries, and trade and industry in nearly all countries had more and more been devoted to war requirements. As a consequence of their adaptability, the electricity works would have suffered less if constructional and raw materials had not become scarcer and more costly. The unfavourable situation of the works using coal continued, and a considerable increase in the costs had also now taken place, even in those districts where coal mines are to be found. The total result was that it was almost impossible to carry out renewals and extensions, and owing to the great wear and tear brought about the work of replacement would assume considerable dimensions after the war. This state of affairs was already still more noticeable in the case of tramways than in that of the electricity works. The depreciation of money and the dearth of commodities had led to increases in the wages of the employees, which, together with the higher taxes, had prejudiced the financial results, and this would also have to be reckoned with after the war. As a consequence, efforts were being made by the electricity works to obtain an increase in prices, and by the tramway companies in the passenger fares. Of the companies closely associated with the bank, only the Electric Co., which supplied the Roumanian petroleum industry with current, had suffered not inconsiderable material damage through the war, and the hope was expressed that the endeavours to secure compensation would be successful.

The directors refrain from making any definite prediction as to the prospects of electrical undertakings in the near future, although the hope is entertained that the existing difficulties would be overcome in the course of a few years after the termination of the war. The hope also might be cherished that the ratio between receipts and expenditure would again approach normal conditions through a reduction

in the working expenses and an increase in the sale prices for energy, and that this recovery would be facilitated by the constant growth in the use of electric power, since new applications for electricity had been opened up by the war, particularly in the electrochemical department, and especially as it had become generally admitted that small works were not economical, and that they must be connected with large works. All these considerations led to the expectation that undertakings which were sound internally, and established and worked on right principles, would again yield satisfactory results in a few years' time. After giving details of the numerous companies in which the bank is interested in different parts of the world, the directors report that the gross revenue amounted to £335,000, as compared with £459,000 in 1915-16, on an ordinary share capital of £3,000,000. The net profits, after defraying general expenses and interest charges on the loan capital of £3,790,000, are returned at £162,000, as contrasted with £258,000 in 1915-16, and the dividend is at the rate of 5 per cent., as against 8, 8, and 10 per cent. in the three preceding years respectively.

During the half-year ended at June last the company made a profit of £2,913, to which is added £5,965 brought forward. After paying 5 per cent. dividend and putting £1,000 to marine insurance account, £477 is carried forward. The war again prejudicially affected business, the acceptance of messages from the public being practically prohibited. Work in the manufacturing department was plentiful, so as to tax the resources of the company.

The annual meeting was held on August 30th, at Sydney, Mr. E. T. Fisk, the acting managing director, in the chair. The chairman expressed regret at the retirement of Mr. H. R. Denison from the position of managing director, because of the great demand made upon his time by other interests. Mr. Denison was one of the pioneers of wireless development in Australia. For the year, which ended on June 30th last, the profit was £7,453. A 5 per cent. dividend was recommended, and the reserves had increased to £20,500. The company had been able to pay a steady 5 per cent. dividend practically from its inception, in spite of the fact that progress in at least one important direction, that of "message traffic," was impossible during war time. The directors had followed a policy of carefully building up reserves for marine insurance, depreciation, and for patent rights. The position would improve as more of the available resources were employed in extending the company's operations. As a result of the policy of building up the manufacture of wireless telegraph apparatus in its own factory, the company had received some important orders from the Australian and New Zealand Governments. The company had recently gained the position which was undoubtedly unique in the history of Australian manufacture, of receiving a number of orders from England, Africa, India, and other places for the manufacture and export of complete wireless telegraph stations. The company's patent rights were being continually added to by means of the new inventions of Signor Marconi and his associates, all of which belonged, in Australian and New Zealand, exclusively to the company. Among the most recent patents acquired by the company was a new invention made by Marconi which had already been referred to in the newspapers. Only partial particulars had been received at present, and the matter was still confidential, but the invention promised to mark a new epoch in wireless communication equal to that brought about by Marconi's famous tuning invention of the year 1900.

The report for 1916 states that Dr. H. F. Parshall, the president and consulting engineer of the Ebro Irrigation and Power Co. and the Ferrocarriles de Cataluña, S.A., has issued a report showing that substantial progress has been made by the companies operating in Spain, and the results are satisfactory having regard to the conditions under which they were realised. The war makes construction everywhere more difficult and expensive, and this is especially true where a large quantity of the materials has to be brought from overseas. Nevertheless, the works outlined in Dr. Parshall's original report have been substantially completed. The continued high price of coal, however, has necessitated a considerable change of plans, and in view of the rapid growth of business it became necessary for the Ebro Co. to begin the construction of another hydro-electric power plant without further delay. It is not easy at present to raise new capital, but it is satisfactory to report that such financial provision has been made as will enable the Ebro Co. to carry on construction into 1918. Work on the new plant was begun in July last, and is being pushed forward as rapidly as possible. It is hoped that when complete it will furnish sufficient power to cover requirements for a number of years. The net revenue amounted to \$1,875,315, against \$1,316,282, and the interest on prior lien "A" bonds \$331,900, against \$96,355, leaving a surplus of \$1,543,415, against \$1,219,927. The results for the first six months of 1917 indicate a further large increase, and it is anticipated that this rate of increase can be maintained throughout the year. Under the plan approved by bondholders all surplus earnings from operation up to June 1st, 1918, were to be applied to further construction, all bond interest, excepting

that on the prior lien "A" bonds, being satisfied by the issue of 5 per cent. notes. As a result no profit and loss statement is published, as all earnings of the associated companies are applied as provided in the committee agreement. The share in the capital stock of the Tramways de Barcelone purchased by the company are still held as security for the balance of the purchase price, and will probably remain so until after the war. The application for a concession for unification which the Tramways Co. is making is still pending, and the managing director reports that there is reason to believe it will be granted in due course. The tramways earned a surplus over the dividend upon their common shares, which the company guarantees.—*Financial Times*.

Monte Video Telephone Co., Ltd. After providing for all charges in Monte Video and London, and making provision for income-tax and excess profits duty, the net profit for the year ended July 31st, 1917, is £25,324, against £25,985 for the previous year. The interim dividends paid in May absorbed £4,313, leaving £21,981, plus £5,691 brought forward. After applying £8,000 to depreciation of property and plant, transferring £9,000 to reserve for renewals, and paying final dividends of 2½ per cent., less income-tax, on the preference shares, and 3 per cent., free of tax, on the ordinary shares, making 5 per cent. and 6 per cent. respectively for the year, £6,332 remains to be carried forward. There has again been a satisfactory increase in the number of subscribers during the year.

Norwich Electric Tramways, Co., Ltd.—Dividend, 2 per cent. for the year, placing £8,000 to reserve, and carrying forward £39.

Isle of Wight Electric Light & Power Co., Ltd.—Owing to the reduced profits, the half-yearly preference dividend will not be paid until the results of the complete year are known.

Indian Electric Supply & Traction Co., Ltd.—Interim dividend of 2½ per cent.

STOCKS AND SHARES.

TUESDAY EVENING.

Stock Exchange markets remain quiescent. The news from the Italian front continues to bear rather depressingly upon most departments, the view being, of course, that any serious set-back in that quarter will have the effect, by prolonging the war, of causing fresh expenditure of men, material, and money, and therefore acting as a fresh drag upon the money markets of the world.

Financial conditions are none too comfortable in the United States and Canada at the present time. So far as the latter is concerned, a better tone has supervened within the past few days, and there is rather more support being given to the Canadian industrial concerns, including those of the electric power companies. At home, the tendency is to let prices droop a little in the absence of effective support. It would appear as though the public were refraining from investment just at present, because the returns of the amounts subscribed to the National War Bonds are not as large as might well be expected.

The home railway market is once more on the decline. Underground Electric Income bonds slipped back to 83, and the £10 shares to 35s. Metropolitan Consolidated weakened to 23, and most of the steam stocks are also lower. Meanwhile, the mild agitation continues for a more generous treatment by the Government of the railway stockholders in the matter of dividend payments. One correspondent wrote bitterly to an evening paper the other day, pointing out that on Metropolitan Consolidated his dividend for three years preceding the war was 1½ per cent. each year, whereas since that time he had received only 1 per cent., in spite of the fare-raising which has come into operation.

The London United Tramways Co. announces its intention of applying to Parliament for the right to raise its fares, and for power to abandon some portions of its lines in Middlesex and Surrey. Proprietors will probably be thankful to know that the directors are alive to the necessity for action to pull the company out of its present condition; the 4 per cent. debenture stock last changed hands at 32½ and 33 at the end of October. London and Suburban Traction ordinary are slightly better at 2s. 9d. The preference were done yesterday, Monday, at 7s., and the 4½ per cent. First Mortgage debenture stock at 61½ and 61. The most recent business marked in Metropolitan Electric Tramways ordinary was 10 days ago, at 1s. per share, the preference recording a bargain at 5s. at the same time.

Electricity Supply shares are unchanged, and amongst the manufacturing issues, General Electric ordinary at 18½ are 10s. up. India-Rubber shares are ¼ higher. British Westinghouse preference declined a similar fraction to 2 13/16. Babcock & Wilcox gave way to 3, and recovered to 3½.

British Columbia Electric Railway $4\frac{1}{2}$ per cent. debenture stock rose 4 to 55, on the expectation that, after all, the Municipality will recognise the fairness of the company's contentions with regard to competition. The preference stock is 2 better at 42 $\frac{1}{2}$. Canadian General common stock has improved to 115, the preferred to 110 $\frac{1}{2}$. Kaministiquia Power common is 122 $\frac{1}{2}$ ex div. The Mexican group leans to the lower side, though the changes are comparatively small. Brazil Tractions dropped another 2, to 42, Brazilians being dull all round. The preferred remains steady about 90. Brisbane ordinary are good at 6 $\frac{1}{2}$, and this is ex div.

It is a little unusual to have a fall to record amongst the best-class cable shares, but this week Eastern Extensions have eased off $\frac{1}{2}$ to 14 $\frac{1}{2}$. Westerns, however, are $\frac{1}{2}$ up at 15 $\frac{1}{2}$, while Eastern ordinary at 149 $\frac{1}{2}$ stands just between the two. Marconis are very quiet, with a dull tendency for choice. The parent shares gave way $\frac{1}{2}$; Americans are tolerably steady at 21s. 6d., Canadians at half-a-guinea.

Rubber shares keep a firm market, though business has been quiet. Raw rubber is a farthing or so lower at 2s. 8 $\frac{1}{2}$ d. per lb. The armament group is good, and iron and steel descriptions are mostly better. Round the Stock Exchange generally there is not much going on, and the next developments on the Italian front are awaited with keen interest.

Stock Exchange Notice.—Application has been made to allow the following to be quoted in the Official List:—

Fraser & Chalmers, Ltd.—£100,000 6 per cent. debentures of £100 each.

City of Buenos Aires Tramways (1904) Co., Ltd.—Dividend of 1s. 3d. per share, being at the rate of 5 per cent. per annum, less tax, for the three months ended September 30th.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend		Price Nov. 6, 1917.	Rise or fall this week	Yield p.c.
	1915.	1916.			
Brompton Ordinary	10	9	6 $\frac{1}{2}$	—	56 18 6
Charing Cross Ordinary ..	5	5	4	—	6 5 0
do. do. 4 $\frac{1}{2}$ Pref.	1 $\frac{1}{2}$	4 $\frac{1}{2}$	3 $\frac{1}{2}$	—	6 13 4
Chelsea	4	3	2 $\frac{3}{4}$	—	5 9 1
City of London	2	3	13	—	6 3 1
do. do. 6 per cent. Pref. ..	6	6	10 $\frac{1}{2}$	—	6 18 6
County of London	7	7	11	—	6 7 3
do. do. 6 per cent. Pref. ..	6	6	10	—	6 0 0
Kensington Ordinary	7	6	7 $\frac{1}{2}$	—	5 14 3
London Electric	8	3	1	—	Nil
do. do. 6 per cent. Pref. ..	4	4	8 $\frac{1}{2}$	—	6 6 8
Metropolitan	9	8	3 $\frac{1}{2}$	—	4 12 4
do. do. 4 $\frac{1}{2}$ per cent. Pref. ..	1 $\frac{1}{2}$	4 $\frac{1}{2}$	1 $\frac{1}{2}$	—	7 4 4
St. James' and Pall Mall ..	8	3	7	—	5 14 6
South London	5	5	3	—	6 13 1
South Metropolitan Pref. ..	7	7	21 $\frac{1}{2}$	—	6 10 6
Westminster Ordinary	7	7	6 $\frac{1}{2}$	—	5 8 3

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	8	6	58x1	—	6 2 0
do. Def.	85 6	1 $\frac{1}{2}$	34 $\frac{1}{2}$	—	6 9 0
Chile Telephone	8	8	7 $\frac{1}{2}$	—	5 11 4
Cuba Sub. Ord.	5	7	8 $\frac{1}{2}$	—	3 0 0
Eastern Extension	5	8	14 $\frac{1}{2}$	—	5 7 9
Eastern Tel. Ord.	5	8	14 $\frac{1}{2}$	—	5 7 0
Globe Tel. and T. Ord.	7	7	13 $\frac{1}{2}$	—	5 5 8
do. Pref.	6	6	11 $\frac{1}{2}$	—	6 15 8
Great Northern Tel.	22	21	89	—	6 3 1
Indo-European	13	13	12 $\frac{1}{2}$	—	6 3 10
Marconi	10	16	3 $\frac{1}{2}$	—	4 14 0
Oriental Telephone Ord. ..	10	10	8 $\frac{1}{2}$	—	3 4 0
United R. Plate Tel.	8	8	6 $\frac{1}{2}$	—	5 18 6
West India and Pab.	8d.	6d.	1 $\frac{1}{2}$	—	3 9 6
Western Telegraph	7	8	15 $\frac{1}{2}$	+ $\frac{1}{2}$	5 5 0

HOME RAILS.

Central London, Ord. Assented	4	4	60 $\frac{1}{2}$	—	6 12 8
Metropolitan	1	1	48	—	4 7 0
do. District	Nil	Nil	16	—	Nil
Underground Electric Ordinary	Nil	Nil	1 $\frac{1}{2}$	—	Nil
do. do. "A"	Nil	Nil	6 $\frac{1}{2}$	—	Nil
do. do. Income	6	4	83	-1	4 16 5

FOREIGN TRAMS, &c.

	Dividend		Price	Rise or fall	Yield
	1915.	1916.			
A telaide Sup. 6 per cent. Pref.	6	6	4 $\frac{1}{2}$	—	6 3 1
Anglo-Arg. Trams, First Pref.	5 $\frac{1}{2}$	5 $\frac{1}{2}$	8	—	9 3 4
do. 2nd Pref.	5 $\frac{1}{2}$	5	2 $\frac{1}{2}$	—	—
do. 5 Deb.	5	5	68	+ $\frac{1}{2}$	7 7 3
Brazil Tractions	4	4	42	-2	6 4 8
Bombay Electric Pref.	6	6	9 $\frac{1}{2}$	—	11 13 2
British Columbia Elec. Rly. Pref.	Nil	Nil	3 $\frac{1}{2}$	+2	Nil
do. do. Preferred	Nil	Nil	27 $\frac{1}{2}$	—	Nil
do. do. Deferred	Nil	Nil	41	—	7 14 7
do. do. Deb.	Nil	Nil	55	+4	Nil
Mexico Trams 6 per cent. Bonds	Nil	Nil	41 $\frac{1}{2}$	-1	Nil
do. 6 per cent. Bonds ..	Nil	Nil	3 $\frac{1}{2}$	-1	Nil
Mexican Light Common	Nil	Nil	22 $\frac{1}{2}$	—	Nil
do. Pref.	Nil	Nil	35	—	Nil
do. 1st Bonds	Nil	Nil	42 $\frac{1}{2}$	—	—

MANUFACTURING COMPANIES.

Dabcock & Wilcox	15	15	9 $\frac{1}{2}$	—	4 16 0
British Aluminium Ord. ..	7	10	1 $\frac{1}{2}$	—	6 3 1
British Insulated Ord. ..	17 $\frac{1}{2}$	2 $\frac{1}{2}$	3	—	6 13 1
British Westinghouse Pref.	7 $\frac{1}{2}$	7 $\frac{1}{2}$	21 $\frac{1}{2}$	—	5 6 9
Callenders	20	20	11 $\frac{1}{2}$	—	6 15 0
do. 5 Pref.	5	5	4 $\frac{1}{2}$	—	6 1 1
Castner-Kellner	22	22	6 $\frac{1}{2}$	—	6 8 0
Edison Swan, fully paid ..	—	—	2 $\frac{1}{2}$	—	Nil
do. do. 4 per cent. D-b. ..	1	4	71 $\frac{1}{2}$	—	5 7 5
Electric Construction	7 $\frac{1}{2}$	7 $\frac{1}{2}$	1 $\frac{1}{2}$	—	7 10 4
Gen. Elec. Pref.	6	6	1 $\frac{1}{2}$	—	5 14 3
do. Ord.	10	10	1 $\frac{1}{2}$	+ $\frac{1}{2}$	5 8 4
Henley	25	25	16 $\frac{1}{2}$	—	7 14 8
do. 4 $\frac{1}{2}$ Pref.	1 $\frac{1}{2}$	4 $\frac{1}{2}$	4	—	5 12 6
India-Rubber	10	10	14 $\frac{1}{2}$	+ $\frac{1}{2}$	7 1 7
Telegraph Co.	20	20	11	+1	5 17 0

* Dividends paid free of income-tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, November 7th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/6	..
a Ammoniac Sal	per ton	£75	..
a Ammonia, Murate (large crystal)	"	£58	£4 inc.
a Bisulphide of Carbon	"	£43	..
a Borax	"	£84	..
a Copper Sulphate	"	£66	£3 inc.
a Potash, Chlorate	per lb.	2/6	..
a " Perchlorate	"	2/-	..
a Shellac	per cwt.	£13 10	£1 inc.
a Sulphate of Magnesia	per ton	£16	..
a Sulphur, Sublimed Flowers ..	"	£35	..
a " Lump	"	£2	..
a Soda, Chlorate	per lb.	10 $\frac{1}{2}$ d.	..
a " Crystals	per ton	120/-	..
a Sodium Bichromate, casks ..	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2" to 12" basis)	per lb.	..	..
c " Tubes (solid drawn) .. ..	"	..	..
c " Wire, basis .. ..	"	..	..
c Copper Tubes (solid drawn) ..	"	1,6 $\frac{1}{2}$ to 1/7	..
g " Bars (best selected)	per ton	£150	..
g " Sheet	"	£150	..
g " Rod	"	£150	..
d " (Electrolytic) Bars	"	£125	..
d " " Sheets	"	£152	..
d " " Wire Rods	"	£13 $\frac{1}{2}$	..
d " " H.C. Wire	per lb.	1/3 $\frac{1}{2}$	..
f Ebonite Rod	"	3/-	..
f " Sheet	"	2/6	..
n German Silver Wire	"	2/3	..
h Gutta-percha, fine	"	6/10	..
h India-rubber, Para fine	"	5 5 $\frac{1}{2}$	..
i Iron Pig (Cleveland warrants) ..	per ton	Non.	..
l " Wire, galv. No. 8, P.O. qual.	"	£42	..
g Lead, English Pig .. ..	"	..	..
g Mercury	per bot.	Non.	..
e Mica (in original cases) small ..	per lb.	6d. to 3/-	..
e " " " medium	"	3/6 to 6/-	..
e " " " large	"	7/6 to 4/- & up.	..
d Silicon Bronze Wire	per lb.	1/5 $\frac{1}{2}$	..
r Steel, Magnet, in bars	per toe	..	..
q Tin, Block (English) .. ..	"	..	..
n " Wire, Nos. 1 to 16	per lb.	8/6	..

Quotations supplied by—

a G. Boor & Co.	g James & Shakespeare.
c Thos. Bolton & Sons, Ltd.	h Edward Tilt & Co.
d Frederick Smith & Co.	i Bolling & Lowe.
e F. Wiggins & Sons.	j Richard Johnson & Nephew, Ltd.
f India-Rubber, Gutta-Percha and	k P. Ormiston & Sons.
Telegraph Works Co., Ltd.	l W. F. Dennis & Co.

Swedish Metallurgy.—According to statistics, the output of electric furnaces in 1915 was as follows:—

	Metric tons.
Iron	33,075
Ferro-silicon	11,819
Manganese ferro-silicon	2,328
Ferro-chrome	242
Ferro-manganese	957
Ferro-silicon-aluminium-manganese	785
Ferro-silicon-aluminium	346
Ferro-vanadium	4

The major part of this output is derived from the Trollhättan works. In this works the output of zinc from the electric furnace by direct treatment of the ore and scrap metal rose in 1915 to 8,588 tons, against 2,290 tons in 1914, an increase of about 273 per cent. There were in Sweden at the beginning of 1916 about ten electric furnaces ranging from 2,000 to 3,000 kW.—viz., at Domnarfvet, two furnaces of 3,000 H.P. and one of 6,000 H.P., all working; at Soderf, three furnaces of 3,000 H.P. under construction; at Ljusne, one furnace of 3,000 H.P. under construction; at Hagfors, three furnaces of 3,400 H.P. under construction; at Trollhättan, one furnace of 2,000 H.P. working and one of 3,000 H.P. under construction. Some of these furnaces were finished in 1916, and it is reckoned that the output of electric iron will greatly exceed that of 1915. Besides these furnaces, there is a large number of steel furnaces which treat either cast or scrap iron or else refine ordinary steel; their output at present is 100,000 tons yearly. According to observations and calculations made, a complete works fitted with three furnaces of 3,000 or 4,000 H.P. capacity would cost before the war about 400,000 fr. per furnace; the working requirements of each 3,000-H.P. furnace turning out 20 tons of iron per effective working day being, per ton:—

Anthracite coal	300 kg.
Electrodes	5 kg.
Lime	107 kg.
Electrical energy	2,116 kW.-hours
Labour	3 fr.

Such a furnace would require the services of 30 men for all purposes.—*Rivista Tecnica d'Elettricità.*

THE RHODES-FIRTH COMBINED LIGHTING AND ENGINE-STARTING SET.

AMONG those who are devoting attention to the question of dynamos for train and motor-car lighting purposes, and to combined generators and motors for use for engine starting as well as lighting on petrol motor vehicles, are Messrs. Jos. Firth, of Windsor Road, Werneth, Oldham, and Wm. F. W. Rhodes, of Bradford, from whom we have received some particulars of their joint productions, which embody some interesting details.

Dealing first with the car-lighting generator, this is of the shunt-wound, double-pole variety, the leading feature being the method of drive adopted to secure that the dynamo shall be run at a constant speed—when a pre-determined speed of the engine or vehicle has been attained—despite the ever-varying speed of the

undue heating of the generator, but prevents the drawing in of any dust or other impurities with the air, which passes through apertures in the generator casing and out at the opposite end of the machine to that at which it enters.

Reference may now be made to the means provided for automatically making and breaking the connection between the generator and the storage battery employed when the engine speed attains or falls below a predetermined rate. Pivotaly mounted on the exterior of the generator casing is an insulated lever, one end of which passes through the casing surrounding the friction pulley and governor. On this end of the lever is mounted an anti-friction bowl or roller, so that when the friction driving pulley is in a certain position on its supporting shaft the bowl or roller engages with a collar on the upper end of the truncated cone of the friction pulley. The lever is acted upon by a suitably-disposed flat spring, which tends to keep the lever end opposite to that above referred to away from the generator casing, the lever being thus at one time influenced by the movement of the truncated cone and at other times by the spring. The outer end of the lever is attached to a flat spring, which, in its turn, is connected with a cut-out

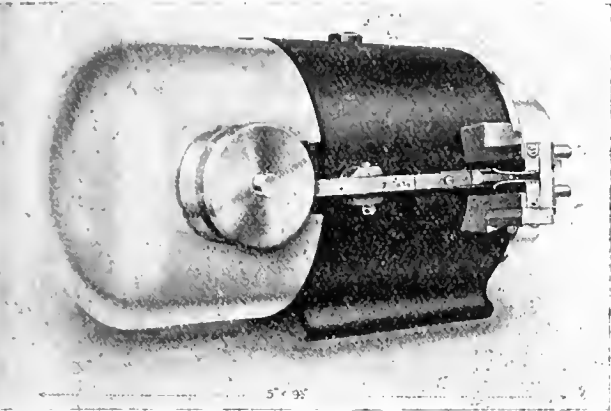


FIG. 1.—RHODES-FIRTH CAR-LIGHTING DYNAMO.

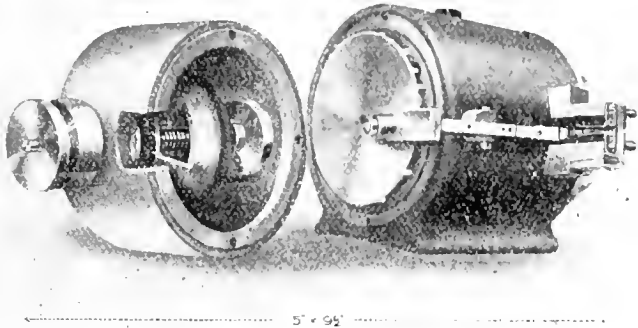


FIG. 2.—DYNAMO, AND CASING ENCLOSING FRICTION DRIVE.

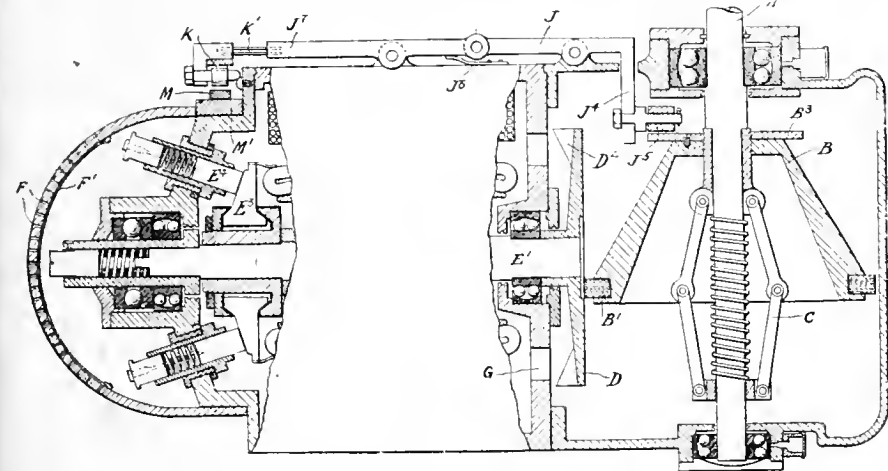
engine or other part of the chassis from which the generator derives its power, and so enable the current generated to be delivered to the battery at a practically constant voltage. The system of drive adopted, both for the generator in its simple form, and in the combined dynamo-motor, is indicated by the sectional plan drawing fig. 3. From this it will be seen that, mounted on ball bearings in a casing at one end of the machine, is a spindle, the outer end of which projects through the casing and terminates in a bevel gear meshing with a bevel ring fitted to the engine flywheel or other rotating part of the chassis of the car, as shown in fig. 6. The inner end of the spindle, within the casing, is provided with a friction pulley, with which is combined a spring-controlled governor of the centrifugal type, so mounted as to rotate with the shaft, and to be able to slide along it as the speed of the shaft increases or decreases. In order to allow for the compact disposition of the governor in relation to the friction driving pulley, the latter

lever so situated as to be able to engage with, and disengage from a contact device of spring form, mounted on an insulated block and arranged in circuit with the battery. Thus, when the pre-determined speed of the engine—or in other words, the battery-charging voltage—has been attained, one end of the lever is raised and the other lowered, the circuit between the generator and the accumulators being thus automatically completed, and, *vice versa*, broken when the engine or vehicle speed falls below a certain rate. In order to secure a quick make-and-break action between the contacts, a suitable projection is provided to act in combination with the cut-out lever. The projection holds up the movement of the contact for a brief period, irrespective of the movement of the lever operating it, the resulting lag ensuring that the make or break, when it occurs, shall be practically instantaneous, any "arcing" or burning of the contacts when coming into or out of action being at the same time avoided. It may be added that the generator is provided with a disk commutator in combination with spring brushes, their form being such as to render more positive the contact between the driving and driven friction surfaces already mentioned.

As will be seen from the general views figs. 1 and 2, one of the features of the machine is its compactness, the 6-volt, 150-watt dynamo, including the casing containing the friction drive, measuring only 5 in. by 9 1/2 in., this being a point of importance in motor vehicles where it is extremely desirable that the installation of a lighting dynamo shall not interfere with the accessibility of any of the component parts of the engine or chassis. Another important factor is that of the weight, the machine illustrated, which is claimed to have a minimum overall efficiency of 67 per cent., being only 16 1/2 lb.

As already indicated, Messrs. Rhodes and Firth have also adapted their constant-speed friction drive to a combined dynamo-motor for engine-starting as well as lighting purposes on motor vehicles.

The double-purpose machine is driven as a generator in the manner already described; to enable it to be used as a starter, however, the machine spindle, in addition to carrying on its extremity a driven friction disk, is also provided with a small bevel pinion (C, fig. 4) which meshes with a bevel crown wheel, C 1, secured to the lower, wide end of the truncated cone which carries the friction driving band. In this way a positive drive is, for engine starting purposes secured, the gear ratio being 4 1/2 to 1. When used as a starter the centrifugal governor is automatically put out of action by a locking device—not shown in any of the accompanying drawings owing to the fact that the necessary patents are not yet issued—so that the truncated cone is held stationary, as to its position thereto, on its shaft. The locking device is arranged to remain in action until the engine has been set in operation and has attained



Friction pulley, B, B'; friction disk, D; fan vanes, D'; air inlets, P'; automatic contact mechanism, J, J'. K, M; commutator and brushes, E, E'.

FIG. 3.—SECTION PLAN OF RHODES-FIRTH CAR-LIGHTING DYNAMO.

is, as will be seen, made in the form of a truncated cone, provided at its larger end with a relatively narrow friction band which makes contact with a friction disk mounted on one end of the generator spindle. A feature of the governor spring is that it embodies provision to overcome the usual tendency of centrifugal governors to have a greater movement as the rate of revolution increases, thus adding to the uniformity of the generator speed, which in the case of the 1,500-watt train-lighting dynamo referred to further on, is claimed not to exceed 5 per cent. The friction disk on the generator spindle is made in the form of a fan that is, vanes or blades are provided on the back of the disk so that, when it is rotating, air is drawn in through holes, covered by pads, formed in the cover over the brush or commutator end of the machine, an arrangement which not only assists in preventing any

from $\frac{1}{4}$ th to $\frac{1}{3}$ rd of its maximum speed, when it automatically releases the governor, so allowing not only the disengagement of the bevel gear, but the friction drive of the dynamo to come into

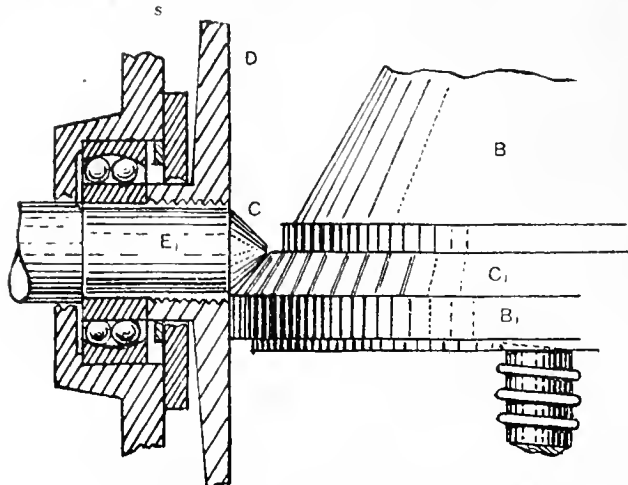


FIG. 4.—ENGINE-STARTING DEVICE.

operation. When the engine is at any time stopped, the friction drive spindle, under the action of the governor, automatically lowers, so bringing the bevel gears into engagement ready for the

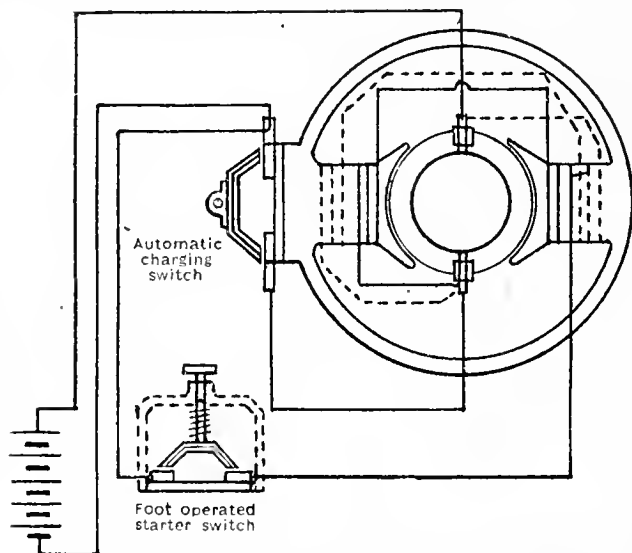


FIG. 5.—GENERATOR-MOTOR CONNECTIONS FOR ENGINE STARTING.

next start-up. The combined generator-motor is made to work at a pressure of 12 volts and has a capacity of 250 watts, the gross weight being 28 lb. The ratio of governor speed as a generator is

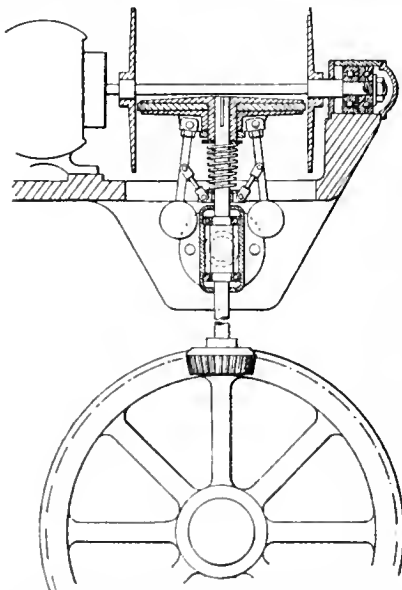


FIG. 6.—RHODES-FIRTH TRAIN-LIGHTING DYNAMO WITH DOUBLE FRICTION DISK.

33 to 1, while, when used as a motor or starter, the machine is claimed to be capable of giving a starting torque equal to $\frac{1}{3}$ B.H.P. The minimum efficiency as a generator is stated to be 72 per cent.,

and as a motor 76 per cent. A diagram of the connections when the machine is used as a starter is given in fig. 5.

For train-lighting purposes, the same method of drive as indicated in fig. 3, is adopted, the principal variation being the provision made to enable the dynamo to be driven in a constant direction whether the train is running either forwards or backwards. In this case, the extension of the generator spindle carries two friction-driven disks either of which may be automatically engaged by the friction driving band, according to the direction of running of the driving shaft, by reason of the "pull" exerted by the gear wheels forming the drive on a swivel joint which, as shown in fig. 6, is provided in conjunction with the friction driving band spindle. The train-lighting set has a capacity of 1,500 watts, the gross weight being 200 lb.; the ratio of governed speed is 10 to 1, the variation of speed of the generator spindle being, as already mentioned, claimed not to exceed 5 per cent., and the variation of pressure not more than 8 per cent.

GERMAN ECONOMIC ORGANISATION.

THE following important quotation from the *Board of Trade Journal* may to some extent explain the very emphatic advice which has recently been given by representatives of the Government Department of Commercial Intelligence with respect to the need for co-operation and combination amongst British manufacturers:—

"The *Neue Zürcher Zeitung* follows up its review of the progress made in industrial discoveries and processes in Germany during the war, with a review of the progress accomplished in the field of economic organisation in that country in the same period. The chief characteristic of the third year of war has, it is said, been the tendency towards compulsory and voluntary syndication of industrial concerns. Compulsory syndication has been demanded by the Government to secure economy in view of the scarcity of material and the shortage of labour; while voluntary syndication has been suggested and carried out by the parties interested, by way of preparation for the prospective economic war, and in order to facilitate the return of peace conditions in the economic sphere, though in some cases this action has been in response to suggestions and hints on the part of the Government. This was the case with the renewal of the coal syndicate, in which all mining firms hitherto remaining outside are now included. The sole reason for the smooth progress of the negotiations was the threat of compulsory syndication in the event of non-agreement.

"The great union in the chemical industry, on the other hand, has been voluntary. This combine, which is for a period of fifty years, is primarily of a defensive nature. The constituent works retain complete independence and freedom of action, but profits will be pooled, all manufacturing experiences exchanged, and all products produced in at least two places. This arrangement, it is hoped, will do much to further the exploitation of new discoveries and to promote technical progress, with the result that the position of the German chemical industry in the world market will be strengthened.

"Agreements with the same object have recently been made between the dyeing and explosives groups of industries. The same tendency is observable in the central combines of the German wholesale trade, the shipping trade, &c., which have arisen during the third year of the war, and also in the efforts now being made towards the further syndication of numerous small industries, e.g., the rope, leather, iron small wares, and enamel industries. The pooling tendencies do not, however, meet with approval everywhere. In the leather industry, for instance, there is keen opposition between the heavy branches, which are in favour of a trust, and the fine branches, which are against it.

"In the iron industry, syndication proceeds slowly but surely, and not without official support. Efforts are now being made to re-establish the rolled wire combine, which was dissolved soon after the outbreak of war. Altogether the syndicate idea has gained ground in the by-products industry much more quickly and distinctly than had been expected. But it is not probable that all the recently-formed syndicates will continue after the war, unless Government action is taken to ensure that they should continue, at any rate for the transition period, in the interests of national economy.

"In addition to the combines properly so-called, there have been numerous amalgamations and fusions of individual concerns, which are further evidence of the general tendency towards the development of large organisations in German economic life. Numerous individual men of business are retiring into private life, their places being taken, as a rule, by large companies and combines. This concentration has been further promoted by measures taken or proposed within the States, such as the proposal to tax turnover. Were such a proposal carried into effect, it would probably give a great advantage to the large enterprises which carry on the whole range of production from the raw material to the finished product, so that the turnover is not subject to frequent charges. Such measures have brought about a similar concentration in trade, as they have resulted in many liquidations of smaller firms.

"The role played by the banks in these fusions, amalgamations, and absorptions is much less important than in peace time: first, because the undertakings in question have as a rule made such large war profits that they can dispense with the assistance of banks; and, secondly, because the banks themselves are undergoing a process of concentration, which is, however, being carried on below the surface. The chief reason for this tendency towards concentration is that the problems confronting German finance on the conclusion

of peace (the problems connected with supplies of raw materials, resumption of issue, reconstruction of credit organisation, &c.) can be accomplished only by institutions of extraordinary capacity and internal strength. The result of this must perforce be a further reduction in the number of medium-sized houses."

LEGAL.

ABRAHAM C. ALLIED MANUFACTURERS' GUILD, LTD.

In the City of London Court, on November 1st, before his Honour Judge Atherley-Jones, K.C., Victor Abraham, Bayswater, sued the Allied Manufacturers' Guild, Ltd., 21, Coleman Street, E.C., for £81, for two weeks' salary at £4 a week, and damages for breach of agreement.

Mr. Clements appeared for the plaintiff, and Mr. Mayne, defendants' managing director, defended.

It seemed from the plaintiff's case that he was employed as defendants' manager at Moorgate Hall, at a salary of £4 per week, and he had to take up £100 worth of shares in the defendant company at the outset. The £100 was to be refunded if the company went into liquidation, and within 12 months when he left their service. Plaintiff declared that defendants wanted to alter the payment of his salary from weekly to monthly, and then they would not, or could not, pay him at all. That, he urged, put an end to his contract, and he demanded damages. Defendants denied that they had put an end to the contract. They never refused to pay him his money. The Guild was formed to develop trade in electrical goods between England and the allied and neutral countries, to stop dealing in German goods. They co-operated with manufacturers to that end. Plaintiff undertook that class of work, but, owing to import and export restrictions, the company could not get an income. Plaintiff's services were practically of no use to them. He agreed to take his salary monthly.

JUDGE ATHERLEY-JONES said plaintiff had no right to assume that he would not get his salary. There had been no breach by the defendants. Plaintiff would get the £8 paid into Court as wages, but no more. Judgment accordingly.

WAR ITEMS.

Cancelling German Contracts in Brazil.—A Reuter dispatch from Rio de Janeiro states that the Foreign Committee of the Chamber has authorised the Government to cancel all contracts entered into with Germans.

Ministry of Reconstruction.—The Minister of Reconstruction has appointed Mr. Vaughan Nash, C.V.O., C.B., and Mr. G. H. Young, C.B., to be joint secretaries to the Ministry of Reconstruction.

Russian Industrial Demobilisation.—The "Times" states that delegates representing mobilised industries of Russia have decided at a general meeting to begin the preparation for industrial demobilisation.

Unscreened Lights.—Vernon Lovegrove, electrician at the Cold Storage of the Port of London Authority in Charterhouse Street, E.C., was fined £10 at the Guildhall on Saturday for leaving unscreened lights on the top floor of the premises on October 24th.—*Times*.

Ball Bearings.—The Minister of Munitions has made an Order under the Defence of the Realm Regulations forbidding the manufacture after November 1st of ball bearings or roller bearings without a licence. He has also prohibited on the same conditions the sale of ball bearings in this country and the purchase of them outside the United Kingdom. Manufacturers may be called upon to make returns of their stocks. Applications for licences may be addressed to the Director of Ball Bearings, T.M.3, Ministry of Munitions, Whitehall Place, London, S.W. 1.—*Times*.

The F.B.I. and Italy.—Sir R. Vassar Smith, Bart., president of the Federation of British Industries, has sent the following telegram to Signor Orlando, the Premier of Italy:—

"The Federation of British Industries extends its full sympathy to the Italian Army and nation in the present crisis, and pledges its members, whose joint capital represents over 2,000 million sterling, and who employ some 3,000,000 work-people, to stand unreservedly behind the British and Allied Governments in furnishing to Italy any support which they may deem necessary."

Building Materials.—The Minister of Reconstruction has appointed a committee to consider and report upon the question of the supply of building materials after the war. They will collect information as to the probable demand for such materials and the availability of supplies, also how the latter may be increased, and the effect of such increase upon price, also the principles and methods by which the priority of various claims should be settled. They will report what steps are necessary to facilitate the prompt commencement of building work at the cessation of hostilities, and will make

recommendations as to any measure of control that may be necessary in regard to charges, production, transport, or distribution of material. The matter is in the hands of the Buildings Materials Supply Committee, Ministry of Reconstruction, 2, Queen Anne's Gate Buildings, London, S.W. 1.

French Electrical Anti-German Propaganda.—We have before us copies of an illustrated leaflet which is being distributed in Paris by the Ligue Nationale de Defense des Interets Francaise. Translated the circular reads in part as follows:—

"To you who used to buy apparatus, material, and electric fittings from German firms, Siemens & Halske Aktien Gesellschaft, Wernerwerk, Berlin-Nonnendamm (Preussen, Deutschland), and Siemens Schuckert, Gesellschaft mit beschränkter Haftung, Siemens-Stadt bei Berlin (Preussen, Deutschland) through their representatives in France, . . . be it known that these German firms show you their gratitude by manufacturing shells now for killing or mutilating daily French officers and soldiers, your sons, brothers, relations, and friends." An illustration is reproduced in the circular of a shell fuse picked up by "one of our gallant soldiers in Champagne." "The trade-mark 'S.I.' stands out most clearly, and it is the duty of every Frenchman henceforth to exclude this trade-mark rigorously from France."

"A.E.G., Société Française (.) d'Electricité, Société Anonyme. Représentation générale de la Allgemeine Elektrizitäts Gesellschaft, Dorotheen-Strasse, No. 40, Berlin, N.W. 7 (Preussen, Deutschland); Paris. Agencies at Caen, Lille, Lyons, Marseilles, Nancy, Nice, Toulouse. Board of Directors: President, Mr. Deutsch. Members, Messrs. P. Mannroth, Thurnaner, Burrell, Roos Koch. Managing director, Mr. Koch. Auditors, Messrs. Gnéronlt & Pfeffer."

An illustration is here reproduced of a shell fuse picked up at Avocourt, "on the battlefield before Verdun (May, 1916) by Lieut. Copen, Knight of the Legion of Honour, slain by the enemy in August, 1916. Notice how these three letters A.E.G., trade-mark of this German firm, stand out plainly on the fuse, clearly justifying the charge so often made that the only true 'industry' of Prussia and Germany is war. The least we owe to the memory of our fellow-countrymen who have fallen is to shut out from France for ever this detested trade-mark."

Exemption Applications.—The Military appealed against exemption to January 31st (or until a substitute was found) given by a Local Tribunal to L. W. Cornish, Exeter (21, single), B.I, acting shift engineer at Exeter Corporation electricity works. It was urged that three shift engineers, each working eight-hour shifts, were essential at the works. The Military Representative said he had made an offer to Mr. H. C. Munro, city electrical engineer, to consent to Cornish being given six months' exemption, with leave to apply again, provided Mr. Munro did not appeal for Benson, another engineer, a younger man in Class A. Mr. Munro agreed, and the Tribunal approved.

Application was made to the Fulham Tribunal for the exemption of an electrical and mechanical engineer, aged 32, married, employed by the British Vacuum Cleaner Co. It was stated that the man was engaged practically the whole of his time on Government work, and was responsible for the repair of all machinery. He was the only engineer left to the firm, and was more or less at the call of the Government. Subject to military training, four months' exemption was granted.

At Barnsley, the Electric Traction Co., Ltd., appealed for 15 employés, the whole of whom were conditionally exempted.

On the recommendation of the Advisory Committee, Rochdale Tribunal has granted temporary exemption until March 31st to J. T. Hoyle (34, B.I), controller cleaner and examiner, appealed for by the Corporation Tramways Committee.

With the assent of the Military, three months have been allowed to A. Deahl (40), electrician, and E. G. Durdle (40), dynamo attendant, engaged at Brookwood Asylum, Woking.

Kidderminster Tribunal has granted exemption until March 31st to E. Turner (37, Class A), car-shed foreman, and A. E. Jackson (37, B.I), motorman.

At Ilfracombe, the Tribunal adopted a recommendation by the Advisory Committee giving temporary exemption until April 1st to A. H. Friend (33, C.3), electrical engineer.

At Tunbridge Wells, an electrical engineer appealed for two electric light wiremen. The Military Representative said that there were nine men engaged in this work in the town, and that these two men previously held protection certificates. Mr. S. A. Cheale (a member of the Tribunal) suggested that lads of 17 could do many of the jobs, but the employer declared that lads could not do nine out of ten such jobs. One of the men was refused exemption, with grace until January 1st, and the other was exempted until a suitable substitute is found.

Epsom Rural Tribunal has granted three months' exemption to W. West, electrician, of Cobham.

Before the Cumberland Appeal Court, the Carlisle Tramway Co. appealed for the traffic inspector, H. Shrubsole (32, Class A), the only inspector left, and stated to be working from early morning to late at night. Most of the old drivers had gone, and it was represented that the staff needed a great deal more looking after than formerly. In reply to questions, it was stated that the company had no female drivers; the

Corporation would not licence them. The appeal was dismissed.

At Southwark, F. J. Leach, 22, an electrical sub-station attendant, was summoned at the instance of the Military Representative to show cause why his conditional exemption certificate should not be withdrawn. He did not attend, the Clerk stating that he had received exemption through the Metropolitan Railway Co. Coun. King said it was outrageous that exemption should be granted to a single man, who probably was fit for general service. The Clerk said the Tribunal had no power in a case like this, as an arrangement had been come to between the Government and the railway company. The conditional exemption certificate was withdrawn.

Messrs. Paice & Endicott, electrical engineers, of Southwark Bridge Road, applied for the exemption of a metal polisher, 3ft. fit for garrison duty abroad (B1), whose wages averaged £3 a week. He was engaged entirely on Government work, grinding and polishing spare parts for munition factories. They held certificates under the Protected Trades' Schedule for three men, but had not been granted one for this man. The Military Representative said the protected trades' certificate was the real test of the man's work. Was he essential to the firm's output? The firm's manager replied that he was. The Military Representative: Then why have you not pressed for a certificate? The manager replied that they had pressed for one, but they had received a letter from the Ministry of Munitions stating that they could not grant this man a certificate under the schedule until the claim for exemption was disposed of by the Tribunal. The Military Representative said on that letter the applicants had not lost their final application for a protection certificate. The Tribunal appeal must first be disposed of, for the Ministry of Munitions did not know on what grounds his exemption there was granted. He might have got it on domestic grounds, but now the claim must be dealt with under the schedule. A month's final exemption was granted, the firm being referred to the M.A.R.O. for further protection.

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

- 15,302. "Electric switches for lighting and ignition for aeroplanes, motor cars, &c." E. J. BROTHERS. October 22nd.
- 15,304. "Electric flashlight walking-stick and umbrella." B. C. HILLS. October 22nd.
- 15,314. "Electric hand lamps." F. A. BULEY & J. W. TREHERNE. October 22nd.
- 15,316. "Induction motors." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.) October 22nd.
- 15,330. "Galvanometers." T. CLARK & J. MAY. October 22nd.
- 15,348. "Insulation of electric conductors." L. B. ATKINSON. October 22nd.
- 15,351. "Resistances for use in heating liquids electrically." J. F. BARR. October 22nd.
- 15,369. "Electric trams, &c., propelled by overhead wire." R. D. BAILEY. October 23rd.
- 15,383. "Adjustable electric fittings of the pendant type." J. M. COPLAN. October 23rd.
- 15,393. "Ovens and hot cupboards heated by electricity, steam, oil, or gas." F. P. FLETCHER. October 23rd.
- 15,394. "Systems of electrical transmission." BRITISH THOMSON-HOUSTON CO. & GENERAL ELECTRIC CO. October 23rd.
- 15,402. "Method of removing tubes deposited by electrolysis upon mandrels." T. F. NEWMAN. October 23rd.
- 15,404. "Electric clocks." W. G. KENT & L. W. PULLMAN. October 23rd.
- 15,415. "Electric controllers for direct-current motors for works, cranes, travellers, charges, &c." J. GEARV & W. GEARV. October 23rd.
- 15,419. "Electrical switches, links, fusible cut-outs, &c." C. J. BAKER, KARTERLE ENGINEERING CO. & V. G. MIDDLETON. October 23rd.
- 15,425. "Machines for making electrodes for batteries." S. L. CASELLA. October 23rd. (U.S.A., December 7th, 1916.)
- 15,431. "Means for cooling electric motors." E. HARRIS. October 24th.
- 15,445. "Generating coal gas in electrically-heated retorts." J. WALSTER. October 24th.
- 15,464. "Aerial circuits for wireless telegraphy, &c." R. A. W. WATT. October 24th.
- 15,488. "Radio telegraphy or telephony." Soc. FRANCAISE RADIO-ELECTRIQUE. October 24th. (France, October 24th, 1916.)
- 15,505. "Electric mufflers." W. F. JONES. October 25th.
- 15,511. "Electrical make-and-break contact." J. H. POTTES. October 25th.
- 15,541. "Electric accumulators." E. A. COTTE. October 25th. (France, October 25th, 1916.)
- 15,543. "Audion or lamp relays or amplifiers for wireless telegraphy and telephony." M. LATOUR. October 25th. (France, October 23rd, 1916.)
- 15,583. "Automatic arc lamps." W. ENGELKE. October 26th.
- 15,610. "Wireless signalling systems." J. H. ROGERS. October 26th. (U.S.A., November 10th, 1916.)
- 15,611. "Wireless signalling systems." H. H. LYON. October 26th. (U.S.A., November 10th, 1916.)
- 15,612. "Dynamo-electric machines." ENCLOSED MOTOR CO., H. C. E. JACOB & P. A. H. MOSSAY. October 26th.
- 15,621. "Apparatus for electrolytic production of zinc, copper, &c." Soc. DE METALLURGIE ELECTROLYTIQUE. October 26th. (France, October 25th, 1916.)
- 15,635. "Electric light apparatus." N. PAPA. October 26th.
- 15,670. "Electrical regulating apparatus." B. DAVIES, EASTERN TELEGRAPH CO. & W. J. DODD. October 27th.
- 15,688. "Electric switches for motor cars, &c." P. O. DORER, R. H. ROGERS & S. SMITH & SONS. October 27th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

- 5,237. AUTOMATICALLY-CONTROLLED ELECTRIC WATER AND OTHER HEATERS. C. S. FORBES. October 10th, 1916. (109,979.)
- 10,855. ELECTRIC LIGHTING AND HEATING OF RAILWAY OR OTHER VEHICLES. C. H. VIDAL. August 1st, 1916. (Addition to 19,977/14.) (109,985.)
- 12,986. ELECTRICAL WAVE TRANSMISSION. M. I. PUPIN & E. H. ARMSTRONG. September 17th, 1915. (101,541.)
- 12,987. WIRELESS SYSTEMS AND THE LIKE. M. I. PUPIN & E. H. ARMSTRONG. October 1st, 1915. (101,702.)
- 12,988. TRANSMISSION OF ELECTRICAL SIGNALS. M. I. PUPIN & E. H. ARMSTRONG. February 10th, 1916. (104,158.)
- 13,707. ELECTRIC SWITCHES. A. CRAWFORD & W. PRESTON. September 27th, 1916. (109,992.)
- 13,813. MANUFACTURE OF ALKALINE PEROXIDE. G. F. JAUBERT. October 2nd, 1915. (101,709.)
- 13,934. PRODUCTION AND UTILISATION OF MAGNESIUM CHLORIDE. G. H. BAILEY, G. W. A. FOSTER & BRITISH ALUMINIUM CO. September 30th, 1916. (109,996.)
- 14,027. MAGNETIC COMPASSES. F. BARKER & SON AND E. W. BARKER. October 3rd, 1916. (110,002.)
- 14,031. WIRELESS ELECTRIC CIRCUIT CONTROLLING APPARATUS. M. INOUE. May 11th, 1916. (106,266.)
- 14,100. FLASH LAMPS. S. PELOW & F. N. HEPWORTH. October 4th, 1916. (110,014.)
- 14,113. SWIVELLING ELECTRIC COUPLINGS. J. D. SHAW. October 4th, 1916. (110,018.)
- 14,690. ELECTROLYSING APPARATUS. R. J. J. MUELLER & UNIVERSAL OXYGEN CO. October 16th, 1916. (110,036.)
- 14,927. ELECTRICAL CUT-OUT OR DISTRIBUTION BOARD. R. W. BILL. October 20th, 1916. (110,038.)
- 15,153. ELECTRIC RADIANT HEAT FIRE. H. S. ELLIS & J. C. PETERSEN. October 25th, 1916. (110,039.)
- 16,005. MEANS FOR RELAY TRANSMISSION OF DIRECTIVE ANGULAR MOVEMENTS. R. E. GILLMOR (Sperry Gyroscope Co., U.S.A.) November 8th, 1916. (110,046.)
- 17,060. LATCHING DEVICES IN CONNECTION WITH ALTERNATING-CURRENT ELECTROMAGNETS. Akt. Ges. Brown, Boveri et Cie. January 10th, 1916. (103,640.)
- 17,588. ELECTRIC DISCHARGE TUBES. BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.) December 7th, 1916. (110,057.)
- 18,174. FORMATION OF JOINS IN IRON AND STEEL PILING. Quasi-Arc Co. and W. L. COLE. December 19th, 1916. (110,065.)
- 18,509. ELECTRICAL TRANSFORMERS. A. G. ELLIS & J. L. THOMPSON. December 27th, 1916. (110,070.)

1917.

- 631. CASINGS FOR TELEPHONE RECEIVERS. H. W. DOVER. January 13th, 1917. (110,076.)
- 802. CORD GRIPS FOR ELECTRIC LAMP HOLDERS. C. G. M. BENNETT. January 16th, 1917. (110,078.)
- 6,239. VALVES. BRITISH WESTINGHOUSE ELECTRIC & MANUFACTURING CO. June 5th, 1916. (106,996.)
- 8,908. MEANS FOR VARYING ELECTRIC RESISTANCES. C. R. HOUGH. June 21st, 1917. (110,128.)

New Norwegian Carbon Factory.—A U.S. Consular report states that the A/S Norske Elektroleverker is erecting a new factory at Frederikstad for the manufacture of carbon and graphite electrodes. The plant's capacity is 4,000 tons of carbon or 1,000 tons of graphite electrodes a year. It is expected to be in full operation by the end of December, 1917.

The same general standards and sizes of graphite electrodes are to be manufactured as those used throughout the United States, while the carbon electrodes run in very large sizes; most of them are rectangular in section, after a European style, the most common size being $15\frac{1}{2} \times 7\frac{1}{2}$ in. Carbon electrodes will be the first product to be turned out. American engineers and machinery experts have been engaged to conduct the work of the factory, in which the machinery is to be almost exclusively of American manufacture.

The Norske Elektroleverker has contracted to supply the demands of several Norwegian firms for electrodes, all such contracts providing that the prices named therein shall be subject to change to conform with any rise in the market prices of raw materials. This clause in contracts is made necessary, it is explained, by reason of the vast advances in price to which almost any commodity is subject in Norway in these times. The standing orders which this company now has in hand are said to be sufficient to ensure the profitable disposal of the factory's output for some time, but it is believed that by February 1st, 1918, the management will be in a position to accept general orders from Norwegian firms for delivery within a reasonable time.

The factory is working in co-operation with the Norwegian Government, and the Royal Department of Industrial Supplies has promised to facilitate the provisioning of the company with sufficient raw material for the successful operation of the plant. The Government will have the first call on the company's finished product whenever electrodes are required for Governmental uses.

Permission to receive anthracite from the United States has been granted to this company by the British authorities, upon the usual assurances that its products are not to be disposed of to nations hostile to the cause of the Allies.

The Norske Elektroleverker has contracted to be regularly supplied with 1,500 h.p. by the Hafslund A/S, one of the three largest power companies of Norway, which derives its power from the Sarpsfall on the Glommen River. In anticipation of its present plant becoming inadequate and the necessity of erecting a branch factory, the Norske Elektroleverker has purchased the rights to the entire power to be derived from a waterfall on the west coast of Norway, near Kristiansund.

THE ELECTRICAL REVIEW.

VOL. LXXXI.

NOVEMBER 16, 1917.

No. 2,086.

ELECTRICAL REVIEW.

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THE INSTITUTION OF ELECTRICAL ENGINEERS.

The Inaugural Address affords the one opportunity for the President of a great Association, such as the Institution of Electrical Engineers, to say what he thinks upon any subject whatever, with the comfortable assurance that no man can say his nay for it is not open to discussion. That Mr. Wordingham availed himself to the utmost of the opportunity will be admitted by all who were privileged to hear his address on Thursday last week, and we tender our respectful congratulations not only on the manner of its delivery, which testified to the physical energy of the speaker, but also on the matter of the address, crammed as it was with ideas, aspirations, suggestions, and exhortations all directed towards the advancement of the Institution and of the industry with which it is associated.

We must confess that the opening passages of the address cast a momentary gloom over our spirits; the President, whilst emphasising the importance of the functions of the Institution with regard to scientific progress, declared that it should not attempt to look after the commercial interests of any one of the sections of which it was composed, on the ground that it was impossible for it to do so efficiently. Yet in an earlier paragraph he said:—"The Institution and the industry should be one, and if they are not, it is our business to make them so." Our thoughts are irresistibly carried back to the spring of 1914, when the Industrial Committee, which had been framed to secure the widest representation of the industry, was deliberately smothered by the Council, which refused to confirm a *compromise*—not a conflict—between two important sections of the industry on the ground that the agreement included clauses relating to trade discounts, and that it was undignified to deal with money matters. Likewise, the Council declined to accept the Committee's proposal to set up a national testing institution (a proposal dear to the heart of Mr. Wordingham) on the ground that it had a "political" tendency.* How, in Heaven's name, can the Institution be identified with the industry if it adopts this "high-browed" attitude? The President cannot have it both ways.

Mr. Wordingham has made no secret of his opposition to the "broader policy" initiated by Dr. Ferranti; he is a clean fighter, as befits the Electrical Engineer to the Admiralty, and he set forth his views on this subject, as well as many other points that are dealt with in his address, in an article in our issue of May 29th, 1914. While we do not see eye to eye with him in this matter, we respect his views, well knowing that no one has worked harder for the Institution than he.

In order to solve the difficulty arising out of the heterogeneity of the components of the Institution, the President proposes that each of these groups

* For a fuller treatment of these topics, see the ELECTRICAL REVIEW, May 22nd, 1914, p. 853.

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

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Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 8d.; Canada, £1 8s. 10d. (\$5.80). To all other countries, £1 10s.

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THE "ELECTRICAL REVIEW'S"
ELECTRICAL & ALLIED TRADES DIRECTORY
(THE RED BOOK),

1917 EDITION.

H. ALABASTER, GATEHOUSE & KEMPE,
4, Ludgate Hill, London, E.C. 4.

shall be organised after the manner of the I.M.E.A. and the B.E.A.M.A., Associations whose activities unquestionably have been of the greatest value to their constituents and to the industry in general, and that each group shall be directly represented upon the Council, in addition to members elected by the whole body of members of the Institution. This also is one of the proposals which he put forward in the article to which we have referred, and it raises an important question of principle. Every member of the Council is understood to act in the interests of the whole body of members, and not in the special interests of the section with which he happens to be more particularly associated. However, the proposal is distinctly interesting; whatever the theory, in practice an elected representative is often called upon to act on the immediate behalf of his electors, and if that were accepted as one of the duties of his office, it would appear desirable that steps should be taken to ensure the adequate representation of all the groups concerned.

We have often thought it a pity that the fine building of the Institution could not be utilised to greater advantage; as the President points out, its "load factor" is painfully low, and the restrictions imposed by the regulations which bind the Institution under the Companies' Acts at present constitute an insuperable obstacle to its more profitable utilisation. Undoubtedly there is a large number of electrical engineers who now foregather in the neighbourhood of Kingsway, and who, with others, would gladly make the Institution their rendezvous if it afforded them the necessary accommodation. We believe that there is here an immense opportunity for the Institution, once again in possession of its home, to formulate and carry out a bold scheme which would not only command the success which has attended the Manchester Engineers' Club, but would have even more far-reaching results. With the unique example of the Engineering Societies of New York before us, we still hope to see the Institutions of this country co-operating in the establishment of an Engineering Headquarters which shall become the centre and focus of the engineering activities of the Metropolis and of the Empire. And passing over many other useful and interesting suggestions, which will be found in the abstract of Mr. Wordingham's address elsewhere in this issue, this brings us to what we hope may prove to be the crowning achievement of his year of office—the conferment of a Royal Charter upon the Institution and its kindred societies. Could this be secured, many of the difficulties and disabilities which at present hamper the progress of engineering, and especially limit the usefulness of engineering societies, would at one stroke be removed; the status of the profession would be recognised, and its influence would be immensely increased; it would offer a career comparable to that of the other learned professions, to which it is at present only an unhonoured appendage; it would constitute a body representative of engineering, and entitled to speak and act in its name, and it would bring together into one fellowship the whole body of engineers, a feat that could be accomplished by no other means.

The Institution of Civil Engineers, we may point out, was incorporated by Royal Charter in 1828; judging by results, it would appear that the terms of its Charter were not so framed as to secure the foregoing benefits, but these could be amended.

While the whole address bristles with topics calling for comment, the exigencies of space have compelled us to confine our attention this week to but one-third of it, and we conclude our remarks for the moment with the suggestion that, so far as the Institution is concerned, the proposal that it should obtain a Royal Charter is by far the most important of the President's propositions, and should command the hearty support of every member.

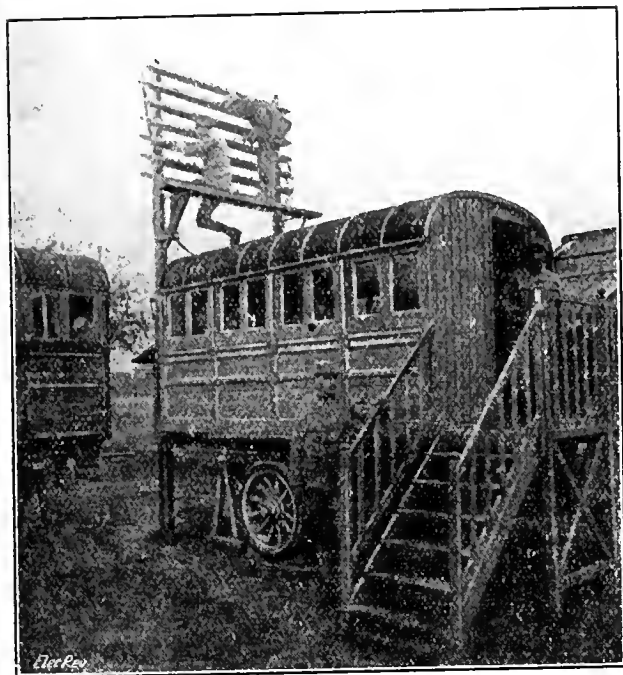
SIR R. V. VASSAR SMITH, who is
The Future President of the Institute of
of Industry. Bankers (his election also as President of the Federation of British

Industries is already known to our readers), delivered his inaugural address on November 7th. The speaker did not attempt anything in the nature of an original discourse. He limited his address to a plain summary of the outstanding facts of the industrial situation. Most of the points here brought together have been urged repeatedly in our pages during the past three and a half years, and some of them were stated here with emphasis many years before the war. In those days they often seemed to fall upon deaf ears. To-day we are pretty well agreed as to what ought to be done. Let us hope that in many directions we may be able to carry conviction on to practical achievement. Sir Richard sees no reason for dejection or discouragement in regard to after-the-war conditions. We shall have to carry a heavy financial burden, and the work of reconstruction will be long and arduous, but we shall build on firmer and fairer foundations than formerly. The President agreed that it was impossible to go back to pre-war conditions, but we had to face the work of rebuilding without suspicion, distrust, or mutual hostility, and must remove, as far as possible, all friction from the machinery of progress. In addition to our financial burden, there would be the cost of repairing the wastage caused by the war, an enormous amount that must be made good, and money must be found to provide the means for increased industrial production. Only with greater industry and production could we meet our difficulties. The first and most serious question was the relations of Capital and Labour. Only by harmonious working between these two forces could the required result be obtained. British trade was capable of vast expansion, and by that means they would have a better remuneration of labour affording a higher standard of living, shorter hours, better housing, and a share of the profits after giving a proper return on capital, and providing reserves for depreciation and betterment. High wages were not necessarily a handicap; low-paid labour was not necessarily economical. Labour must be economised with the loyal co-operation of the working man. Some English employers had reduced their working hours with beneficial results. Reasonable holidays with pay should be allowed to the manual worker as to the clerical. Conferences which had been held to bring about better relations between employers and employed impressed him favourably, and he believed good results would follow. Production without extended markets would not be sufficient. In addition to being in a better position to supply Home demands, they would have to seek wider fields in the Empire and in foreign countries. We had suffered in the past from want of British representation. The necessity for large scale industrial organisation would remain after the war, indeed it would be irresistible, but he hoped and believed that the necessity for State control was only temporary. The day of small industries on individual lines was past, and our manufacturers and traders must organise for united effort, or many of the obstacles would not be overcome. Organisation meant increased stability, and a stable industry could weather storms which would wreck the small producer. The financing of industry would be immensely facilitated by organisation. An unstable, unorganised industry was the despair of bankers. Financial assistance might be required, Overseas trade generally demanded long credit and longer term advances than deposit bankers usually gave. New ideas must be investigated and developed, and that often required money, patience, and experiment.

TELEGRAPHY AND TELEPHONY AT THE FRENCH FRONT.

THE maintenance of continuous communication between General Headquarters and every part of the fighting front is one of the most important factors of success in the kind of warfare which has been evolved during the long struggle

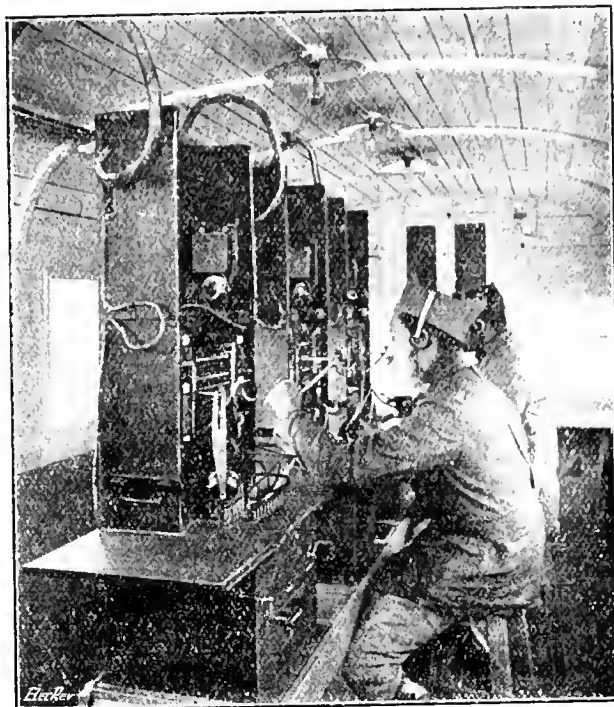
(June 1st) illustrated a number of signalling stations in this part of the French system of communications—in and near the trenches—and we are now able to reproduce some French official photographs showing the arrangements in vogue further back, but still beyond the limits of the permanent lines of the telegraph and telephone administration. It will be seen that portability is an essential element in the constitution of these stations, but the apparatus and



[French Official.]

FIG. 1.—A CENTRAL TELEGRAPH STATION.

in France and Flanders. The forward course of traffic is from G.H.Q. to the Headquarters of the various Army Corps, thence to the respective divisions, brigades, and finally the trenches. In the rear are the main lines of communication between G.H.Q. and the high command, London, and Paris, as well as the hospital bases, store depôts, &c.



[French Official.]

FIG. 3.—PORTABLE TELEPHONE SWITCHBOARD IN CABIN.

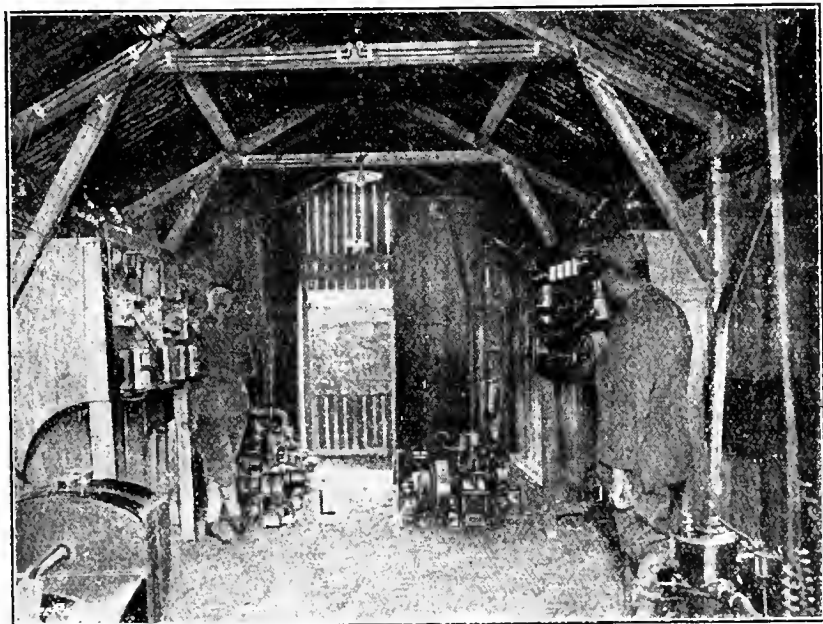
methods employed approximate more closely to those used by the civil service.

Fig. 1 is an exterior view of a "Central d'Armée," consisting of cabins which are provided with wheels, but are, for the time being, mounted on trestles and furnished with convenient staircases. A terminal pole, from which telegraph and telephone wires will radiate to other offices, is approaching completion, and the indications are that this station is not likely to be moved for a fairly long period. The same impression is given by fig. 2, which represents the interior of the dynamo room, a shed roofed with corrugated iron and equipped with four petrol engines driving small dynamos for charging accumulators, lighting the offices, &c.

Fig. 3 shows the interior of one of the cabins, fitted with a magneto-calling telephone switchboard, constructed in portable sections, which can be closed for transport; the services of two men are required, indicating that there is a considerable amount of traffic through this office.

In fig. 4, another interior, there is further evidence of proximity to—or, at least, connection with—civilisation, in the shape of two Hughes printing telegraphs, in addition to telephone apparatus; and in fig. 5, the interior of a "Central de Cap d'Armée," are two telephone switchboards and a Morse recording telegraph instrument.

Since the arrival of the American contingent at the Front, says *Telephony*, the United States Army Signal Corps has completed an entirely independent system of communication lines connecting General Pershing's headquarters with all parts of his command and adjoining

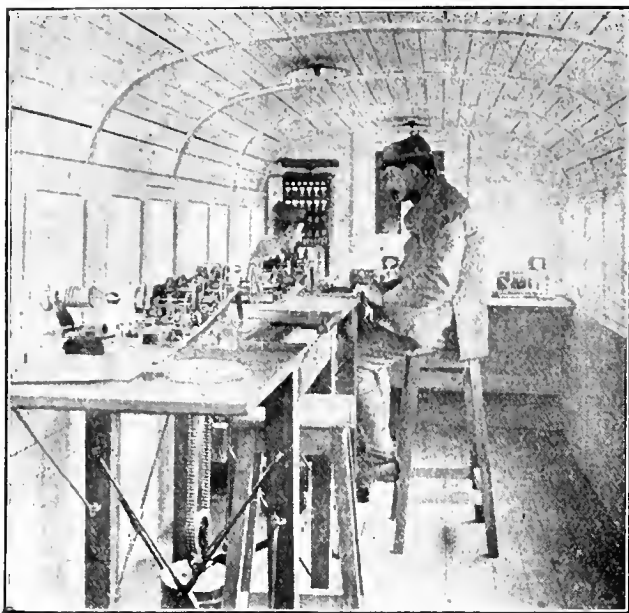


[French Official.]

FIG. 2.—DYNAMO ROOM.

As the network approaches the firing line, the methods and apparatus adopted assume simplified and specialised forms, more portable and more readily rigged up and repaired than in districts more remote from the zone of conflict, and finally arrive at the telephone and buzzer sets which represent the limit of handiness and simplicity. We recently

villages. Everything except the poles was brought from America. Admirable portable telephone switchboards have been devised and supplied at the shortest notice by the U.S. manufacturers. It is interesting to note, too, from the



French Official.

FIG. 4.—HUGHES PRINTERS IN CABIN.

Telegraph and Telephone Age, that the Paris authorities have modified the rule which was laid down at the beginning of the war restricting telephone conversations to the French language: English is now permitted.

THE FUTURE OF THE ELECTRICAL INDUSTRY.

By A. O. HOLT.

Much has been written and said during the past few months concerning a subject of great national importance, viz., "Our Educational System." Mr. Fisher, the Minister for Education, deserves the thanks of the nation for the able manner in which he has reviewed and dealt with the system as a whole, and, undoubtedly, a new era has dawned for the teaching profession. Chief amongst the findings was the fact that teachers were most badly paid, so much so, that many who had a natural gift for training our children were ignoring that gift, and turning their attentions to more remunerative professions. More over, it has been noted that in the past there has been an entire absence of sympathy between various sections of those responsible for the training of the youthful minds of the country. Our great Universities have shown little or no interest in the Public Schools. The Public Schools have never been in real touch with our large Grammar Schools, while they, in turn, have regarded the Primary Schools as the medium merely for turning their own particular grade of youth out upon the world. In short, none of the sections have felt that they had anything in common.

These defects are, in the near future, to be remedied. There is to be a better and more sympathetic understanding between the various grades of the teaching profession, and a large Government grant has

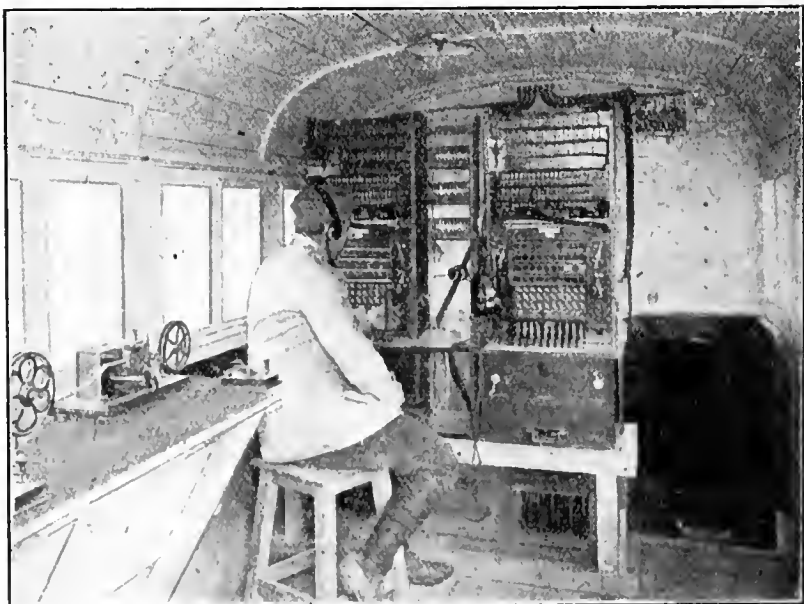
been made for the purpose of increasing salaries, as an inducement to those best qualified for this important work.

Now, the writer is of the opinion that while the foregoing does not concern engineers, it forms an excellent parallel for the electrical industry, and many serious defects might be discovered by a close study of our engineering methods by those engaged in this important science.

With as much has been written and said about our trade after the war, we must be prepared to hold our own against other countries, particularly our enemies, in the struggle for electrical markets. We are engaged in a vast linking-up scheme, whereby we can economise our coal consumption so as to work at a high efficiency, and, generally speaking, we tell ourselves we must be in the van, both technically and commercially, in all matters concerning the electrical future. What are the facts to-day? What is the canker that is gnawing at the roots of our business in just the same way that it was in the teaching profession? Economy in salaries—that is the canker. Our leading engineers have been making precisely the same mistake as the education authorities did.

The writer was, some few weeks ago, invited to the house of a gentleman of what might be termed higher middle-class standing. The morning was spent discussing the best methods of entering the electrical industry as a career for his son, a promising youth just leaving school. The matter was thoroughly discussed, and it was pointed out that much hard work and study would have to be put in to rise to anything more than a mediocre position. Salaries were also mentioned and prospects of advancement, and there for a time the matter ended. Some weeks later the writer found that the youth in question had gone into an entirely different line of business, the explanation being that the chances of a decent salary and reasonable advancement were so remote for the work to be put in that it had been decided the youth could not hope to attain to, or keep, the social standing he had been used to for many years to come.

Inadequate salaries!—there it is. Many excellent youths, brainy, and with a predilection for the profession, are kept from engineering because the average father cannot find anyone of his acquaintance in the engineering line who is receiving a salary anything like in keeping with that of an ordinary middle-class business man. It would be interesting to know what proportion of electrical men under 40 years of age are getting over £250 per annum. The writer has seen engineers of considerable ability resign the positions they held and leave the profession



French Official.

FIG. 5. TELEPHONE SWITCHBOARDS AND MORSE INKER IN CABIN.

entirely to take up more remunerative posts in businesses in which the engineering part was but a side issue.

Engineers will stick it, for pride of profession, up to a

point, but, unless their hopes are fulfilled, and they get a salary in keeping with that of the average business man, they will not hesitate to take their leave of engineering, and will advise our youths to fight shy of it also.

Now, in taking a general survey, what do we find? Our leading engineers, both in control of manufacturing works and of large power supply undertakings, are out to economise first, last, and all the time, and this economy usually takes the form of small salaries. They are making the same mistake as the Board of Education did—starving the profession—choking off, as it were, the would-be engineers of the future by the treatment of the staffs under them. It is a lamentable fact that so soon as an engineer assumes control, either of a works or a large supply system, his whole pride as an engineer is invariably sunk in the piling up of dividends or relieving of rates, chiefly at the expense of his fellow engineers, who are treading exactly the same paths that he trod. Our engineers become more or less successful managers, and, unfortunately, cease to appreciate the valuable work carried on by their staffs, as proved by the miserable salaries doled out. Let engineers in command note that in sacrificing their profession and their fellow engineers they are not only doing a disservice to the electrical industry of the country, but are diverting many of the best brains of the youthful element into more remunerative channels.

And the staffs, that long-suffering body of men who have proved their patriotism over and over again during the past three years, what have they in common with their chiefs? Nothing. They have learned, reluctantly and with bitterness, the lesson that Governments only treat with collective organisations, and that the chief engineers, to whom they looked in their loyalty for some assistance, have literally left them to starve. Staffs are now organising, and are resolved to have a say in the scheme of things. The spirit of organisation is in the air, and is permeating the tissues of the most conservative amongst us: but to what end? The consolidation of our forces so as to be in the front rank of engineering matters after the war?—far from it. Rather to force chief engineers to give them a living wage, and one that they need not be ashamed of owning up to. The average staff engineer is being irritated beyond endurance in finding himself barely better off, and in many cases worse off, than the man with no technical ability, while his position will not bear comparison with that of an ordinary business man.

What is needed just now is an engineer to play the rôle of Mr. Fisher, in the electrical world—someone to review the industry as a whole, who can put his finger on the weak spots, see that the "economy" idea—especially in salaries—is not carried too far, and, with an eye to the future, map out a course in which our leading engineers, staffs, workmen, and embryo engineers can co-operate, so as to steer the electrical industry towards a better, more peaceful, and more sympathetic understanding during the commercial war that will inevitably follow with the introduction of peace conditions.

A LONG-DISTANCE DUPLEX-WORKING CENTRAL-BATTERY SYSTEM.

By R. L. MILBURN.

In this system the apparatus at the home station consists of a double-current key with 9 terminals, 3 top, 3 bottom, and 3 movable, a polarised G.P.O. 200-ohm relay, a rheostat with condensers up to 30 microfarads, and a sounder and local battery. At the out station (fig. 1) the apparatus consists of a key, Vyle sounder, and rheostat without any condensers. Three relays joined in series locally were used in place of the key, as shown in fig. 2.

Mode of Balancing.—The out station depresses his key, cutting off his rheostat, and measures the current, say 39 milliamperes; he then releases his key, and adjusts his rheostat until he measures $\frac{1}{3}$ of 39, or 13 milliamperes; 26

milliamperes is then measured in the rheostat branch after adjusting the rheostat.

Both stations now start balancing, the home station increasing capacity till signals are perfect. The Mandalay-Rangoon circuit, 386 miles of iron wire, required 21 microfarads to balance the capacity of the line.

When Wheatstone and Bandot were both working, 39 milliamperes were found to give perfectly satisfactory results. Both relays were adjusted neutrally.

The currents utilised for working duplex with Rangoon were:—

1. 7 and 21 milliamperes with 100 volts.
2. 10 and 30 140 ..
3. 13 and 39 160 ..

The currents can be traced as follows:—

1. Neither station sending—Mandalay line coil has 13 milliamperes negative current passing from K to L, and 26 milliamperes negative current passing from K to W through rheostat, giving 13 milliamperes negative current passing in the non-working direction of Mandalay relay

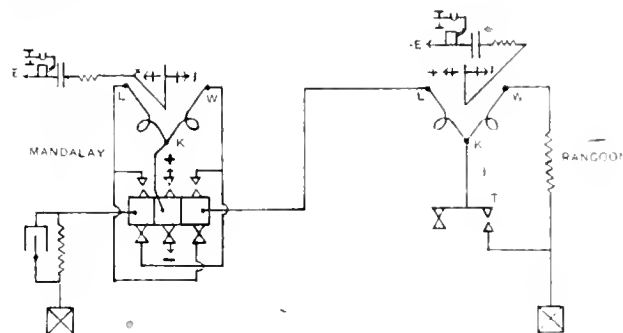


FIG. 1.

at the same time that 13 milliamperes negative current passes on to Rangoon through his relay from L to W to rheostat and earth: being in the non-working direction, at both stations the relay tongues remain at spacing.

2. Mandalay sending—Mandalay line coil has 13 milliamperes positive current passing from K to W, and 26 milliamperes positive current passing from K to L, giving a preponderance of 13 milliamperes positive current passing from K to L in the non-working direction, hence Mandalay relay remains at spacing, but 13 milliamperes positive current passes through Rangoon relay from L to W, producing a mark at that station.

3. Rangoon sending—Mandalay line coil gets 39 milliamperes negative current passing from K to L, and 26 milliamperes negative current passing from K to W, 39—26

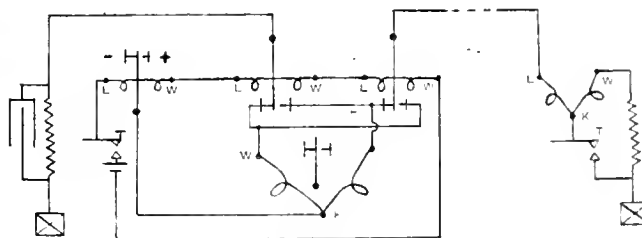


FIG. 2.

giving 13 milliamperes in working direction, and causing a mark at Mandalay, but 39 milliamperes negative current passes through Rangoon relay from L to K in the non-working direction, causing the Rangoon relay tongue to remain at spacing.

4. Mandalay and Rangoon both sending—Mandalay line coil gets 39 milliamperes positive current, passing from K to W, and 26 milliamperes positive current passing from K to L, 39—26, giving 13 milliamperes passing in the working direction at Mandalay, and 39 milliamperes positive current passing from L to K in working direction at Rangoon, hence both station relays will mark.

The system has been worked successfully between Rangoon and Mandalay, a distance of 386 miles, and there is reason to believe that it could be worked up to 600 miles.

OFFICE ORGANISATION IN MUNICIPAL ELECTRICITY UNDERTAKINGS.

By G. W. STUBBINGS.

THE subject matter of this article, which some two or three years ago received a good deal of attention, has lately been little heard of. As there is reason to believe that the separation of the financial management of municipal electrical undertakings from the electrical engineer's department is by no means obsolete, it may be useful to say a few words on this matter with a view to pointing out the peculiar disadvantages of such a system.

The system in question may be briefly described as one in which the control of all money matters in connection with a municipal electricity undertaking is vested in the department of the borough accountant, and is quite removed from the jurisdiction of the engineer and manager. The theoretical reason for this procedure is presumably based upon the idea that finance is a matter as important in its way as the generation and distribution of electricity, and should therefore be controlled by an official and staff specially trained in such work. Obviously, such a principle applied with sufficient strictness would remove from the control of the engineer and manager the whole of the clerical staff. This extreme course is not adopted, but a line seems to be drawn so that all matters involving the paying or receiving of money are managed by the accountant's department. Even this rule has to be relaxed slightly in some small instances—for example, in the case of small cash sales at the works or the showroom when money is received. It therefore appears that the system, so far from resting on any very logical or well-defined principle, is rather the outcome of sentiment or prejudice. It results in such a curious state of affairs as the business of one concern being carried out in two separate offices, which may be a mile distant from each other; or of a clerk in the electricity works office who deals with meter readings, having his time occupied, not in making out consumers' accounts, but in copying the meter readings into books, which are duly taken to the office of the borough accountant in order that another clerk may copy them into another book, and, finally, make out the consumer's demand note.

The real reason for such a state of affairs, inefficient and inconvenient as it undoubtedly is, seems to be found in a misunderstanding of the legitimate functions of the borough accountant's department. Whatever work such department may carry out, or whatever control it may exercise in connection with the smaller non-trading departments of a Borough Council, it seems clear that the accountant and his staff should function, with respect to the electricity undertaking, as auditors only.

A small shopkeeper will, if he is wise, take care to have his books made up periodically by a competent book-keeper; but a large firm will keep a staff sufficiently trained to do this work, and will not call in outside assistance to make out customers' accounts. The auditing of the books by qualified accountants is, of course, compulsory in the case of a limited liability company, and it is, perhaps, the legal status thus given to accountants which makes them inclined, in the opinion of many impartial onlookers, occasionally to over-estimate the scope of their responsibilities and importance.

The advantages of having the whole of the business side of an electricity undertaking under the direct control of the electrical engineer and manager are obvious and manifold. A larger salary can be paid to the chief clerk, who can then be a man having a good training in accountancy. Overlapping of the work will be entirely eliminated; and in cases where the offices of the electricity department and the borough accountant are some distance apart, a host of correspondence will be saved which otherwise would be necessary, due to the many queries which would inevitably crop up owing to the abrupt break in the routine of the work. The steps in the sequence, from reading the consumer's meter to receiving the money in settlement of his account are easy and gradual; but if the routine be interrupted in the middle of its course and transferred to other hands, friction is almost bound to occur.

A further advantage in the system of single control arises from the fact that a great number of consumers' complaints are received at the time of paying their bills. This is, perhaps, not unnatural—and frequently these complaints are of a most trivial nature. If they are received by the accountant's department they have all to be noted, and communicated by letter to the electrical engineer, when, as it is then sometimes impossible to decide the importance of any particular complaint, great waste of time can be occasioned by following up such as are only trivial. If these complaints were received at the office of the electricity department, the majority of them could be dealt with there and then, an immense amount of time thereby being saved.

It is, of course, understood that the borough accountant will be vested with the authority of an auditor with respect to the financial matters of an electricity undertaking. This is, however, quite a different matter from the normal routine work being carried out by his staff, and in his office. Matters concerning the capital of the undertaking and the raising of loans will also, naturally, be the accountant's concern. It seems, however, that there is a very clear case for the routine work of rendering consumers' accounts, and the collecting of the same, being undertaken by the clerical staff of the electricity department. The disadvantages and clumsiness of the older system are manifest, and it is greatly to be deplored that prejudice and conservatism so frequently stand in the way of the inauguration of a simpler, smoother, and more efficient system.

AUTOMATIC CONTROL OF BLAST PRESSURE FOR DIESEL ENGINES.

By HERBERT S. RUSSELL, B.Sc., M.I.E.E.

(Abstract of paper read before the DIESEL ENGINE USERS' ASSOCIATION.)

THE working of a Diesel engine is substantially improved if the pressure of the air which blows the fuel into the cylinders is regulated according to the quantity of fuel to be blown in, or, in other words, according to the load on the engine, as the quantity of fuel used varies with the load. The present practice is for the regulation of the blast pressure to be effected by hand, but the objection to this is that, with variable loads, it demands constant attention from the man looking after the engine.

Automatic devices to effect this control have been tried in the past, without practical success. In the electrical air regulating device which has been developed by Messrs. Mirrelees, Bickerton & Day, the difficulties have been overcome, and the air pressure can be varied according to the load, irrespective of the efficiency of the air compressor, and without loss of compressed air.

Fig. 1 is a diagram of connections. The main current is passed round the solenoid A and controls the finger B, which is arranged to move round the scale of a pressure gauge, and is calibrated to point to that blast pressure which is best for the engine for the amount of power being generated at the moment, its "zero" or "no load" position being the no-load blast pressure. The pressure gauge is connected to the blast pipe; consequently its finger C points to the pressure in that pipe at any time. Both fingers are provided with platinum contact pieces D, E, and are insulated one from the other. The fingers B and C act therefore as a single-pole switch and make and break a relay circuit, which in its turn makes and breaks the circuit which operates the throttle valve F on the air-compressor inlet. The normal position of the throttle valve is closed, and it is held in that position by a spring G.

Supposing now that the engine is at work and the pressure in the blast pipe is lower than that indicated by the finger B, as being the proper pressure for the load, the fingers would be apart, and no current would pass through the relay coil H, so that the core J would make contact with the carbons K. This would complete the compressor throttle valve circuit, and the current would then pass through the solenoid L and pull the core (which terminates in the throttle valve F) downwards, and so cause the throttle valve to be held wide open, as illustrated on the diagram of connections. The pressure in the blast pipe would then rise rapidly (the compressors always have a substantial margin of capacity), so causing the gauge finger C to move up to and make contact with finger B. This would complete the relay circuit and cause a current to flow through the relay coil H and pull up the core J, thus breaking contact with the carbons K and breaking the compressor throttle circuit. The throttle valve F would immediately close under the action of the spring G, and it would remain so until the fingers came apart again. The slightest variation in the blast pressure or the load will operate the

relay, thereby opening or closing the throttle valve, as the case may be. When on a dead steady load the relay is continually in operation, and no variation in the blast pressure is visible. A variation of from 550 lb. ("no-load" blast pressure) to 950 lb. ("full-load" blast pressure) can be obtained in four seconds. As the fly-wheel takes several seconds to slow down in speed so that more fuel can be admitted by the governor, the correct pressure is always on the top of the fuel.

Fig. 2 shows the arrangement of the air inlet control valve for the compressor. This is divided into two parts, the top portion containing the valve and the bottom portion the solenoid. In the valve easing A, which is made of cast iron, a gun-metal liner B is fitted, having a series of holes in its periphery. In this liner the piston valve C is situated. This piston has a series of holes in its periphery which come opposite the holes in the liner when the valve is open. A groove is turned on the inside of the liner B in line with each row of holes, and similar grooves on the outside of the piston, so that the air has a free passage through the holes even if the piston is turned so that the holes do not coincide. The piston is fixed to a central spindle D, the bottom part of which forms the core for the solenoid. The valve is normally held closed by the spring E.

When current passes through the coil F situated in the bottom or coil casing G, the pressure exerted by the spring E

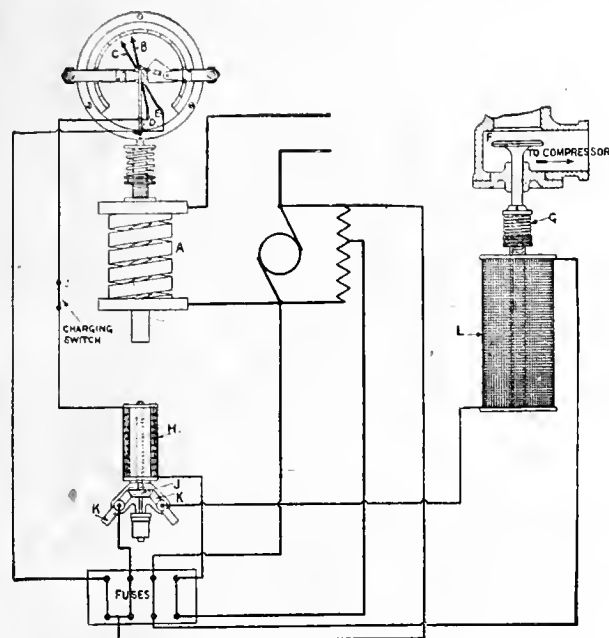


FIG. 1.—DIAGRAM OF CONNECTIONS OF ELECTRICAL BLAST CONTROLLER.

is overcome and the valve opened. The requisite opening is governed by the top adjusting nuts H, or, rather, the minimum opening required for "no-load" blast.

When the valve is opened air is drawn into the valve (due to the suction of the air-compressor piston) through the openings K and L into the interior of the valve, then through the holes in the piston and liner into the annular space M round the valve, and thus into the compressor. Holes N in the bottom of the piston are provided for the purpose of balancing the piston when in operation, so as to ensure free action, which would otherwise be impeded by the cushion of air below the piston. The air which passes through the annular opening L enters the piston through the holes N *via* the holes O drilled in the spigot of the coil casing G.

The coil itself F is made in two sections, and wound in such a way that both the terminals come to the centre of the coil, and, furthermore, are brought from the outside of the coil into the terminal block P. In the event of one of these terminal wires breaking, to obtain a new end all that is required is to unwind sufficient from the outside of the coil for this purpose.

The apparatus is made in three forms, a switchboard type, a pillar type, and a bulkhead type. The pillar type, as shown in fig. 3, consists of three sections, the top case A, intermediate box B, and pillar C. In the top case the control gauge D, main-current solenoid E, relay coil F, and fuses G are situated, mounted on mica covered rods H, which are secured to vertical bars fixed to the casing A. The front of the case is covered by a door secured by eye bolts and thumb nuts, two of which act as hinges. The main cables are led up the pillar C, and are fixed to the terminal block J, and the ends of terminal bars K, held by the top and bottom coil supports L. The case is insulated from the terminal bars by the ferrules M, and from the smaller wires by ferrules N. A large door O is fitted to the intermediate box B for easy access to the cable connections.

When the apparatus is used in connection with alternating currents the main solenoid is comparatively light, and the intermediate box B is used to house a transformer.

The apparatus is connected across the generator terminals so that it is always in operation and independent of the main switchgear; the power required to operate it is 50 watts.

A switch is mounted on the gauge board, and is so connected that when open it breaks the relay circuit, thereby causing the air inlet valve to be held full open when it is desired to charge the starting receivers.

Where this automatic blast control apparatus is fitted to Diesel engines very important advantages are obtained, among which the following may be particularly mentioned: Smoother running; saving of fuel on variable loads, as the control reduces the power absorbed by the compressors, and com-

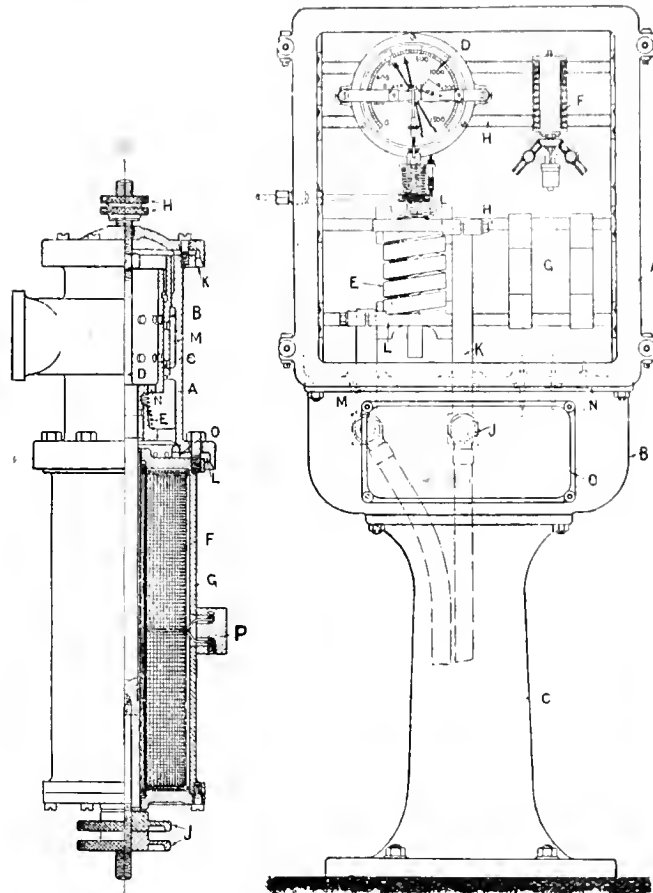


FIG. 2.—ARRANGEMENT OF AIR INLET VALVE.

FIG. 3.—CONTROL GEAR: PILLAR TYPE.

plete combustion is more uniformly obtained; less attendance; less attention to exhaust valves, due to the complete combustion of the fuel at all loads, which ensures a clean exhaust; blast bottle dispensed with, a small separator being inserted in the pipe between the H.P. delivery from the intercooler and the blast distributor on the engine; parallel running of alternators facilitated; at sea an engine, as in the case of plants supplying current for lighting and wireless telegraphy, may be run after the engine-room has been abandoned.

Although this apparatus has so far only been fitted to Mirlees-Diesel engines, it is applicable to all makes of Diesel engines.

WAR ITEMS.

Lord Balfour's Committee.—Lord Balfour of Burleigh's Committee on Commercial and Industrial Policy After the War held a further sitting last week.

An Undertaking Repudiated?—In the "Times" for November 10th there appears a letter from Sergeant W. M. Ronaldson which certainly calls for reply from the Falkirk and District Tramways Co. From the statement itself, and from a letter from the company that is published along with it, it appears that Sergeant Ronaldson left the company in August, 1915, to join the Colours, and it was understood that his position as traffic superintendent was to be kept open. The directors under date October 3rd have written to him stating that as no one really anticipated that the war would continue so long, and as there are no signs of it coming to an end, they cannot keep the position open any longer, and will have to make a permanent appointment. As the *Times* points out, any general repudiation of this kind would undermine the whole feeling of security in which a large part of the Army went to war.

Trading with the Enemy.—The "London Gazette" for November 9th contains names of additional firms in the following countries with whom trading is prohibited:—Argentina, Paraguay and Uruguay, Bolivia, Brazil, Central America, Chile, Colombia, Netherlands, Netherlands East Indies, Norway, Peru, Spain, Sweden, and Venezuela.

Electrical Workers' Bonus.—With reference to the Skilled Time Workers' Wages Order, and the Ministry of Munitions explanatory circular M.M. 165, dated October, 1917 (see ELEC. REV., October 26th, p. 394, and November 2nd, p. 419), the Ministry has now issued a further circular specifying the occupations of scientific instrument maker (metal), and electrical fitter, as among those entitled to the bonus of 12½ per cent. if the men satisfy all the conditions of the Order. Skilled men in all the occupations that have been mentioned are covered by the Order, whether working in ferrous or non-ferrous metals. Only those skilled men in these occupations who are paid at or above the current district time-rate for turners and fitters are covered by the Order.

Works War Savings Association.—The Faraday Works War Savings Association, formed among the staff and employes of Messrs. Gent & Co., Ltd., Leicester, held their first annual meeting on November 8th. The secretary's report of the year's work showed that there were 140 members on the books out of 200 employes. Cash collected amounted to £750, making a total of 980 certificates purchased. The Association commenced with a membership of 60, which has been steadily increasing, thus showing that the idea, as elsewhere, has "caught on." Interest was stimulated as a result of the meeting, and 10 new members joined on the following Saturday.

Silvertown Employes' War Funds.—The Silvertown Co.'s Employes' War Relief Fund now totals £1,800. Each £100 collected is distributed as follows: £75 to the British Red Cross Society, £15 to the Serbian Relief Fund, £10 to the Anglo-Russian Hospital (Petrograd). In March last a War Savings Association (for the purchase of certificates by weekly contributions) was started by the India-Rubber Co.'s employes, and has been very successful. There are now 1,020 members.

Subscriptions to the German War Loan.—The following subscriptions, among others, are reported to have been made to the seventh German War Loan:—

A.E.G., Berlin	£500,000
Dynamo Brush Special Works, P. Ringsdorf, Mehlem	8,700
F. C. Guillaume, Cologne	150,000
Theodor V. Guillaume, Cologne	125,000
Pelten & Guillaume, Carlswerk	200,000
Emag, Electrical Measuring Instruments, Apparatus, and Switchboards Co., Frankfurt-on-Main	7,500
Hedderheim Copper Works & South German Cable Works	100,000
Continental Caoutchouc & Gutta-Percha Co.	375,000
L. Schwartzkopf, Berlin	250,000
Saxony Light & Power Works	175,000
Vollhorn Rope & Cable Works	50,000
Electrotechnical Works (late Stroecker & Co.), Offenbach	5,000
Rheinfelden Power Works	12,500
Electrotechnical Works, Offenbach, A.M. (late Schroder & Co.)	100,000
Max Schorch & Co., Rheidt	750,000
Siemens-Schuckert Circles, Nuremberg	75,000
Cassirer & Co. (Cable Works), Berlin	10,000
Richter Electricity Co. (Wol & Co.), Frankfurt-on-Main	10,000
Siegerland Electricity Works	75,000
Rheidt Cable Works	100,000
Electricity Co. (late Lahmeyer & Co.)	10,000
Lech Electricity Works, Augsburg	15,000
Telephone Apparatus Works, E. Zwietsch & Co., Charlottenburg	10,000
Lower Silesian Electricity & Tramway Co.	50,000
Voigt & Haeflner	10,000
Saxony Tramway Co., Plauen	75,000
Ludwig Sudicatis & Co., Berlin (Berlin Telephone Works Group)	25,000
Telephone & Telegraph Construction Co., Frankfurt-on-Main	100,000
C. Lorenz & Co., Berlin	15,000
Eupen Cable & Rubber Works Co., Eupen	15,000
Insulated Wire Works Co. (late Vogeli), Berlin	200,000
Deutsche Incandescent Gas (Auer) Co., Berlin	15,000
Telephone Apparatus, Cable & Wire Works Co., Nuremberg	7,500
Purchasing Association for Electrical Requirements, Frankfurt-on-Main	7,500
Accumulator Works Co., Berlin and Hagen	125,000
Land & So. Cable Works Co., Cologne-Nippes	25,000
Hartmann & Braun, Frankfurt-on-Main	50,000
Hermann Gradenwitz's Electric Motor Works, Berlin	7,500
Kempen-Rhein Electrotechnical Works	7,500
Hartmann & Braun (Officials and Workmen of), Frankfurt	5,900

Foremen and Draughtsmen and the War Bonus.—The following letter, received by the London Association of Foremen Engineers, speaks for itself:—

"Ministry of Munitions of War,

6, Whitehall Gardens, London, S.W. 1.
November 12th, 1917.

"Sir,—I have to refer to the interview with you on November 9th and previous interviews with regard to the remuneration of foremen in controlled establishments.

"In reply, I have to state that the Minister has no power, under the Munitions of War Acts, 1915 and 1917, to make any award applicable to persons in receipt of an up-standing salary, and it is contemplated that, in the first instance, employes should negotiate with their employers in the ordinary way, and endeavour to arrive at an agreement, which should then be submitted to the Minister for consideration. In the event of deadlock or failure, it is open to either party to refer the matter to the Ministry of Labour (Chief Industrial

Commissioner's Department) as a difference under Part I of the Munitions of War Act, 1915.

"With regard to the 12½ per cent. bonus which has been awarded to time-workers under the Skilled Workers' Time (Engineers and Moulders) Wages Order, 1917, I have to state that this Department would be prepared to consider an advance to the foremen and draughtsmen in receipt of emoluments not exceeding £250 per annum, provided that they are not in receipt of a bonus on output, and proposals which have been agreed between employers and employes with regard to this should be similarly submitted to the Minister for his consideration.—I am, Sir, your obedient servant,

(Signed) EDGAR DAVIS.

"J. HARRINGTON, Esq.,

London Association of Foremen Engineers,
85, Salisbury Road, Harrow."

Exemption Applications.—The Fulham Board of Guardians applied to the Local Tribunal for the renewed exemption of an engine-driver and electrician, aged 27, married. It was stated that the man was responsible for the maintenance of the electric plant at the workhouse, which is now being used as a military hospital. The Tribunal granted four months' exemption.

At the Cromer Tribunal, Messrs. Edmundson's applied for a mains foreman and general assistant, employed at the electricity works, aged 35, married, and classed A. He has been engaged in a similar occupation for 14 years. Conditional exemption was asked for on the ground that he was essential to the carrying on of the undertaking. He was in a certified occupation. No previous application had been made for him; he had been previously badged, having been lent by the Cromer branch of the firm for Admiralty work. Mr. Kerr, for the Military Authorities, contended that when he was lent to the Admiralty for a time the firm did very well without him, and the question was, could not they spare him now? The manager said he had no other reliable man to attend to the mains. While this man was with the Admiralty another took his place, but he left in January, and that was the reason why the man appealed for now was brought back. If this man was taken he had no-one to attend to the mains. He had to do it himself last year from January to June. The Chairman said it was absolutely essential to the convenience and welfare of the public that there should be someone who was capable of dealing with accidents. He put it to the military that unless an efficient substitute could be found the interests of the town would be very much prejudiced by the man being taken. He ought not to be taken away from the town until some other man was able to take his place and do the work he was now doing. The Tribunal granted conditional exemption, the Chairman remarking that that decision did not prevent the military authorities bringing up the case again if they could find someone in a lower category qualified to take his place.

At Northampton Tribunal, E. Goulston, 39, category A, electrical engineer, applied for exemption. He said he had been 15 years in business, and would have to close if he was sent into the Army. He was solely responsible for the maintenance and repair of the X-ray, medical, and surgical apparatus, and the electrical installation at Northampton General Hospital, and for the electrical installation and apparatus at Northampton School Clinic. Six months' exemption was given.

At Rugby, a tester at the B.T.H. Co.'s works, who is of Russian nationality, aged 20, and in Class C2, was exempted until March 1st in view of the importance of the work he is engaged upon.

At Weymouth exemption was applied for, for W. S. Beale (26, C2), stoker at the electricity works. It was urged that the man's occupation was most important, that the staff at the works was greatly reduced, and that there was great difficulty in maintaining the works. With the Military assent conditional exemption was conceded.

Before the Hunts Appeal Court, the Military appealed against exemption to January 30th given to the assistant to the electrical engineer at the Winchester Corporation Works. He is 18, and the Military Representative said that the services of so young a man in Class A should be available for the Army at once. It was stated that time was required to train a substitute. The appeal was allowed, the calling-up being fixed for November 29th.

An electrician (31, B2), appealing at Sutton (Surrey), stated that he was the only one left to carry on the business. The appeal was respite for a month, with a view to substitution.

At East Grinstead, Sir G. L. Eyles, The Croft, appealed for C. W. Hollingsbee (33, C3), electric light attendant, and, with the Military consent, he was exempted until March 4th.

At Chichester, three months' exemption was granted to an electrical engineer and contractor (36, Class C2), and a final month to an electrical wireman and fitter (24, C3).

Before the Herts. Appeal Court, exemption was claimed for W. H. Marter (35), electrician at Stanborough Park, Watford, who is in charge of the plant of the International Tract Society, Ltd. The appeal was dismissed, the calling-up being suspended until January 1st.

At Windsor, Mr. H. Fowler, electrical engineer, appealed for F. G. Isgrove (18), his apprentice. Mr. Fowler is serving in the R.N.A.S., and it was urged that if Isgrove had to

join up great hardship would ensue, as there would be no skilled person to take Mr. Fowler's place in the business. A medical examination was ordered.

At Whitby, Mr. J. W. Piggott, electrical engineer to the U.D.C., appealed for an electrical apprentice (18), to enable him to train a 17-year-old youth to take his place in the sub-station, and temporary exemption until March 1st was granted.

At Gloucester, an electrical engineer (40, B1), carrying on business in the city, was conditionally exempted on becoming a Special Constable.

At Tunbridge Wells, Mr. Powell, electrical engineer, appealed for A. T. Spurrell (C1) and A. E. Hills (B1), electric light wiremen. The former was refused exemption, with the calling-up on January 1st, and Hills was exempted until a suitable substitute is found, he to join the V.T.C.

At Rochdale, on the recommendation of the Advisory Committee, exemption until March 31st has been granted to R. Rhodes (39, C2), blacksmith's striker, appealed for by the Corporation Tramways Committee.

At Brighton, the Corporation tramway department appealed for 31 men—a traffic superintendent, four traffic inspectors, five skilled mechanics, a night foreman, and 20 drivers. It was stated that 239 men had left the service for the Colours, and that the engineer was opposed to women drivers of trams. The Tribunal granted four months' exemption. In the course of the hearing, Mr. W. Marsh, the engineer and manager, said that since the last appeal there had been a very bad tram accident at Dover, in which 11 people were killed on the spot. The accident was due to a driver losing his head. He was a discharged soldier, and had suffered from shell shock. Many of the men now driving at Brighton were returned from the Front, but discharged soldiers were not coming forward, as they could not stand the strain. The Brighton system had been open for nearly 16 years, and they had never had a bad smash, but if they put inexperienced men on he would not say what the consequences would be. It would not be safe to put women drivers on the many steep hills of the town. He was employing women in the sheds on heavy and dirty work, and they were keeping to it, but he would not have women drivers. The track was bad, but they had so few men to work on the tracks. They did not want a second Dover. They had some drivers who had stiff legs; they were all right otherwise. If the right foot and leg were all right the men were capable, assuming their general health was satisfactory, to drive a tramcar. The brakes were worked with the right foot.

LEGAL.

ELECTROLYTIC CORROSION OF TELEPHONE CABLE.

AN interesting case was heard by his Honour Judge Hugh Sturges, K.C., in the Blackpool County Court, on November 7th. The action was brought by the Postmaster-General against the Blackpool and Fleetwood Tramroad Co., Ltd., claiming the sum of £16 18s. as damages alleged to have been caused to a telephone cable by a leakage of electrical current from the defendant company's lines.

Mr. Ross Brown, for the plaintiff, remarked that although the amount of the claim was a comparatively small one, a question of liability was raised which both parties desired to have settled. It was contended that, under the Telegraph Act of 1878, the Postmaster-General was entitled to have made good any damage caused to the cable by the defendants or their agents. The defendant company had constructed and ran a tramroad between Blackpool and Fleetwood, on the overhead trolley system. The current, after feeding the car, was supposed to be conveyed back to the generating station by means of the tram-rails, but, probably owing to the imperfect bonding of the line, a leakage of current had taken place. The telephone and telegraph cables of the Postmaster-General run practically parallel with the defendants' line, and the leaking current attacked those cables, corroding the lead sheathing, and resulting in a breakdown of the cable, and, consequently, an interruption of telephonic communication. Owing to corrosion alleged to have been caused by the leakage of current near Red Bank Road, Bispham, a length of 52 yards of cable had to be renewed, and it was the cost of this work which was now sought to be recovered. Mr. Ross Brown read correspondence which had passed between the parties, in which the defendant company pointed out that the tramroad was laid in 1898, while the Post Office cable was laid only two years ago. Mr. Ross Brown admitted that the Post Office were second comers, but he contended that this fact did not invalidate the claim. The defendants suggested that the cables should be bonded to the tramroad lines, and the Postmaster-General replied that he was agreeable, if the defendants would agree to bear the costs. The bonding was done, and the cost was included in the account.

Mr. EDWIN JOHN HAMMOND, engineer, gave evidence as to testing the leakage in July of last year, which, he said, was 5 volts maximum, with a 2 volts minimum, and the latter leakage would be sufficient to cause electrolysis. If the defendants' line had been perfectly bonded the line would have been the easier path for the current to travel back, with very little leakage to the plaintiff's cable. In any case, there might be some slight leakage.

Mr. WILLIAM JOHN ROLFE, executive engineer for Preston district, spoke as to tests made which showed that the current was leaving the rails for the cable, with a damaging effect on the latter.

Mr. Ross Brown: Why was the cable not bonded to the rail in the first instance?

The WITNESS: It is most unusual to bond a Post Office cable with private property, as in certain cases it might be dangerous.

Answering Mr. Wingate Saul, for the defendant company, the witness said that at certain points the cable was only 7 ft. from the defendants' lines. He did not think notice was given to the defendants of the intention to lay the cable, but this was not necessary, as the cable was laid along the public highway.

Mr. JOHN CAMERON, the secretary and manager of the Tramroad Co., said the line was perfectly bonded throughout. The line was tested weekly, and returns made to the Board of Trade every six months which showed that it was in a satisfactory condition and complied with the regulations. He was present when the test was made by the Post Office people, and was told that there was a leakage of from two to five volts. There were, however, other cables in the locality; the public lighting cable was within 30 to 40 ft. of the Post Office cable.

Replying to Mr. Ross Brown, the witness said the position the defendant company took up was that the Postmaster-General, by placing the cable near the tram-lines, took the risk of stray current injuring the cable, and should have taken steps to prevent it.

Mr. WINGATE SAUL said the defendants had not committed a breach of the regulations; and he submitted that there was nothing to entitle the Postmaster-General to succeed in that action. They were in the same position as a railway company with reference to sparks from the engine, and were not liable for any damage that might happen from an escape of electricity from their tramways. The arguments of Mr. Ross Brown referred to works of construction or to telegraph lines that were in existence when the lines were constructed. This cable was placed within 7 ft. of the company's rails, and after the latter had been constructed a period of some 16 years. He urged that it would be an injustice to make the Tramroad Co. liable for the damage to the cable.

His HONOUR intimated that he would reserve his decision, and would give it at a later Court. In any case he would give costs on the higher scale, and would give leave to appeal.

AN ELECTRICAL ENGINEER'S CALLING-UP.

BEFORE the Tipton (Staffs.) Magistrates, last week, Leonard A. Jones (23), an electrical engineer in the employ of the Smethwick power station, was charged with being an absentee under the Military Service Act.

The REPRESENTATIVE of the Military Authorities said that the man received his calling-up papers on October 5th, but they were sent back, and his employers applied for his retention. The application was, however, out of date.

DEPENDANT produced a letter from the Dilution Officer to the effect that he would be retained.

The REPRESENTATIVE of the Military said that letter was written after the date of the calling up.

A REPRESENTATIVE of the firm, and an officer of the Aeronautical Department, said the defendant was indispensable at the power station. He was a highly technical man, and as 95 per cent. of the output was required for munition making, the former said he would not be responsible for the running of the station if the man were taken away.

The MILITARY REPRESENTATIVE: I should be responsible.

The REPRESENTATIVE of the Aeronautical Department said he had authority to appear to ask that the defendant should not be sent into the Army. A technical blunder had been made.

The OFFICER for the prosecution replied that he had the authority of the War Office.

The CHAIRMAN said it appeared to be a case that the Military Authorities must settle between themselves, and to enable them to do that the case would be adjourned for a week, defendant being admitted to bail to enable him to attend to his work in the meantime.

HALL v. PORDES.

MR. JUSTICE BRAY and a special jury, last week, heard an action for wrongful dismissal brought by Clement Hall, a metal worker, of Birmingham, against Bernard Pordes, electrical goods manufacturer, of Christopher Street, E.C. Defendants denied liability, and said they were justified in dismissing the plaintiff because he was incompetent and did not obey the orders of the firm.

PLAINTIFF'S case was that he was in a responsible position as a metal worker in a well-known Birmingham firm for 25 years, and then joined in a partnership to work on his own account. Defendant was in the wholesale electrical lamp trade, which, until the outbreak of the war, was supplied from Germany with these lamps. As it became necessary to manufacture them himself, he placed orders with the firm which plaintiff had joined, and then appointed him his manager in London to make the cases for lamps, setting up a special department in the London works for that purpose. The business was successful, and some 10,000 to 12,000 lamps were turned out weekly. Plaintiff was engaged under the agreement for five years at £3 10s. a week and commission. After two years' duty defendant summarily dismissed him, and he asked for damages.

The jury found a verdict for plaintiff for £440 and costs, and his Lordship granted a stay of execution, and gave judgment accordingly.—*Birmingham Post*.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The E.T.U. or the A.E.S.E.?

Referring to the letter of Mr. J. R. W. Grainge in your last issue I may say that at a recent meeting of the E.T.U. the members were advised that the Government and the military authorities could no longer be "swanked," and that if they wished to keep out of the Army, as strikes were illegal and their funds would be confiscated if they suggested one, it would be better for them to refuse to work any overtime after they had done the recognised number of hours. This would spread the jobs out and impress the authorities (it was hoped) with the vast amount of work that the wiremen and their mates were doing. This advice elicited from the body of the hall the opinion that if the members refused to take a few extra shillings per week in the form of overtime, which they admitted among themselves was very rarely, if ever, earned, the small amount saved on isolated jobs would not be sufficient to warrant the employment of one or more of their unfortunate brothers who were of military age but not actively employed. The aim of this new programme of the E.T.U., so far as station men are concerned, appears to be based on a new trade card which they are attempting to force on the industry, coupled with total exemption from the Army, &c. Many of the station men present clearly did not approve of the way that the meeting was being conducted, or the nature of the business in hand, and a spokesman on their behalf challenged the Committee with the fact that they had been enrolled as members of the E.T.U. with the above programme as an inducement to join, and after six or nine months' negotiations nothing had happened to benefit them to the slightest degree. It appeared also from the remarks that had been previously made in their hearing that original members, at all events in so far as military service was concerned, were not to much, if to any extent, receiving that protection which had been promised them. The Committee were therefore challenged by the station engineers' spokesman to bring about a conference with the Ministry of Munitions with a view to settling their grievances.

The result of that conference and other matters arising have since been published and discussed very fully in the trade Press.

One who was Present.

I would be glad if you will grant me space to point out to Mr. Healy that my letter was not written for the purpose of shelving problems or obscuring issues. I desired to make known, what is already quite clear to those outside the lofty domain of power station service, that nothing is gained from wage or salary payers unless it be striven or fought for; and that any organisation framed for making the lamb bed-fellow to the lion, inevitably ends in the former's extinction.

Incidentally, it occurred to me that smaller power stations may possibly be devoured when the centralisation monster begins to grow, and that this event may force the responsible shift men in these important places to compete for employment hitherto reserved for those lower-grade individuals, who, in an organising sense, are so naturally catered for by a vulgar body like the Electrical Trades Union.

No! "C.B.T." (A.M.I.E.E.) your hopes are vain; but I have an awkward feeling that it is more dignified to be included in an organisation which is energetic enough to force vital issues (even in war time) than it is to remain a bickering "free lance" or, say, a member of a mutually congratulating, snobbish circle, which snatches the good things but abuses those who get them.

W. F. K.

Your footnote at the bottom of Mr. Grainge's letter is to me a command. Your courtesy is a model to editors. For the last 10 years or so "spasms" bearing my name have appeared in the columns of your paper. Any comments by you have always borne the imprint of fairness and tolerance, and one only wishes all papers were run on the same lines. I have the reputation among my friends, and my enemies, of saying what I think, and I honestly thank you for your kindness to myself. I have never, to my knowledge, met either of you, but hope to have that pleasure some day, and thank you personally.

Now, Mr. Grainge, you must, I think, be a politician, as you have got the usual politician's trick of culling extracts from speeches or writings, and giving them an importance which possibly, if they were taken with the whole, they would not possess. If Mr. Grainge had been a regular reader of the *Electrical Trades Journal*, he would have known why the paragraph quoted was penned. "Our slogan, &c." was a portion of the London District Committee notes written by myself for our September issue, and, rightly or wrongly, represents the feelings of my Committee and our Union. The reason, too, is plain. Over 12 per cent. of our membership are serving with His Majesty's Forces to-day, and 90 per cent. of that number are in line regiments where their technical knowledge and ability are absolutely wasted. I together with our General Secretary, attended last January a meeting, called by the Government, of the skilled engineering trades. We were addressed by Lord Derby, Dr. Addison, General Geddes, and others, and they wanted skilled men for technical corps. Our General Secretary and myself said they could not have any, as we could not supply the demand for skilled electricians at home. Our General Secretary said he had

forwarded to the Ministry and the Army authorities the names of hundreds of our members who were in line regiments, and had asked for their return to civil employment, or their employment in units where their talents would be most useful to the nation. Representatives of other trades also quoted cases of a like nature, amounting in the aggregate to a large number of thousands.

We had promises galore given us that the matter would be rectified. Such promises have not been kept. Here and there a man has been brought back, amounting in the ultimate to less than 5 per cent. of the total.

Every day I have numerous inquiries from employers and Government Departments for skilled electricians, and cannot supply them. Have had to draw hundreds of men from less important and put them on more important work. Yet all the time the Army Authorities are chasing our members; and if any of them go, they are almost invariably put in line regiments. Absolutely one of the best mechanics in London was for nearly two years a telephone room orderly. Another for six months was picking up the litter in the barrack square. Only to-day, Saturday, November 10th, a member came into the office. He is nearly 21, served a five years' apprenticeship with one of the largest firms in Manchester, and is now a first-class electrical fitter. He had a Protected Occupation Certificate, but thought he should do his bit. He was sent to Woolwich for his trade test, and passed with flying colours. He was then sent to Farnborough and passed another trade test for the Flying Corps. He has been drafted to a line regiment at Reading. If I get him put in a technical corps, it will mean writing to half a dozen different people, and before any decision is come to he will probably be in France or Italy—possibly dead.

You will quite understand we had to call a halt. We had to say to the Government, "Hands off our members." We had to say, "This is an electrical engineers' war; and although you are able to teach a woman in a day how to stand by, or rather work, a capstan ~~lath~~, you cannot make electricians in a day or a year."

"We are fighting for our Union and the industry, and are following the lines of the three strongest Trade Unions in the land to-day. There are quite a goodly number of men of military age in the legal profession, and I really think Haig or Jellicoe would rather trust one electrician to blow the Germans to glory than all the lawyers to talk them there."

Then there is the Medical Trade Union. They threatened a short time ago to "pull" all their members from France if any more of their number were taken. Of course, it was not a strike: it was only the threat of one, but it was effective. Plums fall into their lap, too, without striking—witness the £800,000 gift of insurance money, of which the working class was fleeced.

The Church of England Trade Union is also fairly strong. Strong enough to resist conscription and also dilution. There are no women parsons; oh, dear no! They are not doing so badly out of the war either. They get increases of wages, too (tithes, &c.), without going to the Committee on Production.

So you see, Mr. Editors, we are sinning in "good" company. We, in ten years' time, are going to be the fourth strongest Trade Union in the land. We are going to control the electrical industry; but, unlike the others, we are going to control it in the national interest.

As I have taken up so much of your space, I cannot deal very lengthily with Messrs. Jones and Napier. Let me say here and now, the A.E.S.E. does not cut any ice with anyone. About five years ago an article appeared above my name in the *ELECTRICAL REVIEW*. I was writing as a member of the Electrical Trades Union, and I said I did not care what the station engineers did as long as they organised. We, the Electrical Trades Union, stood aside and gave Mr. Ebben a clear field, and also assisted him, but it was of no use. The will to do was there, but the ability evidently was not, so we had to take the work up, and so successfully that in London alone we are over 1,000 strong, and still Charlie's Aunting.

Poor Mr. Napier! If he has any doubt to whom he is indebted for his increase of wages, I should suggest that he has five minutes with Mr. James Devonshire.

W. J. Webb,
London District Secretary,
Electrical Trades Union.

London, E.C.,

November 12th, 1917.

P.S. By the way, I am wondering if Mr. Grainge is of military age.

In reply to Mr. Napier's remarks in *REVIEW* of November 9th, he challenges me to give him the name of a member of the staff who is also a member of this organisation. Surely he does not admit such an elementary knowledge of Trade Unionism as to not be aware of the fact that one of the primary objects are protection to members.

He charges me with misrepresentation concerning the North Metropolitan Award. Why, then, does he not prosecute this Society for publishing a fraudulent award? Surely, being such an important person, he has that power. He states that the question of bonuses was already under consideration; probably, but what accelerated the consideration he does not say. Happily, men of Mr. Napier's calibre are rapidly disappearing, otherwise the industrial outlook would require more than a Commission of Industrial Interest to cope with it. The days of intimidation by such tactics are, thanks to organised labour, over, and we look forward to a period of mutual understanding which will ultimately work out to the betterment of relationship between employer and employed.

H. H. Morion, Secretary,
No. 1 London Branch Station Engineers.

I am desired by the members of the Marylebone Branch of the National Amalgamated Union of Enginemen, Firemen, and Electrical Workers to state that it is one year and three months since they commissioned Mr. Meakin, their London agent, to investigate the wages and conditions of the London and suburban power stations with a view to securing substantial improvement. This branch has never displayed hostility towards any Trade Union catering for gas, water, or electricity employes, and would advise all such unions to compose their differences. All the members of these unions are travelling along the same road, and far better for all there should be harmony and close co-operation.

Until Mr. Meakin took up the matters referred to with the electrical engineers, nothing was done on a large scale; and whatever benefits are being received now by engineers or workmen are directly traced to those small beginnings of 15 months ago. As a matter of fact, the E.T.U. did not wake up to the full sense of responsibility until a question was asked in Parliament on behalf of three certain members of the Marylebone Branch of the N.A.U.E. And the station engineers seem to have held aloof from their comrades in the power stations. The N.A.U.E. has tried to benefit all employes, whatever their grade and station, for sectionalism is no good.

J. Vincent, Branch Secretary,
National Amalgamated Union of Enginemen,
Firemen, &c.

London, N.W., November 12th, 1917.

[The moderation and restraint of Mr. Vincent's letter compel our respect. On the other hand, we have received some letters from other quarters, the contents of which, as is too often the case in such controversies, consist largely of personal references bordering upon abuse; such letters in no way contribute to the solution of the difficulties of the situation—rather they accentuate them—and on this account, as well as the pressure on our space, we refrain from printing them in this column.—EDS. ELEC. REV.]

The Association Movement.

Association is the nucleus of co-operative effort. Herein then we have the promise of a final emergence from the slough into which the design of capitalistic power has managed to throw our generation. That being so, it seems a pity that the contribution published in your last issue, on the leader entitled "The Association Movement," should reject the idea for the instance, and so clothe the C.M.A. with an importance which the political structure of the new influence would belie.

The movement with its pregnant tissues floating loose, as it were, awaiting the masterly tying of a logical knot, is liable to lose the inherent values that lie in its conception, unless handled broadly, with an eye to the body economic.

It is a natural consequence of the war in which we are so vitally engaged, and as such, should be studied, not on the basis of a past adventure, but on its own merits, as significant of a certain tendency of thought, drawing life from the mutation of the industrial ideal that this strife is responsible for.

The mutation of which I speak, is not a something apart—a revelation complete in itself—but only a fragment thrown up by the moral convulsions of the universal mind. It holds in itself possibilities that affect the well-being of the individual, as well as of the mass, and presented more or less as a novel device, the association movement is in truth but an indication that a different phase of State representation—as far as the engineer is concerned—is at hand.

My inferences from France may be judged abnormal, and perhaps theoretical, but when considered in conjunction with the Whitley Report and the Government's definite statement, that "it will give preferential consideration to industrial organisations, in the councils of which labour has its representatives," we see at once that we are dealing with a combination of interdependent facts, rather than a detached link broken off from a chain.

Abstract though the study may appear to be therefore, it is nevertheless essential that the engineer, on the verge of having new and wider functions added to his already important, though somewhat limited, responsibility, in the guiding of the ship of State, should analyse such indications as the association movement for what they are worth.

It is obvious that the Government is seeking to direct part of the scientific brain into a new channel, wherein the labouring proletariat will have a more regulated voice than hitherto. It is not a case of socialism, but rather an endeavour to find a mutual basis, wherein both the aristocrat and the workman of the technical world may meet, and fuse their respective efforts towards the national well-being of a strained community.

The time has come for the engineer to add very seriously—economics to his list of necessary subjects.

Viewed in this light, I feel it were well to take the substance of the association movement as a whole, and not as the somewhat belated shadow of a single—howbeit successful—forerunner.

R. C. Andersen,
B.E.F.

November 4th, 1917.

Referring to a letter which I wrote you on October 18th as to a claim put forward by Mr. H. H. Berry to be the founder of the Cable-Makers' Association, and having in view his letter of October 23rd, replying to my letter, it appears necessary to make a short further statement on the matter, which is one, probably, of so comparatively little interest to the majority of your readers, that I will not occupy your columns at great length on the subject.

At a recent meeting of the Cable-Makers' Association, at which were present five individuals who took part in the first meeting of the Association, besides others who were closely associated with the foundation, Mr. Berry's letter, and also my letter, were read.

I am authorised to state that, in the opinion of those present, my letter of October 18th correctly sets out the position. It is not in dispute that Mr. Berry called on members of the cable trade in 1898, putting forward his views as to the desirability of founding an Association; but at the date he did so, preliminary action had already been initiated by others, and there is universal agreement among those who took part in the foundation of the Association that the putting forward by Mr. Henry Edmunds of certain definite constructive proposals was the step that made possible the formation of the Association, and there never has been any question in their minds that this gentleman was, in fact, the founder of the Association, so far as any individual can claim that title. Lieut. F. S. Paterson, who was present at the first meeting, in his letter to you of October 23rd, 1917, independently bears out this view.

I may conclude by saying that, personally, I do not intend to continue any further this correspondence.

The Cable-Makers' Association.

LEWELLYN B. ATKINSON, Secretary.

London, November 13th, 1917.

BUSINESS NOTES.

Packing Scientific Instruments.—Mr. R. W. Dalton, H.M. Trade Commissioner for New Zealand, complains of the unsatisfactory packing of scientific instruments sent from the United Kingdom. Though allowance is to be made for the present difficult situation in respect of packing, it is felt that proper care is not being taken. To poorly pack expensive scientific apparatus is like losing the ship for the sake of a little tar. Cases of breakage are quoted by Mr. Dalton. At present, no doubt, packages are being subjected in transit to exceptionally rough treatment, and it is suggested that makers should wherever possible send the cases to the ship by hand and put them into the safe custody of the Chief Officer for special stowage, after making proper arrangements with the shipping company.

Trade with Venezuela.—The British Vice-Consul at Maracaibo has reported on the prospects of developing our trade with Venezuela. There should be great prosperity when the termination of the war opens the trade channels for imports from the United Kingdom, but the market requires special studying, as for the past 20 years it has been dominated by Germans. We have been seriously handicapped in the past by the lack of suitable advertising matter for probable buyers. Catalogues must be in the Spanish language and must state terms and prices. Suitable catalogues should be sent to the Vice-Consulate at Maracaibo and they will be distributed among likely buyers. There is a good demand for marine engines for pleasure boats, electrical equipment and general machinery, also hardware. At present the bulk of the hardware is being imported from the U.S.A., Spain and Italy. The Vice-Consul expresses the opinion that the present time offers an admirable opportunity for our firms to be active; no doubt if there be any of them free to cultivate export trade in this market they will take the hint.

L.C.C. Stores Contracts.—The L.C.C. Stores and Contracts Committee reported on Monday that the current contracts for the supply of general stores, with a few exceptions, would expire on December 31st, and they were taking steps for obtaining supplies for 1918. The group of contracts affected includes metals and metal goods, electric cables, lamps, fittings and materials, chemical and scientific goods, rubber and asbestos goods, &c. It is proposed, under prevailing circumstances, to continue the present practice of purchasing some classes of goods at the current market rates, or under special quotations, until trade conditions again become normal, or until it is considered favourable to enter into new contracts. In other cases, however, new forms of tender and schedules are being prepared. Tenders will be received during November and December.

Japanese Electrical Deputation to Australia.—We read in the *Sydney Morning Herald* of September 10th that Mr. Keizo Yoshino, Secretary of Electrical Exploitations and the Bureau of Special Investigations, Tokyo, had just reached Sydney on a visit to Australia to inquire into its electrical undertakings, and to find out how Japanese electrical machinery and appliances might be improved to suit the requirements of the Australian trade. Mr. Yoshino said that while Japan was very busy making munitions of war when he left for Australia, the regular industries were flourishing.

In reply to a question, he said that they had had strikes in Japan recently; but they were all very small. "The Government does not allow strikes on a large scale."

The total number of electrical undertakings in Japan at the close of last year was 2,501, including supply, traction, isolated plants, and official plants. At the close of 1915 there were 250 manufacturers of electrical machinery and appliances in Japan. The value of these manufactures in 1915 was estimated at 36,065,739 yen, including machinery, &c., exported to China, India, Australia, and other places.

German Ship Installations.—A company under the title of the Schiffs Installation A.G. has been formed at Bremen with a share capital of £70,000 for the purpose of carrying out electrical installations, particularly on ships. The participants include the Hackathal Wire and Cable Works, the Lorenz Co., the Lloyd Dynamo Works, and two banking institutions.

Austria's Future Export Trade.—According to the *Wiener Zeitung* of October 16th, the Austrian Minister of Trade has issued an Order providing for the formation of a Committee of Experts for the Export Trade, in which not only the regular export merchants, but also other industrial groups specially interested in exports, are represented. In all questions of essential importance the Committee will act in conjunction with the existing Economic Committee of Merchants. The new Committee consists of not more than 15 members, nominated by the Minister of Trade, and is under State supervision, which is exercised by a Government Commissioner. Among its functions is that of co-operation in measures for war and transition to peace economy which relate to export.—*Board of Trade Journal*.

Book Notices.—*First Course of Electric-Light Switching and Testing.* Arranged by W. P. Maycock, M.I.E.E. London: A. P. Lundberg & Sons. Price 10d. post free.—This little book should prove useful to teachers of practical wiring and other classes where the connection and testing of tumbler-switch circuits form part of the tuition, as well as to individual students, especially those competing for the firm's Preliminary-Grade Certificate. This "First Course" is of a most elementary nature—in fact, the first exercise deals with the trimming of the ends of flexibles and wires; and in the last, the two-way intermediate circuit is fitted. The work and operations are so minutely detailed that there will be little for the teacher to do except to examine and appraise completed work. A list of apparatus shows him at once what is necessary. The "Hints" on the working-out of problems will encourage the student who is in difficulties, and numerous problems are given for him to solve by himself. The instructors of workshop classes which cater especially for wounded soldiers, should find the simplicity of the course very acceptable to their students.

"Links with the Past" is the title of a very acceptable book, well produced and neatly bound, issued by the Eagle and British Dominions Insurance Co., Ltd. It is a restful recreation to turn from reading about the war to study the charming reproductions from old prints of bits of London in "good old times" and from photographs of those who have been directors of the company in the lengthy period of its history. To read of the old coaching days, to be reminded of the ways of Charles II and Nell Gwynn, to remember the old Fleet Street coffee house of literary men, and many other such matters, all woven into the story of the company's history, is not waste of time in days when stress and anxiety render the mind easily wearied.

"Punch's Almanack" for 1918, published this week, will be on sale at the same price as before, 6d. Its cartoons are of the usual high standard of excellence. Four of them dealing with "Germany and the Next War"—the commercial war in which the Hun faces the difficulties in this and other countries where he has bombed and outraged civilian communities—are quite good.

"British Standard Specification for Charging Plug and Socket for Vehicles Propelled by Electric Secondary Batteries. Report No. 74—1917, of the Engineering Standards Committee." London: Crosby Lockwood & Son. Price 1s. net.—The great importance to the electric motor vehicle industry of a standard charging plug and socket, for use with vehicles propelled by secondary batteries, was brought to the notice of the British Engineering Standards Committee, in 1911, by the Electrical Vehicle Committee of the Incorporated Municipal Electrical Association. After consideration, it was decided to adopt the dimensions recommended by the Electrical Vehicle Association of America, in order that interchangeability should be secured between plugs made in both countries, and the Report was issued in December, 1915 (Report No. 74). Early in the present year the Standards Committee (Electrical Vehicle Division) of the Society of Automotive Engineers of America suggested a small modification in the design of the plug, which they found added considerably to the mechanical strength, and did not affect the interchangeability. The proposal was supported by the Electrical Vehicle Committee of the I.M.E.A., and, after consideration by a Sub-Committee of the British Engineering Standards Committee, the modification was adopted. The revised Report was approved by the Main Standards Committee in July of this year, and is now issued in accordance with the new policy of the Committee in octavo size, price 1s. French, Italian and Spanish translations will be available shortly.

"Scientific Papers of the Bureau of Standards." No. 303. Relative Sensibility of the Average Eye to Light of Different Colours, and Some Practical Applications to Radiation Problems." Washington: Government Printing Office. Price 15 cents.

Trade Announcements.—All communications for the Coventry electricity department should now be addressed to the Council Office.

Mr. F. W. Fox, electrical engineer, of Bank Street, Ashford, Kent, is relinquishing business.

Liquidations.—**BOSCH MAGNETO CO., LTD.**—A petition for the winding up of this company is to be heard in London on November 20th.

P. E. T. CONSTRUCTION CO., LTD. Creditors must send particulars of their debts, &c., to the liquidator, Mr. A. Page, 28 King Street, Cheapside, E.C., by November 30th.

Catalogues and Lists.—**MESSRS. COLE, MARCHANT, AND MORLEY, LTD.,** Bradford.—22-page illustrated catalogue, in expanding binding cover, of the C.M. & M. central exhaust steam engines. The principal points concerning these engines, the advantages claimed, diagram of general arrangement, diagrammatic section of cylinder, and notes on the construction of the engines, are set forth. A number of excellent half-tones show the engines installed for electrical and other work. The horizontal compound type of engine is briefly dealt with.

MESSRS. JOHNSON & PHILLIPS, LTD., Charlton, London, S.E. 7.—Two leaflets: No. T1/10 shows their new design of portable testing transformer and No. T1/22 their shell-band heating transformer.

MR. P. W. RANDS, Caxton House, Westminster, S.W. 1.—Price list of electrical plant and apparatus in stock for sale.

MESSRS. GEIPEL & CO., Vulcan Works, St. Thomas Street, London, S.E. 1.—20-page illustrated price list, fully describing and tabulating data regarding some standard ranges of their motor-starting and controlling gear, of which immediate deliveries can be given against M. of M. certificate.

MESSRS. WARD & GOLDSTONE, Sampson Works, Salford, Manchester.—Leaflet describing and pricing the Sampson acid and water proof lampholder.

For Sale.—The Borough of Eastbourne Electricity Department has for disposal one 150-KW. direct-coupled steam alternator and exciter. For particulars, see our advertisement pages to-day.

British Trade with Italy.—The Headquarters of the British Chamber of Commerce for Italy (Inc.) have been removed to commodious premises at 7, Via Carlo Felice, Genoa, where sample showrooms for British goods are being organised.

New German Cable Factory.—It is stated that the work of erecting the large new cable factory for the Insulated Wire Works (late Vogel) of Berlin, is proceeding so actively that the factory is expected to be brought into operation in the company's present financial year.

LIGHTING AND POWER NOTES.

Australia.—**BROWN COAL.**—Referring to the brown coal deposits of Victoria, the Minister of Mines recently stated that, besides surface coal, it was estimated that at 100 ft. down there were 13 million tons; he believed that 2,000 tons a day would be obtained last month. It is supposed that the State policy will be to generate electricity on the Morwell site from this coal, and transmit the energy to Melbourne, while by-products and briquettes will also be secured, the fuel costs being very much less than in the case of the Newcastle coal now used.

MUNICIPAL HIRING POWERS.—The Legislative Council of Victoria has had under consideration the Electric Light and Power Act Amending Bill, which proposes to give power to Councils to sell or let on hire electrical fittings, apparatus and appliances. After considerable discussion, a new clause was inserted applying the Bill to the City of Melbourne, but empowering the Governor-in-Council to apply it, in whole or in part, upon application to any municipality. The Bill subsequently passed all stages.—*Melbourne Age*.

The general manager of the Mount Lyell Mining Co. has cabled from America that investigation by three different experts has proved beyond any doubt that the ore from the Mount Read and Rosebery Mines is splendidly adapted for treatment by the electrolytic process.—*Sydney Morning Herald*.

The Premier of Victoria stated recently that the application of the Victorian Hydro-Electric Co. to utilise the Kiewa river for the generation of electricity, and to sell same throughout the State, has been referred to the Special Committee which is at present investigating brown coal possibilities, and whether the future supply of electric power in bulk should not be under the direct control of the State. Consideration of the company's application has been deferred until the Special Committee reports.

The South Grafton Municipal Council (N.S.W.) has received an offer to install an electric supply scheme in the municipality. The proposal provides for the Council taking over the plant to be installed in the event of the Nymbodia river hydro-electric scheme being adopted at a future date. An effort is to be made to ascertain the views of the Grafton City Council on the Nymbodia scheme, which would serve both municipalities.

The West Gippsland Hydro-Electric Co., Ltd., Warragul, Victoria, has been formed with a capital of £10,000. The source of supply will be the Latrobe river, and it is proposed to install a 250-H.P. plant.—*Tenders*.

The Newtown (N.S.W.) Council is to consider the advisability of securing a site for a municipal electric lighting plant. At the last meeting of the Council it was pointed out that the contract for lighting with the Balmain Electric Light Co. would expire shortly, and the Council by having its own plant could effect a considerable saving, the destruction of garbage could be carried out, and the cost of lighting the streets greatly reduced.

Belfast.—The Corporation has appointed a Committee, consisting of the Lord Mayor and ex-Lord Mayor, the chairmen and vice-chairmen of the Improvement, Works, Tramways and Electricity, Public Health, and Finance Committees, to inquire

into the working of the departments under the control of the four first-mentioned Committees and report as to what, if any, changes in duties at present discharged by the departments it would recommend. It is stated that as regards the tramways and electricity department, the inquiry is chiefly for the purpose of ascertaining the desirability of placing the two concerns each under a separate Committee instead of the present system. —*Northern Whig*.

Bettwsycoed.—An eel in the pipe line recently stopped the local hydro electric plant, the electricity supply being shut down for some time.

Birmingham.—ELECTRICITY SUPPLY DEVELOPMENT. — In acknowledging his re-election, the Lord Mayor (Ald. Brooks) referred to the reorganisation of electricity supply and the proposals which had been put forward to this end. He said the Birmingham Electric Supply Committee had appointed a Special Sub-Committee to consider the problem, and it would report whether the Corporation undertaking could by itself give effect to the aim of the Departmental Government Committee, or whether the object could best be attained by a scheme of development which might comprise a large Midland area of which Birmingham would be the centre, and managed by a joint board representing the various interests concerned. Birmingham must be in the forefront in that development, or it might run the risk of losing its premier position amongst the great industrial communities of the country.

It would appear, from inquiries, that the Birmingham Corporation has already given much consideration to the problem from the point of view of that city's internal requirements, and, in view of the terms of reference, has also had under consideration the question whether the scheme ought not to provide for a supply of electricity to the great industrial area of which Birmingham is the predominant centre. The matter has, in fact, proceeded further than those connected with the Electricity Supply Committee are able to disclose, and important conferences with the Ministry of Munitions are regularly taking place, though nothing definite is settled. One part of the scheme contemplates the linking-up of the existing electricity supply works within the area of which Birmingham is proposed as the centre, while another portion of the scheme takes into account the whole of the electrical requirements for some years ahead in that industrial area, and whether provision should not be made for the erection of one or two huge generating stations upon the best sites, from an engineering point of view, so as to give electrical energy at the lowest possible rate to all consumers. Regarding the problem of control and management, it is pointed out that there are difficulties owing to the fact that portions of the area are not supplied with electricity, while other portions are served only partially and in varying degrees by power companies or municipalities.

Brandon (N. Devon).—FIRE.—A fire which broke out at the electricity station, on Monday, caused some damage in the engine room.

Burton-on-Trent.—PRICE INCREASE.—It is anticipated that the 10 per cent. increase on electricity charges will add £2,000 to the revenue and about meet the extra cost of coal. Nine years ago slack was obtainable at 2s. 10½d. per ton, but to-day the price is 11s. 1d. per ton.

Canada.—The Hydro-Electric Power Commission of Ontario has refused the city of Niagara Falls (Ont.) permission to build a submerged dam in the upper Niagara River for the purpose of supplementing the city's water supply. It is pointed out that every gallon of water is urgently needed for power purposes. In the meantime the city will be allowed to supplement its supply from the Ontario Power Co.'s conduit. —*Canadian Electrical News*.

Chelmsford.—The Electric Supply Corporation has informed the T.C. that it cannot consent to any further extension of the time during which the Corporation may give notice of its intention to acquire the undertaking, unless some protection is given against the undertaking being transferred at a price based upon its reduced value as a going concern under war conditions. If this protection were given, it would consent to an order being made, extending for two years the time for giving notice, subject to the Council not applying to the B. of T. for a further order. The T.C. has decided to take no further action in the matter.

Chesterfield.—PRICE INCREASE.—The T.C. has decided to increase all prices (except those with coal clauses) by 12½ per cent., making 25 per cent. on pre-war prices.

Clayton (Yorkshire).—E.L. PROPOSALS.—At the D.C. meeting, last week, a letter was received from the Electrical Distribution of Yorkshire, Ltd., asking for a definite answer as to the Council's attitude to the company's proposed renewal of application for power to supply electricity to the district. The letter reopens the controversy which took place last year between the Council and a ratepayers' meeting, which demanded that the supply should be obtained from the Bradford Corporation. There are fears in the township that the Bradford offer, which found much favour with the inhabitants, was part of an effort to secure the incorporation of the place with the city. Bradford would, it was stated bring electricity to Clayton within two years after the war under an incorporation agreement. Eventually the Council decided to inquire as to Bradford's terms at present.

Derby.—PRICE INCREASE.—The T.C. has decided to increase the charges for electricity by 10 per cent. The chairman of the Electricity Committee stated that at the present time the

electricity undertaking was using 30,000 tons of coal per annum, for which it was now paying £11,000 a year more. By the increase of 10 per cent. in the charges two years ago nearly £6,000 a year was produced, or about half the amount of the extra cost of coal. The Council approved a recommendation that £1,500 be granted to cover the cost of land for coal storage.

Doncaster.—PRICE INCREASE.—The Electricity Committee recommends an advance in the price of electricity of 15 per cent., making a total advance of 25 per cent. on pre-war charges, as from December 1st this year. An amendment, moved at a meeting of the Council in Committee, in favour of a total 30 per cent. increase, was defeated.

Edinburgh.—PRICE INCREASE.—The Corporation Electric Lighting Committee reported that the increase in the price of coal of 2s. 6d. a ton would mean an increased cost to the undertaking of about £1,700 up to May 15th, 1918. The estimates for the year showed a credit balance of about £1,000. Utilising this with the present rates for electricity, there would be a loss of about £2,400 at the end of the year. It was estimated that an increase of ½d. per unit on lighting from October 1st would bring a credit balance of £500 on May 15th, 1918. The recommended increase, which brings up the rate for lighting to 3½d. per unit, was adopted.

Faversham.—The Electric Supply Committee is to report on extensions needed to supply a shipbuilding yard to be established in the town.

Greasborough.—The U.D.C. has decided to oppose the proposal of the Rotherham Corporation to include Greasborough in its area for the supply of electricity.

Huddersfield.—A statement submitted to the T.C., last week, showed that in the electricity department the supply of current to ordinary consumers had had to be somewhat restricted during the past year owing to the demands for power. The Committee was stated to be considering extensions to the plant.

Keighley.—WAGES.—The War Wages Committee recommends an increase equal to 15s. per week on pre-war rates of pay of all full-time male employees of the Corporation over 21 years of age—with a few particular exceptions—to be regarded as a war bonus and to replace any bonus previously granted. The bonus is to continue for three months after the declaration of peace.

The Electrical Committee is seeking power from the Board of Trade to disconnect non-essential electricity consumers, in order to concentrate on the supply of important works, if the necessity should arise.

Leatherhead.—The Leatherhead and District Electricity Co. is installing additional generating plant to meet the demand for power purposes, and private consumers are asked temporarily to curtail their requirements in order to assist matters.

London.—L.C.C.—The Finance Committee recommends the sanction of the Council to the borrowing of £1,484 by the Woolwich B.C. for a 1,000-kw. motor transformer.

Manchester.—WAGES.—The Corporation is taking steps to oppose an application by the National Union of General Workers and the Workers' Union for an advance of 5s. per week in wages of all workmen of 18 years of age or over in a number of departments, including those of electricity supply and tramways (permanent way). The application is to come before the Committee on Production. In this connection Sir George Askwith, Chief Industrial Commissioner, has written to the Corporation that, having in view previous demands and awards given, and considering the new claims, he will be glad to know if municipal authorities have considered the practicability of making an agreement with the various workers' Unions on the subject of general wages changes on the lines of the agreement existing in the engineering and foundry trades, chemical trades, &c. There is every prospect of all concerned accepting the invitation, though no definite decision has yet been arrived at.

Norden.—PUBLIC LIGHTING.—The Rochdale authorities having agreed to the fixing of electric lamps to the tramway standards, the U.D.C. has decided to have one fixed to every tenth standard.

Nottingham.—Recently a motion by Mr. Atkey, before the T.C., proposed that in connection with the national scheme of reorganisation of electricity supply, it was desirable that the advantages of Nottingham should be placed before the Government as the site of one of the large power stations, and that a Committee be formed to consider the national scheme and report.

PRICE INCREASE.—The electricity charges have been increased by 7½ per cent., in order to avoid a loss on the undertaking next year.

The Corporation employees, who have already received a substantial war bonus, are agitating for further advances, estimated to cost £60,000 annually. The Corporation has asked the Government authorities to intervene. —*Times*.

Peterborough.—It has been decided that the Electric Traction Co. shall be charged 20 per cent. extra for electricity, the same as other power consumers.

Rotherham.—PROV. ORDERS.—The R.D.C. has under consideration proposals of the Rotherham Corporation and the Electrical Distribution of Yorkshire, Ltd., to apply for prov. orders for supplying current for lighting and power purposes.

Sandwich Islands.—According to the *Electrical World*, the Hilo (Hawaii) Electric Light Co. is making considerable progress during the year connected 40 electric ranges, 85 water heaters, and about 1,000 socket appliances. 600 h.p. of additional motors have also been connected. The company has ordered a 1,000-h.p. hydro-electric unit, and another water-power development is contemplated. The reconstruction of the street lighting system is being undertaken.

Sheffield.—PRICE INCREASE.—Feeder cable is to be laid from Neepsend, at an estimated cost of £1,585. To meet the advance in the cost of coal, all accounts for the supply of electricity now charged at 2d. per unit and under are to be subject to an increase of 25 per cent. in lieu of the previously-decided increase of 20 per cent. The charge is to commence after the December readings. The Parliamentary Committee is advising the Council to confine its application for a Provisional Order to the following districts, viz.:—Handsworth U.D., Wortley R.D., Norton R.D., Dronfield U.D. and the parishes of Coal Aston and Dronfield Woodhouse.

Spenborough.—PROPOSED LOAN.—The U.D.C. has decided to make application for sanction to borrow £8,217 to carry out extensions at the electricity works.

St. Annes.—In reporting on the heavy demands on the electricity works, Mr. Clothier, the engineer, recommends an increase in the steam plant.

St. Helens.—PRICE INCREASE.—The Electricity Committee has decided that the charges for electricity for power and lighting be increased as from October 1st, 1917, by 50 per cent., instead of 30 per cent. as hitherto.

Slaithwaite.—PROVISIONAL ORDER.—The Huddersfield Corporation has given notice of its intention to make an application to the B. of T. for a Provisional Order for supply within the urban district.

U.S.A.—The electric display lighting of New York, including the huge advertisements which have made Broadway historic, will in a few days be discontinued, except between the hours of 7.45 and 11 p.m. It is estimated that 125,000 tons of coal annually will thereby be saved.

Walsall.—The Corporation, having completed the new electricity generating station, is making a big effort to attract manufacturing enterprises. It points out that it has a large amount of surplus power, and that the town is on the fringe of the Cannock Chase coalfields.

Wharfedale.—E.L. PROPOSALS.—The Electrical Distribution of Yorkshire, Ltd., are seeking support of the local Councils of Wharfedale to the proposed development of their supply services in the Menston, Burley, and other areas. At a meeting of the Burley-in-Wharfedale Council, last week, it was stated that the company would not agree to a purchase clause, and the Council decided to withdraw its support.

Wolverhampton.—YEAR'S WORKING.—The annual report mentions that the largest generating set failed, and was out of commission for six weeks, necessitating curtailment of supply. A large new factory took some 2,800,000 units during the year, and its requirements are such that a further 5,000 kW. of plant has had to be ordered, and until available (early next year) the curtailment of supply in certain directions continues. Negotiations have taken place with several large firms which contemplate building works in the area, and one has already purchased the necessary land.

TRAMWAY AND RAILWAY NOTES.

Australia.—The first report of the Melbourne Tramways Board for the year ended June 30th, 1917, states that the traffic receipts totalled £811,781, and a net surplus of £381,167 resulted. Of this £25,000 has been transferred to the renewal reserve fund, and £100,000 to a reconstruction reserve account for extensive renewals of tracks, reconstruction of power houses, &c., which may be required in the near future. After debiting all charges and appropriations, the surplus for the year is £210,019. The credit at the tramway fund, from which the compensation ultimately awarded to the company will be paid, amounts to £384,597.

The Melbourne City Council has decided to oppose the Victorian Government Tramways Bill in its present form and has recommended the Metropolitan Tramways Conference to oppose its passage into law until amendments are made in the method of election of members and the allocation of districts, &c., as provided in the Tramways Bill promoted by the Metropolitan Municipalities and introduced to Parliament in 1913.

MELBOURNE SUBURBAN RAILWAY ELECTRIFICATION.—It was stated recently by Mr. E. B. Jones, the Victorian Railway Commissioner, that the effect of transferring the contract for certain portions of the electrical equipment to America was a reduction in the price, which was not now much in excess of Mr. Morz's actual estimate, *Melbourne Age*.

The report of the Adelaide Municipal Tramways Trust for the six months ended July 31st states that, although there had been a record revenue, expenditure had so increased as to absorb the credit balance of £1,381, and leave a deficit of £2,199. The additional expenditure is accounted for by the increased cost of coal and materials, increase in wages, and the rate of interest.

Birmingham.—It was decided on Tuesday last not to run the tramcars or omnibuses on Christmas Day.

Blackburn.—The Lancashire and Cheshire Tramway Managers' Association has accepted the invitation of the local Tramways Committee to hold its November meeting in the town.

Bradford.—PARCELS DELIVERY.—A deputation from the Hull Tramways Committee visited the city last week, to study the parcels delivery system which has been working in Bradford for some years past under the tramway authority. It is proposed to establish a similar branch of the Hull Tramways Department.

Brazil.—According to the financial Press, the Secretary of Agriculture of the State of Sao Paulo has decided to electrify the railway between Sao Paulo and Boituba. It is stated that this will reduce the cost of transport from this important agricultural area.

Constantinople.—A report through German channels, at Brussels, refers to the Compagnie des Tramways et d'Electricité de Constantinople, which is known under the name of the Constantinople Consortium, which is managed by the Société Financière des Transports, and in which prominent German banks are also interested. The report states that the company has just declared a dividend on the ordinary shares at the rate of 4½ per cent. for 1914-15 and also for 1915-16, which is to be distributed on a future occasion; but no payment is proposed to be made on the other classes of shares. It is added that difficulties are experienced in obtaining raw materials, and only the tramways are in course of favourable development.

Derby.—The Tramways Committee recommends that application be made to the L.G.B. for a further extension of one year for the execution of the tramway work authorised by the Corporation Act, 1913. The tramway receipts for the five weeks ended October 27th, 1917, were £6,224, an increase of £428 over the corresponding period of last year.

Glasgow.—In connection with the announcement by the B. of T. of the appointment of a Special Committee to consider the needs of tramway undertakings as to materials and labour, the local system has, despite a shortage of plant and other handicaps, kept running at a high degree of efficiency, and it has been found possible to give assistance to less fortunate undertakings in Scotland and England. The fact that the department has organised its own repair system very thoroughly has been found of great value. The policy of the B. of T. Committee is to concentrate available material, and in Glasgow it is reported as probable that some of the residential suburban routes may be deprived of their car service, and, should necessity arise, the rails and other plant may be removed.

Huddersfield.—A statement submitted last week shows that the tramway track is in a very bad state of repair, owing to war conditions, and that nothing can be done in the way of thorough renewal until after the war. As a temporary measure of repair, the Tramways Committee, it is stated, has decided to enter into a contract with the Woods-Gilbert Rail Planer and Milling Co. for the grinding and milling of certain sections of track, which, it is held, will prolong the life of the rails from five to seven years.

YEAR'S WORKING.—The tramway receipts for the year ending September 30th amounted to £116,215, an increase of £9,603 on the previous year's figures. The number of passengers carried was 27,580,552, an increase of 1,252,070, whilst the car-mileage of 2,568,874 was a decrease of 12,993. The staff now included 143 females.

London.—L.C.C.—With reference to the curtailment of transfer tickets, &c., the chairman of the Highways Committee has made the following statement:—"The experience of the management confirms the Committee's expectation that the alteration in transfer facilities would lead to more effective control over the traffic; and it is satisfactory to note that the alteration is having the effect of improving the carrying capacity of the tramways by acceleration of the services. It was to be anticipated that any change not obviously for the benefit of passengers would lead to criticism, and, perhaps, to complaints. The Committee is glad to find that the volume of well-founded complaint has been infinitesimal."

Ramsbottom.—TRAFFIC FIGURES.—The half-yearly return of the Council's railless-car system shows a good improvement on last year, although, owing to war conditions, there is still difficulty in maintaining a full service. The population served is 10,000, and has been carried 28 times during the half-year, excluding the return journeys of workmen, and over 10,000 wounded soldiers. The miles run were 38,598, against 37,325 for the corresponding period of last year; 31,710 workmen were carried, and 219,270 ordinary passengers, making a total increase on 1916 of 36,500. The receipts were £1,676, as against £1,165, and the average receipts per car-mile were 10'425d., against 9'418d. last year.

Newcastle-on-Tyne.—ANNUAL REPORT.—Mr. E. Hatton, engineer and general manager of the Corporation tramways, in his annual report says the increase in income (£31,810) is again a notable feature, and is due to the unprecedented conditions prevailing in this area. At the same time, the abnormal conditions have likewise entailed heavy working expenses. The great utility of the car service is clearly shown when it is stated that 78,189,216 passengers were carried in 1916-17, an increase of 5,137,615 over 1915-16, and 13,103,794 over 1914-15. On traffic expenses alone working costs had increased approximately £9,500, and, coupled with an increase of £14,500 on the previous year, made a total increase in the department alone of £24,000 over 1914-15. The aggregate total increase in wages to employees in all departments during the year was £12,910. The only section of the expenditure showing a reduction was general expenses, where the amount payable for local rates, following extended negotiations and litigation with the Poor Law Authorities, had been reduced by approximately £8,000. The increasing demands for a better service of cars for workmen had added to the difficulties of working the undertaking. As showing the extent of the catering for workpeople, more than 380 car loads (averaging 100 passengers per car) are dealt with daily. Mr. Hatton concludes that as they are only able to maintain about 180 cars in service, it is evident that little more can be done in regard to increasing the workmen's service.

On November 5th an electric train from Tynemouth was derailed outside the Central Station; no passengers were hurt, but the line was blocked for some hours.

Reading.—YEAR'S WORKING.—The annual report of Mr. Craven, general manager and engineer of the Corporation tramways, for the year ended March 31st, 1917, shows a total revenue of £44,597, and working expenses amounting to £23,817, which, with war service allowances and war bonuses of £2,132, totalled £25,949, leaving a gross profit which, with bank interest, amounted to £18,647. Interest, sinking fund, and other charges absorbed £19,294, leaving a net surplus of £5,723, as compared with £6,232 in 1916, of which £4,000 has been transferred to the rate relief account and £1,723 to the renewal reserve fund. The total capital expenditure to date is £230,789, the total amount of the sinking fund is £80,183, and reserve fund £24,122. During the year, 10,919,533 passengers were carried and 912,258 miles run, as compared with 9,953,906 passengers and 924,656 miles in the previous year; 140,767 parcels were carried on the tramways during the period under review, producing a revenue of £812 and a net profit of £137.

Shelf.—The U.D.C. has received notice from the Halifax Corporation that it intends to make application to the B. of T. for an Order extending the period for completion of tramway works in Shelf until August 18th, 1919.

U.S.A.—On July 26th last, the last horse car on the New York tramways was withdrawn, the route, which had been operated at a loss, being abandoned.

The Philadelphia City Transit Department has awarded seven contracts for the construction of the city's high-speed subway and elevated railway, involving an expenditure of 15½ million dollars.

Walsall.—The Electricity Committee has reported to the T.C. that it has forwarded a protest to the Coal Controller against the increased price of coal being made retrospective to September 17th. It was stated by Alderman Cope that if these extra expenses continued the Tramways Committee would have to ask for an increase of fares. The Birmingham and Midland Omnibus Co. has declined the Corporation's suggestion that it should cease to run buses in the Walsall areas, and join up at Great Barr to the Walsall tramway service.

TELEGRAPH AND TELEPHONE NOTES.

A Wireless Subterfuge.—The story how a young wireless operator fooled the enemy was related in the Prize Court on Tuesday, when the Crown was asked to condemn the s.s. *Edna* on the ground of un-neutral service and enemy ownership. The plucky operator was Mr. G. D. Smith, an Englishman, who has since received a commission in the R.N.A.S. The *Edna* took on board wireless and gun-sight apparatus, and tried to communicate to the German cruiser *Leipzig* the sailing of British ships—an attempt which was frustrated by Smith.

Before leaving San Francisco, he had heard that the coal taken on board was intended for the *Leipzig*. A German wireless operator was taken on board, and Smith was told that if he refused to do his duty the German would take his place. The German operator, however, did not understand the Marconi system, and Smith shortened the length of the waves, and, though he appeared to be sending out calls for the *Leipzig*, no ship could pick up the message.

The German operator spent three nights and three days trying to call up the *Leipzig*. Smith returned later, and then occasionally called up the German cruiser, putting the wireless right in order to delay suspicions; but the wireless was always out of gear when the German operator tried to use it. At La Paz Smith forwarded a message to the Admiral on the U.S.A. cruiser *California*.

Some of the officers threatened to shoot Smith and throw him overboard if he did not send a code message to the German cruiser, and he then pretended to send it.

The only thing that Smith sent to the *Leipzig* was an inquiry as

to where she was, which brought forth a reply that she was hanging around waiting for the *Edna*. Finally the latter was commandeered by the Mexican Government, who put an officer on board, and Smith said that "after that things were more comfortable."—*Daily Chronicle*.

Alien Enemies and the Telephone.—Sir George Cate, replying to a question by Mr. Joynton-Hicks as to the use of a telephone by Hugo Wiskemann, of the Wool Exchange, the son of a German lawyer, said:—Under Article 22-A of the Aliens Restriction Order an alien enemy may not have a telephone without the special permission of the police, which is very rarely given. I am informed that permission to have a telephone was given by the police to this man, who has been 37 years in England, is married to an English wife, and is carrying on under supervision a business which is considered to be useful to this country. I propose, however, to reconsider the whole question of granting these permits to alien enemies. *The Times*.

Norway.—It is reported that the construction near Stavanger of a wireless telegraph station, which will probably be the most powerful in the world, has been nearly completed. A representative of the Marconi Co. will superintend the testing of the station, which it is expected will take place before the New Year.—*Morning Post*.

Restricted-Hour Telephony.—Leeds Chamber of Trade is advocating the general suspension of the telephone service for an hour at mid-day, in these days of short-handed staffs. It has been reported by Leeds shopkeepers that it is becoming increasingly difficult to get answers to calls at mid-day, partly owing to places being closed during the staff dinner hour. Some Leeds firms have already notified their business connections of a closed hour for the telephone.

CONTRACTS OPEN AND CLOSED.

OPEN.

Aberdeen.—November 19th. G.N. of Scotland Railway. Telegraph material for six or twelve months. Stores Superintendent, 80, Guild Street.

Australia.—PERTH.—December 5th and 12th. Postmaster General's Department. Telegraph and telephone instruments and parts, battery material and telephone switchboards, parts, &c. See "Official Notices" to-day.

NEWCASTLE, N.S.W.—December 5th. City Electricity Department. Single or three-phase transformers. Particulars from Electrical Engineer, Council Chambers.

MELBOURNE.—December 4th. (Extended from November 7th.) P.M.G.'s Department. Telephone and switchboard cable for all States.

ADELAIDE.—December 12th. P.M.G.'s Department. Telephone material, cells, telephone parts, &c.

SYDNEY, N.S.W.—December 6th. P.M.G.'s Department. Silk covered and enamelled insulated wire.

Bradford.—November 24th. General stores for tramway department for one year. Particulars from Tramway Offices, 7, Hall Ings.

Carlisle.—December 4th. Electricity Department. One 1500/2000 kW. turbo-alternator and one surface condensing plant. See "Official Notices" to-day.

Dublin.—November 22nd. Electricity Supply Committee. Twenty-four D.C. magazine flame arc lamps. See "Official Notices" to-day.

Enniskillen.—December 1st. Sligo, Leitrim & Northern Counties Railway Co. Telegraph material for 12 months. Mr. J. Duff, Secretary, Enniskillen.

Manchester.—December 12th. Three fan draught cooling towers at the Stuart Street station, for the Electricity Committee. See "Official Notices" to-day.

Newcastle-on-Tyne.—November 22nd. Tyne Improvement Commissioners. Six and twelve months' supply of incandescent lamps and arc lamp carbons. Mr. J. McDonald Manson, General Manager and Secretary, Bewick Street.

Warrington.—November 17th-22nd. Cheshire Lines Committee. Telegraph materials and carbons for twelve months. Stores Superintendent.

CLOSED.

Australia.—Commonwealth Department of Works and Railways. One 5-ton electric overhead travelling crane for the naval establishment. £1,911.—Babcock & Wilcox.

VICTORIAN RAILWAY DEPARTMENT. 300-watt, 220-volt gas-filled incandescent electric lamps, at 15s. 6d. each, 200-watt, 220-volt do., 13s. each.—Australian General Electric Co.

SYDNEY.—As the British General Electric Co., Ltd., intimated to the City Electrical Engineer that a serious mistake had occurred in their tender for booster plant for the Castlereagh Street sub-station, and that they did not wish to proceed with it, negotiations have been opened with the next lowest tender (Messrs. Wm. Adams & Co., Ltd.) who quoted £6,182 for two battery boosters and one milking motor-generator.

FORTHCOMING EVENTS.

- Junior Institution of Engineers.**—Friday, November 16th. At 8 p.m. At 39, Victoria Street, S.W. Paper on "Apprenticeship of Engineers," by Mr. Towse.
- Institution of Mechanical Engineers.**—Friday, November 16th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Paper on "Some Notes on Air Lift Pumping," by Mr. A. W. Purchas.
- Electro-Harmonic Society.**—Friday, November 16th. At 6.15 p.m. At the Holborn Restaurant (Venetian Chamber). Concert (ladies' night).
- Birmingham and District Electric Club.**—Saturday, November 17th. At 7 p.m. At the Swan Hotel, New Streets. Paper on "Publicity," by Mr. H. Foulds.
- Institution of Post Office Electrical Engineers (London Centre).**—Monday, November 19th. At 1 p.m. At the Royal Society of Arts. Paper on "The Electrical Physics of the Atmosphere," by Mr. J. E. Taylor.
- Royal Society of Arts.**—Wednesday, November 21st. At 4.30 p.m. At John Street, Adelphi, W.C. Inaugural address on "Science and its Functions," by the Chairman of the Council, Mr. A. Campbell Swinton, F.R.S.
- Institution of Electrical Engineers.**—Thursday, November 22nd. At 6 p.m. At the Institution of Civil Engineers, Great George Street, Westminster, S.W. Paper on "Gas Firing Boilers," by Mr. T. M. Hunter.
- Student's Section.**—Friday, November 23rd. At 7 p.m. At the City and Guilds (Engineers) College, Exhibition Road, Kensington, S.W. Opening meeting. Address by Sir Oliver Lodge, F.R.S., on "Astronomical Applications of the Electrical Theory of Matter."

NOTES.

Electrical Trades Union.—We have received copies of handbills calling an open meeting of station men for Monday next, at 7.30 p.m., at the Holborn Hall, Gray's Inn Road, E.C. 1. It is being held under the auspices of the London District Committee. The handbill says: "London Station Engineers: membership over 1,000."

Electricity in Farming.—In a recent New Zealand paper, Mr. R. M. Matheson, of the Rangotea Dairy Co., referred to the use of electricity on farms in the Taitapu district, where electricity is largely used for lighting the farm buildings, yards, &c., and for milking operations. Energy is distributed locally from the Taitapu dairy factory, no meters being used on the farms, which are charged flat rates—i.e., £9 per annum for lighting the yard and driving the milking machine and separator, while for a herd of 60 or more cows the charge is £18 per annum, this being the maximum. For home lighting and other domestic uses a charge of 5s. per month is made. The scheme is considered a great success by the farmers, equally as regards economy, efficiency, and cleanliness.

Electrical Incubation.—The Sydney Daily Telegraph recently referred to experiments carried out some years ago at Hawkesbury College with electric incubators, which showed their superiority to the lamp incubator. The most important feature was that the electric chicks developed better, and at a month old were 25 per cent. heavier than those from the lamp incubator.

The incubator then used had a faulty temperature control, though at the present day several suitable automatic regulators are available. The *Hobart Mercury* mentions an installation for hatching and rearing chickens at New Town, with 250 and 400-egg incubators, fitted with temperature regulators, which have been designed locally.

Iron-wire Transmission. A recent issue of our American namesake described a small rural farming electric supply company, composed of 25 farmers, who provided the money and built their own transmission line. The supply, at 6,600 volts, 60 cycles, obtained from the Wisconsin River Power Co., is carried by a No. 4 galvanised iron wire main line, with laterals of No. 6 galvanised iron wire; at a typical farm, two 5-kw. single-phase transformers are installed in open delta, three-phase 250-volt current for power being taken off the two secondaries, while single-phase 140-volt current for lighting is taken from one-half of the secondary of one transformer.

Mr. R. E. Protheroe, presiding at an address by Prof. Wood on Food Stuffs, &c., at the Regent Street Polytechnic, said he looked forward to the great benefit that science could confer on agriculture. Farmers now recognised the value of science, and no longer turned the cold shoulder to scientific experiments.

An Indian Bank for Industry.—The Bombay correspondent of the *Times* states that the Tata Industrial Bank is being formed with an authorised capital of £4,000,000, which will have as one of its special functions the assisting of industrial development. "The bank will have an expert intelligence section, scientific and commercial, to report on schemes brought to its notice."

Institution and Lecture Notes.—Institution of Electrical Engineers. At the meeting held on Thursday, last week, Mr. W. M. Morley announced the death of Mr. W. du B. Duddell (past-president), and briefly recounted the valuable services which he had rendered to the Institution and the electrical industry before proposing a resolution of condolence with Mr. Duddell's relatives, which was passed by the members standing in silence. Mr. C. P. Sparks (the retiring president), then presented the premiums awarded to the authors of papers during the past session, and installed the new president (Mr. C. H. Worthingham) in the chair. An abstract of the inaugural address is commenced elsewhere in this issue.

The opening meeting of the SCOTTISH LOCAL SECTION was held in Glasgow on Tuesday last, when Mr. A. Page (the new chairman) gave his presidential address. Dealing with the electricity supplies of Scotland Mr. Page referred to the appointment of the B. of T. Committee on electricity supply. He said that, in accordance with the plan of that Committee, the smaller and older power

stations, with their comparatively inefficient plant, would be gradually shut down, and that power would be generated in big central power stations. The proposed developments, he explained, had for their purpose the conserving of the coal wealth of the country and the cheapening of the cost of power to manufacturers, so as to assist them to compete successfully in the markets of the world. He showed how economies could be brought about mainly through the improved efficiency generally in the process of transformation of the energy in coal into electricity, the use of waste heat and water power, improved load and power factors, growth of standardisation, and more equitable taxation on electrical undertakings. He also commented at some length on the various sources from which were likely to come outlets for electrical energy—namely, the electrification of railways, the application of electricity to metallurgical and chemical processes, and also to agriculture. Mr. David A. Starr (the retiring chairman) occupied the chair at the outset, and introduced Mr. Page.

The first meeting of the session of the WESTERN LOCAL SECTION was held at the South Wales Engineers' Institute, Cardiff, on Monday last. Mr. R. Howard Fletcher was inducted to the chair by Mr. W. A. Chamen, who, in alluding to the absence of Prof. D. Robertson (the retiring chairman), referred in eulogistic terms to the interest Prof. Robertson always evinced in anything appertaining to the Western Local Section. Physical inability alone prevented him from coming to Cardiff. Mr. R. H. Fletcher then read his inaugural address, which was followed by a brief discussion. Mr. W. A. Chamen stated that a great deal of the present unsatisfactory relationship between employers and employes could be alleviated, if not actually removed, by the men thoroughly appreciating that the employers were not making the supposed abnormal profits at the expense of the employes' labours. He gave a case in point where dissatisfaction was immediately removed when the men were informed of the true state of affairs. Mr. Teasdel remarked that legislation ought to be brought to bear to enforce the obligations of the men, as well as the employers, in any dispute that might arise; until this came about he could not see how conditions could very much improve.

Royal Society of Arts.—The following are the arrangements for meetings during November and December:—

Wednesday, November 21st, 4.30 p.m., inaugural address of the 164th session of the Society, on "Science and its Functions," by A. Campbell Swinton, F.R.S., Chairman of the Council.

Wednesday, November 28th, 4.30 p.m., (ordinary meeting), G. Holt Thomas, chairman Aircraft Manufacturing Co., "Aerial Transport After the War."

Monday, December 3rd, 4.30 p.m. (Cantor Lecture), Prof. H. C. H. Carpenter, M.A., Ph.D., M.Inst.M.M., "Progress in the Metallurgy of Copper" (Lecture I).

Wednesday, December 5th, 4.30 p.m. (ordinary meeting), Sir Dugald Clerk, R.S.E., D.Sc., F.R.S., Inaugural Trueman Wood Lecture.

Monday, December 10th, 4.30 p.m. (Cantor Lecture), Prof. H. C. H. Carpenter, "Progress in the Metallurgy of Copper" (Lecture II).

Wednesday, December 12th, 4.30 p.m. (ordinary meeting), Lord Charnwood, "Technical Training for Disabled Soldiers and Sailors."

Thursday, December 13th, 4.30 p.m. (Indian Section), D. T. Chadwick, I.C.S., "The Trade of India with Russia, France, and Italy."

Monday, December 17th, 4.30 p.m. (Cantor Lecture), Prof. H. C. H. Carpenter, "Progress in the Metallurgy of Copper" (Lecture III).

Wednesday, December 19th, 4.30 p.m., Prof. J. Wemyss Anderson, M.Inst.C.E., M.I.Mech.E., "The Cold Storage Industry."

The following papers are among those to be read after Christmas:—

Lord Leverhulme, "The Relations Between Labour and Capital—Reasonable Hours, Co-partnership, and Efficiency."

W. L. Hichens, Chairman of Messrs. Cammell Laird & Co., "Labour Economy and Works Organisation."

Sir W. H. Clark, K.C.S.I., C.M.G., Comptroller-General of the Commercial Intelligence Department of the Board of Trade, "The Work of the Board of Trade Department of Commercial Intelligence."

Sir R. Armstrong-Jones, M.D., F.R.C.P., F.R.C.S., "The War and its Effects on the Mind."

A. Newlands, M.Inst.C.E., Chief Engineer Highland Railway, "Water Power in the British Isles."

F. S. Courtney, M.Inst.C.E., Consulting Engineer to the Royal Agricultural Society of England, "Agricultural Machinery."

M. O. Forster, D.Sc., Ph.D., F.R.S., "Organic Chemistry in Relation to Industry."

A. Dickinson, M.Inst.C.E., "Water Power in India."

H. M. Surtees Tuckwell, M.I.Mech.E., "The Tata Iron and Steel Works" (India).

C. du P. Chiappini, Trades Commissioner for the Union of South Africa, "The Industrial Resources of South Africa."

A series of papers has also been arranged dealing with the application of scientific research to the development of particular British industries.

The Cantor Lectures include a series of three by Mr. R. Darling on "High-Temperature Processes and Products" (January 21st, 28th, February 14th); and three by Mr. Edgar Crammond on "The Economic Condition of the United Kingdom Before the War," "The Real Cost of the War," and "Economic Reconstruction" (February 18th, 25th, March 14th).

Decimal Coinage.—At a joint meeting of the Institute of Bankers, the Association of Chambers of Commerce, and the Decimal Association, unanimous agreement was assented to as to the retention of the £ sterling as the monetary unit, and its division into 1,000 parts or mils. This enables all the existing gold and silver coins down to, and including, the 6d. piece, to be retained without any alteration in their respective values. With regard to the coins of lower denomination, it was unanimously agreed that they should consist of 1, 2, 3, 1, 5 and 10-mil pieces, of which the last two would be of nickel.

This enlarged range of the coins of lower value, in addition to providing coins substantially equal in value to the existing half-penny and penny, will provide coins of intermediate value between the present halfpenny and penny, and thus overcome a defect in our present coinage, which has resulted in prices in millions of small transactions in daily life being unduly increased because of the absence of suitable intermediate coins.

New Parliamentary Bills.—Sir A. Stanley, President of the Board of Trade, is introducing three new Bills:—(1) A Bill to continue, with modifications, for a limited period after the termination of the war, certain powers in relation to imports and exports; (2) A Bill to restrict temporarily the persons who may engage in business connected with certain non-ferrous metals and metallic ores (Sir Arthur told the House of Commons that the Bill would have the effect of preventing German companies from obtaining control of metals in the United Kingdom after the war. The Dominions would deal with the matter as it affected them); (3) A new Trade Marks Bill.

With regard to (2) the *Morning Post* states that the Bill applies to zinc, copper, tin, lead, nickel, and aluminium; and is to remain in operation for five years after the war. Licences issued by the Board of Trade will be required before any person can extract, smelt, dress, refine, or deal in any way wholesale or retail with these metals or ores. Licences may be suspended or revoked, and large powers are given to the Board of Trade to call for information and to inspect documents.

Appointments Vacant.—Engineer and manager, for the Borough of Leigh electricity department; secretary (£800), for the City of Birmingham electricity supply department; instructor in electrical work (lighting and power) for the Salford War Pensions Committee; two engineers-in-charge for Worcester electricity works (£55s. and a bonus of 10s.). See our advertising pages to-day.

The Alliance of Employers and Employed.—It is announced in the Press that, in view of the success of the National Alliance of Employers and Employed since its foundation in London in December last, it is proposed to hold a meeting of leading employers and representatives of Trade Unions shortly, in connection with the Alliance, to adopt a constitution and a programme which will establish the organisation on a permanent basis and set forth its views and intentions, as a body jointly representative of Capital and Labour, in regard to the crucial industrial issues of the day. The offices of the Alliance are at 61, Victoria Street. Mr. A. H. Paterson is the secretary.

Commercial Treaties.—In the House of Commons, on Monday, the President of the Board of Trade said that the position of this country in regard to its commercial treaty engagements with foreign countries was being carefully examined by the Government with special reference to their bearing on inter-Imperial trade relations and the conservation of Empire resources after the war. The examination was still proceeding.

Allied Control of Metals.—The *Times* states that the scheme for securing the future of the mineral and metal industries of the Allied countries is gradually taking more definite shape. A French company has just been formed, entitled the Société Minerais et Métaux, with a capital of 10 million francs (£400,000), for the purpose of fostering and protecting the metal industries of France. The company, which is thoroughly representative of existing interests, will seek to improve and extend the methods of distribution, treatment, and marketing of the metals produced in France and her colonies, and will also provide financial facilities for their development. It will not be a profit-making enterprise so much as an organisation for securing the economic development and control of the country's mineral and metal industries.

Industrial Reconstruction.—In our issue of October 12th, p. 353, we gave a somewhat full abstract of the scheme of Industrial Reconstruction, for the study of which a Council is to be established. A preliminary meeting, attended by a number of the signatories to the manifesto, was held on Thursday last week at the Savoy Hotel. Sir Wilfrid Stokes, President of the British Engineers' Association, presided, and Mr. E. J. P. Bunn gave an account of the progress that had been made, and his ideas respecting the place the Council should fill. It was decided to appoint a provisional committee of five to consider the establishment and constitution of the Council. The committee consists of Sir W. Stokes, Mr. Bunn, Mr. T. B. Johnston, and Mr. J. Johnstone, and one other, and it will report to a subsequent meeting.

Problems of Reconstruction.—Speaking at the National Liberal Club last week, Dr. Addison, Minister of Reconstruction, said that no sensible man would say in what precise aspect the problems arising after the war would present themselves, but there were certain conditions which they knew certainly would exist. There would probably be a new world after the war with, perhaps, a better conception of public duty, with different conditions and new problems. It was their intention to minimise control as soon as was possible in accordance with national interests. In view of shortages of some essential commodities it would not be possible wholly to free ourselves from all those things at once. They were endeavouring to bring into their counsel experts in trade, commerce, labour, &c. The progress of this country after the war depended on the increased productivity of the nation as a whole. Unless we could produce more we should be bankrupt. The war had manifested a gigantic capacity, and he wanted to see some of that great enthusiasm projected into reconstruction. After the war the problem of material supplies would immediately become urgent. He had a strong body of experienced men working on the problem, and they were doing all they could to secure the raw materials which would be necessary. The needs of our Allies also had to be considered. Referring to demobilisation, Dr. Addison said

that a number of experienced men in the engineering trades were going into the question as to what new industries could be developed. He hoped to announce the names of the committee shortly, and it was intended that this inquiry should be the first of a series. They would also inquire in view of the coming dislocation of labour what class of labour should be employed.—*Morning Post*.

U. D. Councils' Association and Electricity Supply.

We referred in our issue of August 3rd to the resolution of the Executive Council appointing a sub-committee to consider evidence to be furnished on behalf of the Association. The sub-committee held two meetings, and requested Mr. Nicholas to give evidence on certain lines. Prior to the reference by the Executive Council it had been suggested that an engineer witness should also be appointed, and Mr. A. H. Dykes, of Messrs. Hancock, Dykes & Trotter, consulting engineers, was invited, and subsequently gave evidence before the Electric Power Supply Committee. The U.D.C. Association Sub-Committee has expressed its indebtedness both to Mr. Nicholas and Mr. Dykes for the care and attention they have given to this matter.

Electrically-Controlled Motor Boats.

The Admiralty has issued the following statement:—
“The electrically-controlled motor-boats used on the Belgian coast are twin petrol engine vessels partially closed in, and travel at a high speed. They carry a drum with between 30 and 50 miles of insulated single-core cable, through which the boat is controlled electrically. The forepart carries a considerable charge of high explosive, probably from 300 lb. to 500 lb. in weight. The method of operating is to start the engine, after which the crew leave the boat.

“A seaplane, protected by a strong fighting patrol, then accompanies the vessel at a distance of three to five miles, and signals to the shore operator the helm to give the vessel. These signals need only be ‘starboard,’ ‘port,’ or ‘steady.’ The boat is zigzagged while running; this may be either intentional or unintentional. On being steered into a ship the charge is exploded automatically.

“The device is a very old one. A boat similarly controlled was used in H.M.S. *Vernon* (the torpedo experimental ship) as far back as 1885. The only new features in the German boats are petrol engines and W/T. signals, neither of which existed then.”

Scottish Local Authorities and B. of T. Electricity Committee.

A conference of representatives of Scottish Local Authorities has been held in connection with the remit to the B.O.T. Special Committee on Electric Power Supply. Representatives were present from Glasgow, Paisley, Greenock, Kilmarnock, Ayr, Wishaw, Motherwell, Falkirk, and Stirling. After an interchange of views the conference resolved as follows:—

(1) That the conclusions of the B.O.T. Committee, so far as relating to the division of the country into areas and the establishment of large generating stations, be approved generally; (2) that, where a local authority is generating or is able and willing to generate electricity on a comprehensive system such as is recommended, the local authority should have the right to do so in preference to a joint board or a company, and be constituted the generating authority for the area in which their district is situated; (3) that the distribution be left in the hands of local authorities or existing companies; (4) that the objects outlined in the remit made to the B.O.T. Committee and in the conclusions already arrived at would appear to be attainable in large measure by the establishment of a central generating authority coupled with a scheme of linking-up, and that the trunk mains necessary in connection therewith should be put down wholly or partially at the expense of the Government; (5) that underground and overhead cables and other underground and overhead works of electricity undertakings be rated on one-fourth of the annual value thereof; (6) that the proposal to establish a Board of Electricity Commissioners is unnecessary, and that a separate department of the B.O.T., with additional powers if necessary, be constituted for dealing with electricity matters, subject to the retention of an appeal to Parliament in cases where such now exists. If such a board is constituted, it should be subject to the control of Parliament, and all existing rights of appeal should be conserved; and (7) that the existing rights of local authorities as regards overhead wires, non-interference with streets, and powers of purchase be retained, with an appeal where consent is unreasonably withheld.

Coun. J. W. Stewart and Mr. W. W. Lackie were appointed to represent the views of the conference to the B.O.T., and a committee, consisting of one representative from each of the towns invited to the conference, was appointed to go over the evidence to be submitted, and to watch further proceedings in the interests of local authorities.

At a subsequent meeting of the Glasgow Electricity Committee it was agreed to recommend the Corporation to authorise the witnesses to state that if it is ultimately determined to divide the country into areas for the purpose of generating electricity, and an area is created for Glasgow and the Clyde and places adjacent, the Corporation is prepared to become the generating authority for such area, provided the terms and conditions upon which they are required to do so will not be detrimental to the city and its existing electrical undertaking.

Inquiry.—The makers of "Uacolite" are asked for.

Volunteer Notes.—COUNTY OF LONDON VOLUNTEER ENGINEERS (FIELD COMPANIES).—Headquarters, Balderton Street, Oxford Street, W. 1.

Orders for the week, by Lieut.-Colonel C.B. Clay, V.D., commanding:—
Officer for the Week.—Lieut. C. E. Campbell.
Next for Duty.—Lieut. W. J. A. Watkins.
Drills.—Week ending Sunday, November 25th, 1917:—
 Monday.—No. 3 Company, Left Half. Recruits, signalling, 6.30.
 Tuesday.—Physical drill and bayonet exercise, 7.30.
 Wednesday.—No. 1 Company, 6.30.
 Thursday.—No. 2 Company, 6; signalling, ambulance, 6.30.
 Friday.—No. 3 Company, Right Half. Recruits, 6.30.
 Sunday.—Commandant's Parade for heavy bridging instruction at Esher.
 Parade Waterloo Station, opposite No. 10 Platform, 8.35 a.m. Uniform, haversack, and water bottle. Mid-day rations to be carried. Compulsory for men in Sections A, B, and C.
Musketry.—Belvedere Road, Tuesday, Wednesday, and Thursday, 5.30 to 7.

(By order) MACLEOD YEARSLEY, Capt. and Adjutant.

The Whitley Report.—In the course of the debate in the House of Lords on the Marquess of Salisbury's motion respecting "Industrial Unrest," Viscount Milner, in replying, referred to the Whitley Report. He said that the establishment of Industrial Councils was by universal consent the most important point in the debate. The Whitley report reached the Government as a confidential document in March. It met with universal approval, and very high hopes were raised as to the beneficial effects that might result from the adoption of the system recommended. Its reception was encouraging beyond the highest hopes of those warmly in favour of it. Seven of the Industrial Unrest Sub-Commissions emphatically favoured it. The Trade Unions by a great majority favoured its principles; several made criticisms and reservations; hardly any were absolutely adverse. Taken as a whole, the views of the Trade Unions and of the Employers' Associations were overwhelmingly in favour of the recommendations. The Government had no longer any doubt as to what was the proper course to pursue, and they had given instructions to the Ministry of Labour to take immediate action to carry out the scheme. A new department of the Ministry of Labour was now at work trying to get Industrial Councils established as quickly as possible in the various leading industries. Certain trades were to be started with, as these, before the report was published, were making preparations for the constitution of such Councils. From these the Ministry would proceed to more difficult spheres of action, and so cover as large a portion of the field as could be covered at once, as quickly as possible. Viscount Milner said that although he was not absolutely optimistic, he thought that he could say that the new departure was the most hopeful that he could remember in the great field of social reform. The situation was full of anxiety, and the work which had been done was as nothing compared with the mountains that had to be climbed, both in the war and in peace.

Control of Tramway Labour and Material.—The Board of Trade has issued the following announcement in regard to the regulations of the supply of material, &c., for tramways:—

"In view of the difficulty in meeting the demands for various materials and labour required for the maintenance and renewal of the permanent way and rolling stock of the tramway undertakings, the Board of Trade are appointing a Committee to consider the needs of these undertakings, so that the necessary steps may be taken to supply, as far as possible, such needs, even though it may be at some temporary sacrifice to less essential undertakings."

"The Municipal Tramways Association and the Tramways and Light Railways Association are being invited to nominate members to the Committee, and the Board have asked the London County Council to allow Mr. A. L. C. Fell, the manager of their tramways, to serve on it."

"Mr. James Devonshire has been invited to be chairman of the Committee. It is not intended that the control of tramway undertakings should be interfered with by the Committee."

In the House of Commons, Sir A. Stanley said that the object of the Committee was not to take control of tramway undertakings, but to meet the needs of these undertakings engaged in work essential to the prosecution of the war.

Co-operation between Gas and Electricity.—From the Report of the National Gas Council on Coal Supplies, &c., which was recently submitted, it appears that six meetings of the "Utilisation of the Fuel Resources Committee" have been held, and a report, which it is proposed to submit to the Government, is now in preparation. It is anticipated that suggestions on the following lines will be made: (1) In the interests of national economy, the desirability of all coal of a bituminous character hitherto used directly as fuel being first treated for the extraction of its by-products. (2) Where gas undertakings are in proximity to electric power stations, an endeavour should be made to enter into an arrangement with electric undertakings for the supply of fuel for steam-raising in the form of coke or breeze. A Sub-Committee is now investigating the question of tar-burning for steam-raising.—*London and C. T. R. News.*

The Six-Hour Day. Lord Laverbuhne continues to advocate the six-hour working day in factories as a means for increasing production and providing work for all the men who return from the war. Machinery would increase production and enable higher wages to be paid. He argues for a better environment, a better outlook better education, and more leisure, out of which real culture springs. He suggests that with a six-hour day the one shift could work from 7 o'clock until 1.30 and the second could then come on, each having half-an-hour allowed for meal-times. The order of the shifts would be reversed in alternate weeks.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station Officials.—The Poplar B.C. Electricity Committee recommends that in order to bring the war bonus of junior officers in the electricity department into line with the last increase granted to workmen and advances to junior officers in the works department, an additional war bonus of £10 per annum should be granted to these officers. Eleven officers will be affected, viz.: seven at £185, three at £150, and one at £120 per annum.

Derby T.C. has approved of the following increases in salaries:—Messrs. G. J. Scales and H. T. Letchford, charge engineers, from £130 to £160 per annum, and, to £170 in January, 1918; Mr. R. Littlewood, clerk, from £112 to £130 per annum; Mr. W. G. Huliston, clerk, from £108 to £125 per annum.

Mr. J. W. Lowe, senior shift engineer, Wigan Corporation electricity department, was presented with a case of cutlery on 7th inst. on his leaving to take up the post of station superintendent to the Leyland Motor Co. at the new steel works, Farington.

Mr. JOHN LAMBERT, Corporation electrical engineer, Perth, has had his salary increased by £25.

At the end of November, Mr. ARTHUR T. SMITH will be severing his connection with the Leigh Corporation electricity works, of which he has been engineer and manager, as he has accepted an appointment on the staff of the British Dyes, Ltd., Huddersfield.

General.—The King has granted the Royal authority to Sir JOHN HUNTER, K.B.E., Director of Factory Construction and Director of Iron and Steel Production; Sir LEONARD WILKINSON LLEWELYN, K.B.E., Controller of Non-Ferrous Materials Supply; and Mr. WILLIAM TURNER MACLELLAN, Officials of the Ministry of Munitions of War, to wear the Cross of Chevalier of the Legion of Honour, conferred upon them by the President of the French Republic in recognition of valuable services.

The following service appointments have been gazetted:—Fortress Electric Lights.—The undermentioned to the Second-Lieutenants on probation: Corporal James Paton, from the Royal Engineers (T.F.); Corporal Arthur Ormans Lyons, from Royal Engineers (T.F.); Sergeant Albert Seddons, from Royal Engineers (T.F.); and Staff-Sergeant J. H. Tulloch, from the Royal Engineers (T.F.). Tyne Electrical Engineers.—John R. Lang-Hyde to be Second-Lieutenant.

Glasgow T.C. has appointed the following conveners and vice-conveners:—Tramways Committee, Mr. M. W. MONTGOMERY and Mr. T. KELLY; Electricity Committee, Mr. W. H. HANNAY and Mr. P. G. STEWART respectively.

Mr. HARRISON BARRON has been elected chairman of the Birmingham Tramways Committee for the eleventh time.

Mr. H. LUTON and Mr. J. CLARK have been elected chairman and vice-chairman respectively of the Leeds Corporation Electricity Committee.

Aldermen R. A. SMITHSON and H. BROWN have been elected chairman and vice-chairman respectively of the Leeds Corporation Tramways Committee.

Roll of Honour.—Second-Lieutenant R. O. GLADSTONE, R.E., has been killed in action. At the outbreak of the war he was in Spain for the British Thomson-Houston Co., but came home and at once joined up in the ranks.

Sergeant W. J. BENNETT, R.E., killed in action, was a wireless operator with the Marconi Co.

Private N. WHITE, wounded and missing, was employed by the Automatic Telephone Co., Liverpool.

Private W. WEIR, Manchester Regiment, killed in action, was before the war in the employ of Messrs. Baxendale and Co., Ltd., Manchester.

Private H. CROWLEY, Manchester Regiment, of Spring Gardens, Barton, killed in action, was employed at the British Westinghouse Co., Ltd., Trafford Park.

Private D. GREGORY, Border Regiment, killed, was employed by Messrs. W. T. Glover & Co., Ltd., Trafford Park.

Private P. H. BOWERS, Royal Warwickshire Regiment, killed in action, was 29 years of age, and employed by the St. Helens Cable Co., Warrington.

Sapper C. VICKERS, R.E., killed in action, was an electric meter inspector for the Leeds Corporation.

Corporal W. HOLGATE, K.O.Y.L.I., killed in action, was employed by Messrs. Wright & Wood, Halifax.

Private E. KYLE, of the Loyal North Lancashire Regiment, who was wounded and taken prisoner during the Battle of the Somme last year, has written home from Germany, enclosing a photograph, and saying he is as cheerful as circumstances will permit. He thanks Messrs. Dick, Kerr and Co., Ltd., Preston, for the parcels sent during the last 12 months, all of which he has received.

Private E. STARKLY, West Yorkshire Regiment, an employé of Messrs. Messenger & Sons, Birmingham, electric lamp manufacturers, has gained the Military Medal for carrying messages continuously through heavy shell fire.

Corporal J. E. MOGG, K.O.Y.L.I., has fallen in action. He

was an employé of the Electric & Ordnance Accessories Co., Birmingham.

Gunner J. W. OSBORNE, R.F.A., of Elland, who is an electrician, has been awarded the Military Medal.

Private J. L. MILLINGS, Australian Infantry Force, who was an electrical engineer, has fallen in action.

Corporal A. G. PEARCE, R.E., formerly an overhead linesman on the Corporation tramways at Croydon, who is in hospital, has been awarded the Military Medal.

Lance-Corporal C. THAKE, R.W. Kent Regiment, who has been wounded, was on the staff of Mr. B. Powell, electrician, Tunbridge Wells.

Corporal C. H. TOMPKINS, Oxford and Bucks Light Infantry, who has died of wounds, was in the Rugby works of the B.T.H. Co.

First-Class Air Mechanic P. F. HOOKER, who joined the R.F.C. in February, 1915, whilst an electrical engineering pupil with Mr. A. T. Lambert, manager of the Maidstone Corporation tramways, has been awarded the Military Medal for bravery.

Private A. W. JACOBS, City of London Fusiliers, who has fallen in action, was an employé of Messrs. Johnson and Phillips, Ltd., of Charlton, S.E.

Sergeant H. H. J. HERITAGE, who was with Messrs. Hill, Upton & Co., electrical engineers, of Oxford, when he was mobilised as a Territorial on the outbreak of war, has been given a commission as Second-Lieutenant in the R.E.

Private F. HILDITCH, killed in action, was in the electrical department of the Potteries Electric Traction Co.

Driver G. H. MASON, R.F.A., who has fallen in action, was on the staff of the Potteries Electric Traction Co.

Obituary.—MR. J. STELL.—Mr. John Stell, of Shipley, who died last week in his 68th year, was the chairman of the Yorkshire Cable Co., Ltd., Bradford, from its inception.

MR. WOODHEAD.—The death is announced of Mr. Woodhead, rolling stock superintendent to the Walsall municipal tramways undertaking.

MR. W. DU B. DUDELL.—The funeral of the late Mr. W. du B. Duddell took place at Brighton on November 8th, in the presence of his relatives; Mr. W. M. Mordey and Mr. Roger Smith, representing the Institution of Electrical Engineers, and Prof. T. Mather, F.R.S., representing the Royal Society and the Physical Society, were also present at the ceremony.

COMMANDANT C. TISSOT.—From *La Revue Générale d'Electricité* we learn that Commandant C. Tissot, the distinguished French naval officer, Professor at the Naval School, and a noted exponent of wireless telegraphy, died on October 1st at the early age of 49. Amongst other achievements, he was one of the first to measure the current received in wireless telegraphy, and to deduce the law of range, to study the damping of antennæ and its relation to the quality of the earth-connection, and to advocate and assist in the introduction of wireless time signals, and during the war he was constantly employed upon work of national importance, in the course of which he contracted the illness which led to his untimely death.

NEW COMPANIES REGISTERED.

Rustless Iron (Cowper-Coles Process), Ltd. (148,832).—Registered November 6th. Capital, £5,500 in 3,000 7½ per cent. cum. pref. shares of £1 each, and 10,000 ord. shares of 1s. each. To carry on any business connected with the manufacture of rustless iron and other metals, and the development of processes for preventing rust and corrosion, and to carry on the business of mechanical and electrical engineers, metallurgists, chemists, &c. Agreement with Sherard Cowper-Coles. The subscribers (each with one share) are:—W. H. Essex, Haven-o'-Rest, Sunnecad Road, Sunbury-on-Thames, company secretary; H. V. Steele, 9, The Avenue, Sunbury-on-Thames, company secretary. First directors: Sherard Cowper-Coles, and others to be appointed by the subscribers.

Taylor & Co. (Hatton Garden), Ltd. (148,833).—Private company. Registered November 6th. Capital, £1,000 in £1 shares. Manufacturers of and dealers in mica, micanite, electrical plant and accessories, insulating machinery, mica chimneys, lamp tops, &c. The subscribers (each with one share) are:—Miss J. Taylor, 40, Hatton Garden, E.C.; E. W. Tester, 25, Victoria Street, S.W., stockbroker. The first directors are to be appointed by the subscribers. Solicitors: Campbell, Hooper & Todd, 30, Golden Square, W.

G. & S., Ltd. (148,816).—Private company. Registered November 5th. Capital, £1200 in £1 shares. Electrical, general, and mechanical engineers, machinists, founders, smiths, fitters, wood workers, builders, painters, japanners, enamellers, manufacturers of and dealers in motor cycles and cars, &c. Agreement with K. E. L. Guinness and C. M. Smith. The subscribers (each with one share) are:—K. E. L. Guinness, Aranmore, Kingston Hill, Surrey, engineer; C. L. Smith, Glenavon, Bedford, engineer; H. P. Hawthorn, Newlyn, Jarvis Brook, Sussex, engineering works manager; Mrs. B. Fuller, 17, Moscow Court, W. 2. The first directors are to be appointed by the subscribers. Solicitors: Mellor & Co., 8, Coleman Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Isle of Thanet Electric Tramways & Lighting Co., Ltd.—Agreement dated October 25th, 1917, to issue £3,000 debenture stock for a loan of £1,500. Property charged: That charged by trust deed of January, 1902, securing the company's debenture stock, viz.:—The company's undertaking and property, present and future. Holder: J. B. Glenn, Moorgate Station Chambers, E.C.

CITY NOTES.

Auckland Electric Tramways Co., Ltd.

The traffic receipts during the year ended June 30th, 1917, were £282,638, an increase of £7,911. The total revenue was £286,886. After providing for all expenses chargeable to revenue, including £20,802 for debenture and other interest, £5,101 for rental and percentage of profits payable to the Auckland City Council, and setting aside £25,000 to renewals and depreciation account, the surplus is £55,317, plus £1,601 brought forward, making £56,917. After paying the preference dividend (£9,000), putting £10,000 to reserve, and paying a total dividend of 1s. 7d. per share, less income-tax, for the year on the ordinary shares, £5,292 is to be carried forward. During the year £8,186 first mortgage debenture stock was bought and cancelled at an average cost of 93½ per cent. No further capital was issued. The capital expended was £9,546, chiefly for the Upper Queen Street extension, which was opened in October of last year. The route miles open are 27.13, as against 26.59. The passengers carried were 13,351,632, against 12,352,531. Average receipts per passenger 1.57d., against 1.56d. Average expenditure per passenger 1.00d., against 99d.

Drake and Gorham, Ltd.

In his speech at the annual meeting held last week, Mr. B. DRAKE said that the year's profit of £11,395 compared with £8,527 for the preceding year, and constituted a record since 1903. Although, as in most British electrical concerns, their dividends paid in the past had not been such as an investor expected from an industrial enterprise, yet the amounts earned had now exceeded the capital of the company. The assets had been increased by over £35,000, and about £93,000 had been distributed in dividends. By adopting a conservative policy in the matter of distribution they had been able to enter new fields without having to raise additional capital, which would have been difficult to obtain. It was fortunate that the board decided in the past not to rely solely on country-house lighting, with which the name of the company was originally connected, for, in spite of the practical suspension of this class of work, they had been able by manufacturing and wholesale trade, coupled with contracting for the equipment of war factories, camps, aerodromes, &c., to reach a turnover considerably in excess of what was previously found possible. There was little doubt that the supply of electrical power to factories, in which direction the company had acquired considerable experience, would after the war become a more valuable branch of their business. The power station erected by the company for a leading chemical company had for some time been working night and day, and had given satisfaction. Negotiations were in progress for similar work on a larger scale. The Manchester branch had done well in all departments, and again showed increased profits. The electric vehicle business, as might be expected, had increased, and there was no doubt that the results obtained would ensure a continuance of this method of propulsion even when petrol was again available at reasonable prices. As the lease of the present warehouse and works was expiring, and it was evident that the turnover warranted larger premises, they had taken the Rockingham Works, Newington, on lease. It had been difficult to decide on the size of works which they were justified in acquiring, owing to the absence of any declaration on the part of the Government as to their after-war policy. Manifestly, if the pre-war dumping was again to be permitted, and the electrical industry was not to be fostered more than in the past, the manufacture of electrical goods would again show poor returns on capital invested. In view of the uncertainty, they had not felt it wise at present to extend their manufacturing on the scale that they would have wished. They, however, anticipated that in any event the wholesale merchanting branch at home and overseas would expand, and they were negotiating for a warehouse which should meet their needs for many years. They had a good list of orders for the first quarter of the current year, and were constantly receiving repeat orders, but if the war continued it was impossible to foretell what results they might be able to show in the next balance-sheet.

Western Telegraph Co., Ltd.—The company has now issued its report for the year ended June 30th. The revenue was £1,073,206, and the working expenses were £397,591. After providing £32,747 for debenture interest, and £149,226 for income-tax and excess profits duty, the balance is £493,432, plus £38,345 brought forward. There has been transferred in further reduction of the amount of capital expenditure in excess of the share capital and debenture stock issued £150,000, to general reserve £100,000, to land and buildings depreciation fund £30,000, and to maintenance ships reserve fund £50,000. The total distributions for the year have amounted to 8 per cent., free of tax, leaving £35,433 to carry forward.

Stothert & Pitt, Ltd.—Dividend of 10 per cent. and a bonus of 2½ per cent., free of tax, on the ordinary shares. £5,000 is put to reserve, and £12,998 to the extinction of goodwill account.

Quebec Railway, Light, Heat & Power Co., Ltd.—At the annual meeting, held in Montreal on October 11th, it was reported that the gross earning for the year ended June, 1917, were \$1,832,032, an increase of \$100,299. Miscellaneous income was \$230,851, and the increase from all sources was \$91,281. Operating and maintenance expenses at \$1,155,909 showed an increase of \$126,218. The net surplus is \$200,587. The properties had been kept in a high state of efficiency, \$226,366 having been expended during the year on maintenance accounts. The capital expended during the year was \$302,661. Mr. H. G. Matthews, the general manager, died in July, and Mr. W. J. Lynch, treasurer and comptroller, had been appointed to his post. The Hon. R. Mackay, a director since the organisation of the company, died in December.

Nairobi Electric Power & Lighting Co., Ltd.—The accounts for 1916, the publication of which has been delayed by war conditions, shows that the units generated were 1,495,281, as against 1,122,744 for 1915; motors connected, B.H.P. 648, against 431 in 1915; lights connected (40 watts) 9,811, against 8,044 in 1915. The auxiliary steam plant erected at Nairobi was used to the extent of rather more than 10 per cent. of the total units generated. The share capital is £32,950 issued, a slight increase. The preference and ordinary shares have been consolidated into shares of one class only. The war occasions increasing difficulties in carrying on the company's operations. Further developments are nearly stopped on account of the impossibility of procuring the necessary plant and materials at Nairobi. A final dividend of 4 per cent., making the total 10 per cent. for the year, less income-tax, on all shares, is to be paid.

Trafford Park Estates, Ltd.—For the year ended June, 1917, the profit was £35,526, plus £50,352 brought forward. A dividend of 5 per cent. is recommended, carrying forward £54,766.

United Electric Tramways of Caracas, Ltd.—A dividend of 7 per cent., less income-tax, for the year is to be paid, carrying £1,899 forward.

STOCKS AND SHARES.

TUESDAY EVENING.

Stock Exchange markets are in quiet mood. Russia and Italy are uncomfortable factors. From the merely financial point of view, Russia is, for practical purposes, written off for the time being, but it is hoped that the Italian prospect may any day take a sharp turn for the better. Money goes steadily into the new War Bonds; subscriptions, however, are less than they ought to be, and it would appear as though capital were being accumulated in deposit and other accounts. Still, the applications do make a difference to the volume of investment business which might otherwise be flowing into Stock Exchange markets.

While Home Railway stocks are letter as a whole, the Underground list is dull and heavy. Income Bonds further gave way, and the shilling shares went back to 6s. Metropolitan Consolidated rallied after being weak at 22½.

The most active part of the electrical markets is that concerned with the manufacturing shares. Comparatively speaking, there is a lot of business doing in Edison Swan shares, which stand at the good price of 26s. 6d., while the fully-paid hold their rise at 21. Cromptons, too, are strong at 13s. 6d., with a good demand for them, and the preference are 15s. General Electrics hold their big rise, the ordinary at 18½, while the preference are 10½, and there would be much more doing in them were there sufficient supply of shares to render the market liquid. British Aluminiums reacted a shade to 32s. The little rise in Aron ordinary brought in a few sellers, and the price has gone back a trifle to 2s. 3d. There still seems to be an expectation, rather than a hope, that some kind of amalgamation or agreement of interests will be arrived at between various manufacturing interests, and to the expectation is added the hint that the United States manufacturers may also come into the business, but we have failed to find any justification beyond rumour only.

The foreign division is dull, with the exception of Brazil Traction. The latter have recovered a point to 43, and are a better market than they have been lately. British Columbia Deferred at 28 is ½ better, and the 1½ per cent. debenture stock retains its recovery of 4 points. Mexican Light and Common first bonds went back to 42, a drop of 3 points, most Mexican issues being weak. There is no change in the Argentine list. It is worth observing that Indian shares are in some request. Bombay Electric preference moved up to 9½. Madras preference are wanted about 4½; the last business recorded in the shares was at 1½ in the middle of July. Calcutta Trams changed hands the other day at 6 13/16; the price of the preference is £1, and the 4½ per cent. debenture stock has lately hardened to 74. There is a little business passing, too, in British Electric Traction, the ordinary being easier at 31½, the 6 per cent. participating preference stock 71, while the first and second debentures are 71 and 65 respectively. La Plata Tramways ordinary were done the other day at 2s. 4½d., and the preference stand about 6s. 3d. Lon-

don United Tramways debenture is unchanged at 35½, on the company's publication of its intention to apply for Parliamentary permission to re-arrange its fares. Cape Electric Trams are lower at 11s. 3d.

The telegraph market is quiet. Anglo-American preferred fell a point to 97, but the Eastern group keeps its prices, and Westerns in particular are strong at 15½. Oriental Telephones went back to 3. Marconis have undergone a change for the better, the parent shares hardening to 3½, while the Marines maintain their position as the firmest of the group at 2 21/32. The speculation in American Marconi and in Canadians has died out for the time being. The prices of the two are respectively 21s. 6d. and 10s. 6d.

City of London ordinary shares are ½ better at 13½, this being the only change in the lighting list on the week. Dealers in the market report that there is still a strong demand for the best class shares, of which the scarcity is almost as marked as that of tea, butter, and sugar, while it is almost impossible to obtain debenture stocks. Activity in the manufacturing list makes up a good deal for the quietude of business in the supply shares, and one hears an occasional wish that certain companies would follow the example set in other directions, and split their shares into smaller denominations in order to render the market in them more liquid. Of this, however, there is no indication at present, nor does it seem to be at all likely that such a course would be pursued.

The Rubber share market is quiet, and inclined to go lower in company with the price of the raw article. Provincial buyers show a mild disposition to pick up tin and copper shares, and the armament group is a little better. Taken all round, however, Stock Exchange business is quiet; the War Loan and industrials make the best showing.

SHARE LIST OF ELECTRICAL COMPANIES.

		Dividend		Price	Nov. 13, 1917	Rise or fall this week.	Yield p.o.
		1915.	1916.	1917			
HOME ELECTRICITY COMPANIES.							
Brompton Ordinary	10	9	6½	—	—	—	£6 18 6
Charing Cross Ordinary ..	5	5	4	—	—	—	6 5 0
do. do. 4½ Pref. ..	4½	4½	3½	—	—	—	6 13 4
Chelsea	4	3	2½	—	—	—	5 9 1
City of London	8	8	12½	—	—	—	6 2 0
do. do. 6 per cent. Pref.	8	6	10½	—	—	—	5 18 6
County of London	7	7	11	—	—	—	6 7 8
do. do. 6 per cent. Pref.	8	6	10	—	—	—	6 0 0
Kensington Ordinary	7	6	5½	—	—	—	5 14 8
London Electric	8	8	1	—	—	—	Nil
do. do. 6 per cent. Pref.	8	4	3½	—	—	—	5 6 8
Metropolitan	8	8	8½	—	—	—	4 12 4
do. do. 4½ per cent. Pref.	4½	4½	8½	—	—	—	7 4 0
St. James' and Pall Mall ..	8	8	7	—	—	—	5 14 6
South London	5	5	3	—	—	—	6 13 1
South Metropolitan Pref. ..	7	7	21/6	—	—	—	6 10 6
Westminster Ordinary	7	7	6½	—	—	—	5 8 3
TELEGRAPHS AND TELEPHONES.							
Anglo-Am. Tel. Pref.	8	8	97	—7	—	—	6 8 9
do. Def.	83/6	1½	28½	—	—	—	6 9 0
Chile Telephone	8	8	7½	—	—	—	5 11 4
Cuba Sub. Ord.	5	7	8½	—	—	—	3 0 0
Eastern Extension	8	8	14½	—	—	—	7 7 9
Eastern Tel. Ord.	8	8	149	—	—	—	5 7 0
Globe Tel. and T. Ord. ..	7	7	12½	—	—	—	6 6 8
do. Pref.	6	6	10½	—	—	—	6 15 8
Great Northern Tel.	22	24	88½	—½	—	—	6 4 8
Indo-European	18	13	52½	—	—	—	6 3 10
Marconi	10	15	3½	—	—	—	4 12 4
Oriental Telephone Ord. ..	10	10	8	—	—	—	3 6 8
United R. Plate Tel.	8	8	6½	—	—	—	5 13 6
West India and Pan.	6d.	6d.	1½	—	—	—	3 9 6
Western Telegraph	7	8	15½	—	—	—	5 5 0
HOME RAILS.							
Central London, Ord. Assented	4	4	60½	—	—	—	6 12 8
Metropolitan	1	1	28	—	—	—	4 7 0
do. District	Nil	Nil	16	—	—	—	Nil
Underground Electric Ordinary	Nil	Nil	12	—	—	—	Nil
do. do. "A"	Nil	Nil	8½	—	—	—	Nil
do. do. Income	6	4	82	—1	—	—	4 17 5
FOREIGN TRAMS, &c.							
		Dividend					
		1915.	1916.				
Adelaide Sup. 6 per cent. Pref.	8	6	42	—	—	—	6 8 1
Anglo-Arg. Trams, First Pref.	5½	6½	8	—	—	—	9 3 4
do. 2nd Pref.	5½	—	2½	—	—	—	—
do. 5 Deb.	5	5	68	—	—	—	7 7 8
Brazil Traction	4	4	43	+1	—	—	—
Bombay Electric Pref.	6	8	9½	+½	—	—	6 3 1
British Columbia Elec. Rly. Pfee.	5	5	42½	—	—	—	11 18 2
do. do. Preferred Nil	Nil	Nil	39	—	—	—	Nil
do. do. Deferred Nil	Nil	Nil	28	+½	—	—	Nil
do. do. Deb.	4½	4½	55	—	—	—	7 11 7
Mexico Trams 5 per cent. Bonds	Nil	Nil	41½	—	—	—	Nil
do. 6 per cent. Bonds Nil	Nil	Nil	85	—	—	—	Nil
Mexican Light Common ..	Nil	Nil	12½	—	—	—	Nil
do. Prof.	Nil	Nil	85	—	—	—	Nil
do. 1st Bonds	Nil	Nil	42½	—3	—	—	—
MANUFACTURING COMPANIES.							
Babcock & Wilcox	15	15	3½	—	—	—	4 18 0
British Aluminium Ord. ..	7	10	1½	—	—	—	6 5 6
British Insulated Ord. ..	17½	20	8	—	—	—	6 13 4
British Westinghouse Pref. ..	7½	7½	2½	+½	—	—	5 2 0
Callenders	20	20	11½	—	—	—	6 18 0
do. 5 Pref.	5	5	1½	—	—	—	6 1 8
Casner-Kellner	22	22	8½	—	—	—	6 8 0
Edison Swan, fully paid	—	—	2½	—	—	—	Nil
do. do. 4 per cent. Deb.	4	4	7½	—	—	—	5 7 5
Electric Construction	7½	7½	1½	+½	—	—	6 13 4
Gen. Elec. Pref.	8	6	10½	—	—	—	5 14 3
do. Ord.	10	10	1½	—	—	—	5 8 0
do. do.	25	25	15½	—	—	—	7 18 8
Henley	4½	4½	4	—	—	—	5 12 6
do. 4½ Pref.	10	10	11½	—	—	—	7 1 7
India-Rubber	20	20	41	—	—	—	5 17 0
Telegraph Con.	—	—	—	—	—	—	—

* Dividends paid free of income-tax.

DOMESTIC ELECTRIC HEATING PROBLEMS.

Water Heating.—At the Joint Convention of the North-West Electric Light and Power Association and Washington Contractors' Association, held recently, a whole day was given to the discussion of electric range and water heating problems. Electric water heating is a live problem in America, and, judging by one of the papers quoted in the *Journal of Electricity*, some sort of agreement as to general practice has been achieved. It is pointed out that an automatic circulation gives the best service, consumption averaging 3 to 4 KW.-hour per day per person, which, at 1 cent per KW.-hour, is satisfactory to the average consumer.

The efficiency depends on the installation as a whole, and, for average conditions, is assumed to be 85 per cent.

The needs of the average small family of three or four persons can be satisfactorily met by a 30-gallon boiler and 2-KW. thermally controlled heater of the circulation type, while larger families of six or eight persons would use a 3 or 4-KW. heater of the same type.

Fig. 1 shows the method of installation recommended, and fig. 2 the thermal switch or automatic cut-off. The bottom of the heater should be as low as, or lower than, the bottom of the boiler, to ensure circulation and the operation of the thermal switch. The heater should take cold water from the bottom of the boiler, and

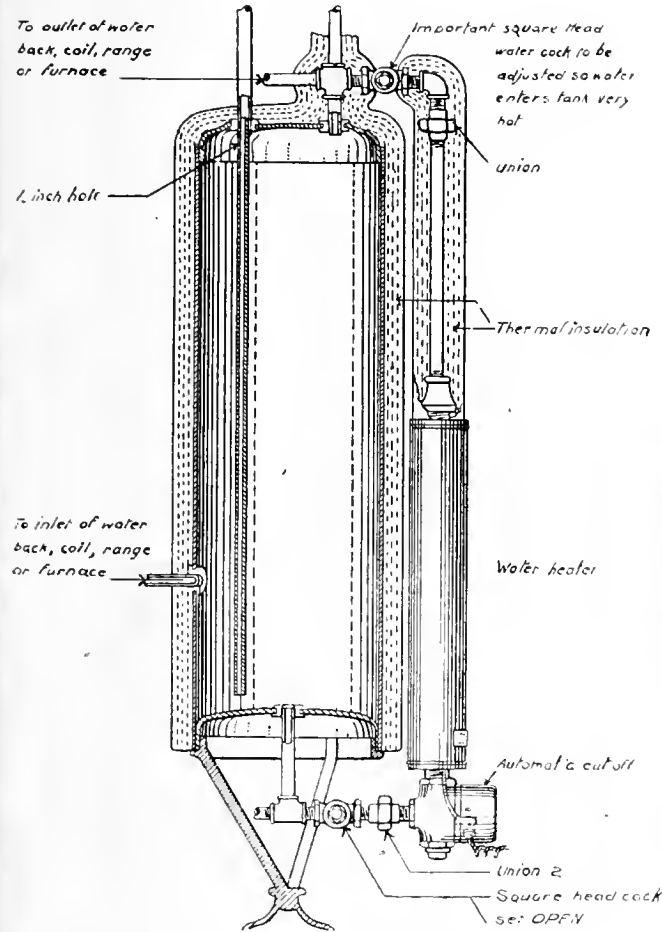


FIG. 1.—AUTOMATIC CIRCULATION-TYPE WATER HEATER.

deliver hot water to the top: cocks are fitted above and below the boiler to enable the heater to be removed without drawing off the water, but the upper cock is also used to restrict water circulation, in order to give a greater heating effect in the circulator. Three makes of heaters are fitted with restricted openings for this purpose, but the use of cocks is advised in any case.

The cocks should be adjusted so that the heater delivers water at 160-175° F.: the lower cock corrects the tendency of cold water in the bottom of the boiler to by-pass through the heater to the top of the boiler when hot water is being withdrawn. The heater and pipes should be insulated with magnesia or similar covering 1 in. thick.

The thermal switch is stated to be simple and reliable, and easily installed in the pipe below any standard circulation heater, the switch being sold for from \$7 to \$8.

The thermally-controlled immersion heater can be used instead of the circulation type, and being within the boiler, will decrease radiation losses, though it should be used with an ample-capacity boiler, so that there is always a sufficient quantity of hot water left at the top to meet demands while the remainder of the water is being heated up.

This heater has the characteristic of mixing the water and raising the temperature of practically the entire boiler at the same time.

Where the rate is considered too high, or it is unnecessary to maintain a hot water supply at all times, a non-automatic circulation heater of 1 or 5-KW. capacity can be used on a double-throw switch with the range, and a lower energy consumption will result by reason of the lower radiation losses, &c.

Non-automatic immersion heaters of small capacity have been used in considerable numbers in the North-West, but suffer from the same disadvantages as the automatic-immersion type.

The instantaneous type of heater without coils or switch, and

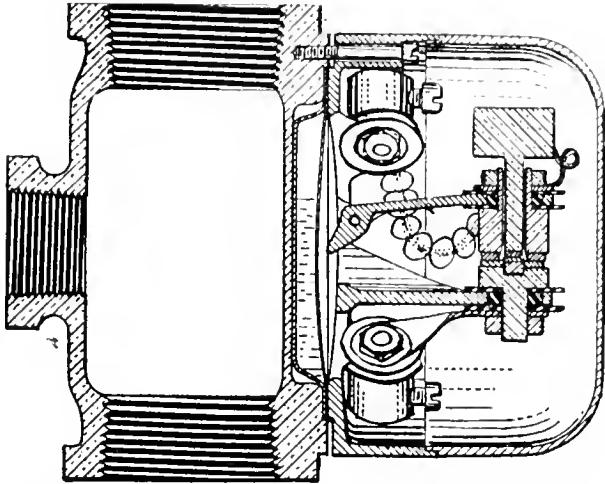


FIG. 2.—THERMAL SWITCH FOR ELECTRIC WATER HEATER.

having the current-limiting feature, is regarded as the most efficient and inexpensive where a limited quantity of water is required.

In the favoured design the electrodes consist of a tube within a cylinder: the water is slowly admitted from the bottom, and gradually rises, filling the electrode space, the current correspondingly rising from zero to maximum, and the reverse action occurs when the water is turned off and the heater drained. The heater has therefore no detrimental effect on the regulation of the circuit. Heaters of this type of about 5-KW. capacity can be installed on double-throw switches with ranges, and will produce limited quantities of boiling water at a very low cost.

Nine of the companies in the North-West have installed a total

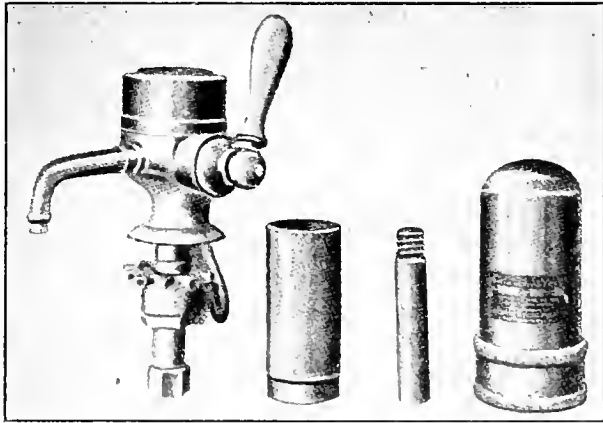


FIG. 3.—INSTANTANEOUS TYPE ELECTRIC HEATER SHOWING PARTS.

of 1,930 water heaters, with a connected load of 3,560 KW.: a thousand of these are on one system.

Feeder Diversity of Electric Ranges.—A paper on this subject dealt with the effect of the electric range load on a lighting feeder, as the immediate question is that of supplementing feeder capacity where the range is threatening to establish a peak.

To observe the effect of the ranges, observations were taken during two weeks on six feeders in both winter and summer: each feeder was rated at 100 amperes at 2,300 volts, single phase. The results were as follows:—

Ranges ...	...	13	39	13	21	11	6
Load factor (winter) ...	106	37.1	35.8	38.5	36.8	37.9	
Ranges ...	...	13	53	17	25	17	6
Load factor (summer) ...	33.4	43.7	34.1	27.9	30.7	28.3	

It is noted that feeders with a small number of ranges show decreasing load factors as summer approaches, while feeders with a large number of ranges show increasing load factors, the only exception being a feeder with a summer amusement park on it. In order to get more accurate information, one feeder with considerable range load was further tested; this supplied small frame houses, a few large houses, and one apartment house, the

sumers being office and professional men. The following data was obtained :

Total number of residences	643
Total number of electric ranges... ..	53
Total capacity connected in ranges	303.3 KW.
Total number of electric water heaters	29
Total capacity, electric water heaters	21.65 KW.
Total number of transformers	44
Total capacity, transformers	437.5 K.V.A.

Daily Load Data.		Average.	Maximum.
		K.V.A.	K.V.A.
Sunday ... ..	...	59.0	109.7
Monday ... ..	...	62.2	91.7
Tuesday ... ..	...	69.3	107.0
Wednesday ... ..	...	68.4	107.5
Thursday ... ..	...	61.8	97.3
Friday ... ..	...	63.7	111.2
Saturday... ..	...	66.3	112.0

Average, 61.1.

Weekly apparent load factor, 57.5 per cent.

From the load curves obtained, it is noted that there is a night load of over 10 K.V.A. on every night, accounted for as to half by water heating and the remainder by all night lighting, and feeder, transformer, and meter losses.

Deducting the 20 K.V.A. with an additional 20 K.V.A. for lighting from the largest range peak (as shown by load curves), 107 K.V.A., there is a net range peak of 67.5 K.V.A. at 6 p.m. on the Wednesday, which, compared with the connected load of 303.2 K.V.A. in range capacity, gives a demand factor of 1.5.

Looking to the future, it is considered that the area served by this feeder will have six times as many ranges—i.e., 318 of 1,820 K.V.A. rating. If this were handled by six feeders of present capacity it is clear that their characteristics would be similar to the present one, with the exception that the lighting and ironing peaks would be 1.6 times as large as at present. The winter peak for the feeder was 193.2 K.V.A. with 39 ranges, which, with a 3.9 demand factor, would give a maximum range load of 60 K.V.A., leaving 133.2 K.V.A. for lighting and losses.

Taking one-sixth of this, there would be a lighting and loss load of 22.2 K.V.A. plus a 67.5 K.V.A. peak due to ranges, giving a total maximum demand of only 89.7 K.V.A., or less than half the capacity of the feeder.

Even allowing one-third of the district to a feeder, in which case there would be a lighting and losses load of 44.4 K.V.A. plus 129.1 K.V.A. (for 106 ranges of 607 K.V.A. rating with a demand factor of 4.7), the load of 173.5 K.V.A. is within the capacity of the feeder.

Further, assuming the case of only one additional feeder, lighting and losses would account for 66.6 K.V.A., which, with 159 ranges of 910 K.V.A. capacity and demand factor 5.2, would only give a maximum load of 241.6 K.V.A., which a slightly larger feeder could handle.

The author, therefore, comes to the conclusion, that on present admittedly inaccurate data, so far as feeders are concerned, the excellent diversity of the electric range will make it possible to handle very considerable loads with only slight increases in feeder investment.

(To be concluded.)

THE INSTITUTION OF ELECTRICAL ENGINEERS.

*Abstract of the Inaugural Address delivered by
MR. C. H. WORDINGHAM, President, November 8th, 1917.*

THE INSTITUTION AS NOW CONSTITUTED.

I PROPOSE to take for the main subject of my address this evening the Institution itself; to consider how far it meets the needs of the profession and industry, and what improvements can be made under its existing constitution; then to inquire whether it may not be possible to raise it to a far higher plane and make it much more potent in the development of electrical engineering. The Institution and the industry should be one, and if they are not, it is our business to make them so.

I have seen from time to time, with great regret, indications that many members are not wholly satisfied with the management of the Institution, and have heard expressions of opinion that it does not sufficiently represent the industry or look after its interests adequately.

These allegations are, in many instances, based upon ignorance of what the Council is doing, but more largely upon a want of appreciation of what it is possible for the Council to do. The Institution comprises in its members every electrical interest in the country; those interests are heterogeneous, and in many cases the interests of one section of the members directly conflict with those of another section. How, then, is it possible for the Council, in the name of the Institution as a whole, to represent adequately the material interests of one particular section without doing an injustice to another section? I have always held the view that the Institution should attend to the promotion of electrical science and its applications to engineering; it should promote research of

every kind; it should encourage the spread of scientific knowledge and the improvement of engineering practice; it should set the highest possible standard of conduct and of attainment in knowledge and skill among its members, but it should not attempt to look after the commercial interests of any one section. It is often stated, in a somewhat sneering manner, that the Institution will not demean itself by looking after such sordid considerations as those involved in commercial pursuits, though its members, one and all, have necessarily to pocket their profits if traders, or their fees if consultants.

No greater misrepresentation of the attitude of mind of those who see the limitations I have indicated could be made. The reason that I contend the Institution should not attempt to interfere with commercial matters is that it is impossible for it to do so efficiently. It is of the essence of the successful prosecution of commercial interests that those interests should be common and homogeneous, and I have always held most strongly that each section should organise its own association for the promotion of such interests so as to bring the greatest possible weight to bear by concentrating the whole action in one direction. This course was followed at an early stage by municipal engineers who formed the Incorporated Municipal Electrical Association. Much later there has been formed the British Electrical and Allied Manufacturers' Association to look after the manufacturing interests. Other associations have been created for other interests which I need not enumerate. There can be no question whatever of the value that the two Associations I have particularised have been to the interests concerned, and this work has been accomplished simply and solely because each has been homogeneous and has only sought to serve the interests of the particular group of individuals affected. If each section is thus benefited, it necessarily follows that the industry as a whole is advanced.

I believe also that much apprehension arises from the fact that the proceedings of the Council are secret. Representations have been made from time to time to the effect that some account of each Council meeting should be communicated to members through the *Journal*, and an attempt has been made to publish those portions of the Council minutes which it has been thought might be communicated without detriment. I am afraid it is impossible effectually to meet this demand. Much of the matter which comes before the Council is of necessity confidential, and negotiations and communications take place which it would be impossible to publish without causing much mischief and defeating the objects in view. In my view the only possible course is for members to trust those of their number whom they have elected to the Council, and to believe that they are doing their best to ensure the good of the Institution and watch over the interests of its members.

It is an unfortunate fact that a very large number of members abstain from voting at the Council elections. The normal proportion of votes recorded to voting papers sent out is about 25 per cent. Obviously, if members will not take the trouble to secure the return of members in whom they have confidence, it does not lie with them to find fault later with the Council. Personally, I am very fully impressed with the need for a thoroughly representative Council, and I should like to see some change made in the mode of its election which would ensure that each section of the members was directly represented thereon in proportion to the numbers in that section. For example, I should like to see the important groups, such as the telegraph and telephone members, the manufacturing members, the municipal members, the company supply members, and so on, each vote for their own representative or representatives, thus ensuring that those representing a specific interest were chosen by the whole body of members devoted to that interest. In addition, I would have a certain number elected by the whole body of members independently of any group representation. There would undoubtedly be difficulties in the way of such a modification in existing practice, and the matter cannot be discussed adequately outside the Council, but I hope that when the next revision of the Articles takes place this matter may be given very full consideration with a view to making the Council as representative as possible in every way.

Yet another matter which calls for attention is the undoubted feeling that London members have a decided advantage over those living outside London and abroad. Not only are they thought to get more than the other members, but in some quarters there is an idea that there is a tendency for them to run the Institution. Every effort has been made by the Council in the past to remove any possible grounds for this feeling. The creation of the Local Sections, their representation on the Council, and the weight given to all suggestions received from such Sections have gone far to bring members outside London into full touch with the conduct of the Institution. The meetings held locally afford the same opportunities to members of meeting one another and of discussing Institution papers as are enjoyed by the London members; important papers read in London are read also at these meetings, in addition to local papers, and there is considerable activity locally, stronger it is true in some districts than in others. The introduction of proxy voting, decided on last session, goes far also to put all members on an equal footing, independently of geographical position.

It is of the utmost importance to the well-being of the Institution that any feeling of the kind I have mentioned should be wiped out. I think it would be desirable occasionally to hold a full meeting with President and Council in some of the more important centres, such as Manchester, Leeds, Birmingham, Newcastle, and possibly Glasgow. Not only would such a course quicken the interest of the members resident in the district, but it would serve the independent purpose of making the Institution better known to those outside the profession.

Turning now to London itself, we may well inquire whether the Institution is doing all that it can for the advancement of its legitimate objects. Many members think that it is not, and I am afraid there is some ground for their doubts. This year we are peculiarly handicapped through the commandeering of our building by the Government. I have often felt that the large sums of money invested in the fine building that we possess on the Embankment have not brought in the return in usefulness that they should. The load factor of the building is painfully low. It is true that the lecture theatre is often lent to other societies, but how often is it filled by the members of the Institution? For what proportion of the members is the common room a place of rendezvous? And how many members ever enter the library or avail themselves of the magnificent collection of books therein? When one sees the extraordinary success of such an institution as the Manchester Engineers' Club in bringing together so many different kinds of people interested in engineering and in initiating useful schemes for the good of the industry, one cannot help asking oneself why it is that something of the sort cannot be done, and done on a far larger scale by the Institution. It is true that Manchester is an altogether exceptional centre, but there is a great number of electrical engineers within a very moderate radius of Charing Cross, and if only the right scheme could be hit upon I am convinced that the Institution could be made an active centre of everything electrical. Even country members are often in London, and they would soon flock to the Institution if they knew they would meet there the men they want to see.

There seems to be something about the ordinary formal meetings which is found to be forbidding in some ways to many members, more especially to the younger ones, and there is a want of the sociability and willingness to take part in the discussions which one finds in most of the local centres. Now that meetings have to be held at 6 p.m., I should like to see arrangements made for the meeting to be followed by an inexpensive dinner. This would suit the convenience of many members living out of town, and it would unquestionably promote acquaintanceship between members and greater familiarity among them.

Then, again, I think short informal meetings, at which points of difficulty or special and immediate interest could be discussed in a more or less conversational manner, would be of great utility. Such meetings would encourage the younger members to come forward. Many who, though possessing valuable knowledge and ideas, are too diffident to write papers or join in formal discussions, would take part in proceedings of this kind, and while adding to the usefulness of the meeting would be encouraged, once the ice were broken, to join in the ordinary meetings. I am confident that the progress of the Institution will be greatly helped by interesting the younger members in its doings, and every possible means should be taken to effect this end.

It would be of extreme value if the Institution were to arrange for a series of lectures on special subjects by experts in those subjects setting forth what has been accomplished in the particular branch concerned, and giving a general idea of the present position of knowledge. For example, electric furnaces have developed to an extraordinary extent during the last few years; electrical theory has undergone many modifications and much development; a practically new field in electrical cultivation is being opened up, and many other examples will suggest themselves.

Again, I should like to see something done with a view to interesting the enormous army of men not qualified to become members in any grade of the Institution, but on whom much of the welfare of the industry depends. I refer to the workmen class. It should be possible to awaken in these men, many of whom are exceedingly intelligent, a desire for a better knowledge of the principles underlying their work. We have seen attempts made by individual firms to promote such interest by the holding of examinations and the offering of prizes; surely if an individual firm can create interest in this manner, is should be possible for the Institution to do far better. The opportunity could be utilised for educating workmen also in the economic questions which are vital to the success of the industry.

The Institution might with advantage come out of its shell and cater for the education of the general public in electrical matters. Popular lectures on the lines so successfully followed by the Society of Arts and the Royal Institution would do much to spread an elementary knowledge of electrical subjects, and to make the public realise the advantages of electrical appliances. Lectures which gave solid facts to individuals of ordinary common sense would, I believe, do far more to promote the objects sought by so-called "publicity campaigns" than any amount of exaggerated state-

ments, or of posters and illustrations, imagined by their authors to be humorous or arresting.

This branch of the work might be supplemented by a carefully organised permanent exhibition of electrical appliances, these being constantly changed, and demonstrations of new apparatus arranged for. It ought to be a well-understood thing that if any new useful electrical invention is brought out it can be seen at the Institution as a matter of course, and an explanation of its action be forthcoming.

From time to time conversaziones might be held on the lines of those given by the Royal Society for many years past. At these, members would bring forward their latest achievements and give demonstrations of their discoveries.

Such a programme would involve an enormous amount of work, but the Institution can only effect useful results by work, and unless we put the energy in we shall most certainly fail to get anything out.

Much more ought to be done in the direction of research. A useful beginning has been made, but there is a practically limitless field to be covered. Speaking from a very intimate experience of the work, I am of opinion that it cannot be looked after adequately if it be dependent solely upon the efforts of overworked members of Council, who can only give portions of their time spasmodically to the work. The Institution ought to have one or more well-paid men of the highest scientific attainments to look after technical questions such as research, and the organisation of the various fields of activity which I have indicated.

THE INSTITUTION RECONSTITUTED.

I have spoken so far of what might be done by the Institution under its existing constitution, but it is seriously and unnecessarily handicapped by being constituted under the Companies' Acts. I am ambitious for the Institution; I want to see it occupying its proper place in the life of the nation and in the enjoyment of a Royal Charter, which shall confer on it those powers which alone can enable it to take effectual action for the good of its members and of the general public whom they serve.

It is a matter of common knowledge that the electrical industry has suffered severely in the past from ill-advised legislation, but it is not, perhaps, so widely recognised that it has been seriously hampered by the absence of mandatory powers appertaining to any body within the profession. The feeling is widespread that compliance with some standard of education, training, and experience should be enforced before a man is allowed to call himself an electrical engineer, and that adherence to certain standards of professional conduct should be a necessary condition of his continuing to practise; at present anyone can call himself an electrical engineer, and no one has the right to object.

The position in regard to the promulgation of rules regulating electrical practice in essential particulars is most unsatisfactory. The Institution has drawn up such rules, but can give them no mandatory force, with the result that those contractors who recognise their necessity and value, and who wish to support the Institution loyally, are placed at a serious and unfair disadvantage in competing with less scrupulous firms who flout the rules, knowing that they can do so with impunity. Bad work is thus put in to the detriment alike of the sound contractor and the public, while the reputation of the industry suffers and its progress is retarded.

Most engineers are agreed as to the imperative necessity of standardising practice in regard to manufacture, both as regards the rating of machinery and the interchangeability of parts of articles in common use, but although an immense amount of work has been done in preparing such standards, no power whatever exists to enforce them, and in the absence of compulsion, which would put all manufacturers on an equal footing, firms who would gladly comply with the requirements hesitate to incur the expenditure necessary to bring their practice into line with them, while others, taking a narrow and short-sighted view, deliberately refuse to adopt them. The result is that the cost of manufacture is unnecessarily high, and users suffer inconvenience from the diversity of practice, the spread of the use of electrical appliances being retarded in consequence.

The absence of any authority which has the power to say whether a given article conforms with certain regulations or standards, or attains some specified degree of excellence, is a serious impediment to trade, especially to British trade abroad, which is perhaps somewhat imperfectly realised. I shall enlarge on this later.

The medical and legal professions already have the power to regulate the admission of new members to their ranks, and to expel those unworthy to continue in them, and there can be no inherent reason why the engineers, on whom depend the lives of countless thousands of the general public, should be denied similar powers.

I am aware that there are serious difficulties in giving effect to the views I have enunciated. In the first place, electrical engineers, though they touch at one point or another the work of almost every other class of engineer, are but one of several important groups. It is difficult for one section of engineers to obtain powers not sought by other sections, and unquestionably our efforts ought first to be devoted to carrying with us those other bodies, such as the Institution of Mechanical Engineers, the Institution of Naval Architects,

and more especially that mother of institutions, the Institution of Civil Engineers, to which we, as an Institution, owe so much. If our efforts to promote this joint action fail, then we must still try what we can do on our own account, but concerted action must unquestionably give the best results. Engineering in the widest sense would then be placed on the same footing as other professions, and be similarly recognised by Government. The powers and privileges granted would be delegated to, and exercised by, the several Institutions for the branches which they respectively represent.

Electrical differs from all other kinds of engineering in the extraordinary variety of the operations included in the general term. We have professional men, large manufacturing firms, municipal engineers, manufacturers of heavy plant, makers of telegraphic and telephone apparatus and instrument makers, electrochemists and makers of batteries. New branches of work are daily opening up, such as electric furnaces which trench on the great steel industry, and electro-culture, at which point we touch farming.

No other Institution has so many and such varied interests to represent, nor has any other profession need for anything approaching the elasticity as to the qualifications to be demanded of those entering its ranks as our own. It is for these reasons, probably, in large measure that the present unsatisfactory state of affairs has arisen, but the difficulty of the problem only makes its solution the more imperative.

Owing to the importance of certain sections, influential bodies outside the Institution have grown up. It is eminently right and proper that they should be formed to look after those members who have common material interests. It is, however, equally important that there should be no overlapping, and that they should confine themselves to those branches of work which the Institution cannot do so efficiently as they. I deprecate most strongly anything in the nature of rivalry. The ideal that I look forward to is a strong Institution, endowed with a Royal Charter, recognised as the embodiment of the whole industry as far as those outside it are concerned, invested with full powers as to the educational qualifications to be possessed by all grades of workers in the profession and industry from the highest to the lowest, and effecting under its aegis the federation of all other associations connected with the multifarious branches of electrical work.

We cannot expect more than one body to be recognised by the Government and the public as standing for the electrical industry, and it is vital to all concerned that such recognition should be bestowed on an association that is truly representative of the entire industry, and that has the maximum weight of authority and numbers behind it; this the Institution would possess if constituted and worked on the lines I have indicated.

A beginning should be made at once, and I see no reason, if all will pull whole-heartedly and loyally together, why the ideal should not be realised. Most of the members of other electrical associations are already members of our Institution, many of them active ones, and if they were satisfied that we were in a position authoritatively and effectually to help their respective organisations there can be little doubt that they would support the federation I suggest, and work unreservedly to assure the Institution occupying the leading position that it should, sinking all rivalry if such rivalry exists.

Broadly, my view is that each section should have its own association to look after its commercial interests, such associations being formed if not already existent for a particular branch, and that each should be represented directly in appropriate proportions on the Institution's Governing Body. The Institution to be given a definite status by the Government, and recognised as the only body representing electrical engineering; the Institution to control entry into the profession, and all regulations on electrical matters to be issued at its instigation, or in accordance with its advice. Grants in aid of research or other national purposes to be entrusted to the Institution for administration.

It may be argued that the Institution, even though modified in its constitution in the manner suggested, would still have the difficulties I emphasised earlier in my address in regard to the discordant commercial interests of different sections of its members. To some extent this is probably true, but its authoritative position would enable it to compose many differences which it is now powerless to influence, and in very few cases would it be found necessary for any special Association to take independent action; but in the last resort this could be allowed without detriment to the scheme.

(To be continued.)

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bedford.

- 15,722. "Holders or fittings for electrodes of electric furnaces." P. FAWCETT & J. R. HOYLE. October 29th.
- 15,736. "High-tension distributors for ignition in multi-cylinder internal-combustion engines." AKI. GES. BROWN, BOVERI ET CIE. October 29th. (Germany, November 6th, 1916.)
- 15,741. "Electric pocket-lamp." COMP. IHOEBUS E.G. October 29th. (Switzerland, October 28th, 1916.)
- 15,745. "Electric furnaces for melting metals." A. G. BLOXHAM (Stabilitenti Blak-Ing. A. Pouchain). October 29th.
- 15,774. "Electric arc lamps." A. E. ANGOLD & A. H. RAILING. October 30th.
- 15,777. "Electric switches." J. C. WILLCOCKS. October 30th.
- 15,779. "Locking device for electric lamps." W. & T. AVERY & F. C. G. HILL. October 30th.
- 15,810. "Telephone systems." R. L. MURRAY. October 30th.
- 15,815. "Electric accumulators." CHLORIDE ELECTRICAL STORAGE CO. AND H. DEAN. October 30th.
- 15,821. "Test sheath joint for electric cables." C. J. BEAVER & E. A. CLAREMONT. October 30th.
- 15,837. "Electrical transformers." F. E. BERRY. October 30th.
- 15,844. "Radio-telegraphy or telephony." SOC. FRANCAISE RADIO-ELECTRIQUE. October 30th. (France, October 30th, 1916.)
- 15,846. "High-frequency alternators." SOC. FRANCAISE RADIO-ELECTRIQUE. October 30th. (France, October 30th, 1916.)
- 15,849. "Electric torch case." R. E. H. FLÉCHER. October 31st.
- 15,883. "Gas burners and electric lights." F. J. GOULD & F. S. STAMP. October 31st.
- 15,888. "Electrodes for electric arc welding." E. LANGUEPIN. October 31st.
- 15,897. "Electrical storage batteries or accumulators." I. E. KOHLMAYER. October 31st.
- 15,901. "Holder for electric lamp shades and lamps." T. H. A. BROWN. October 31st.
- 15,927. "Electric gas-lighter." M. COMPARE & E. PIZZI. November 1st.
- 15,930. "Spark-plugs." C. BRYAN. November 1st.
- 15,970. "Electric plug." E. H. KEFLEY. November 2nd.
- 15,978. "Dynamo-electric machinery." ELECTROMOTORS, LTD., E. GREENHALGH & B. LONGBOTTOM. November 2nd.
- 15,992. "Incandescent electric lamps." R. BUTLER. November 2nd.
- 16,008. "Telephone control systems." M. TOCCHIO. November 2nd.
- 16,017. "Heating electrode." G. BELLAVITI. November 2nd.
- 16,021. "Sound detectors." WESTERN ELECTRIC CO. November 2nd.
- 16,024. "Telephone transmitters." S. G. LOWN. November 2nd.
- 16,039. "Means for completing an electric circuit, specially applicable to alarm clocks." H. O. FARRELL & A. WARD. November 3rd.
- 16,053. "Electrical resistance material elements." C. G. NOBBS & FALKIRK IRON CO. November 3rd.
- 16,054. "Electric heater." FALKIRK IRON CO. & C. G. NOBBS. November 3rd.
- 16,072. "Indicating condition of steel, iron, etc., magnetisable metal during heat treatment." E. P. BARFIELD. November 3rd.
- 16,074. "Prismatic glassware for illuminating purposes." HOLOPHANE, LTD. (Holophane Glass Co.). November 3rd.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

- 12,782. TELEPHONE SYSTEMS. Western Electric Co. & A. E. Reinke. September 9th, 1916. (110,177.)
- 14,521. ELECTRICAL COMMUTATORS. W. R. SYKES Interlocking Signal Co. and R. W. TARRANT. October 12th, 1916. (110,192.)
- 14,522. ELECTRICAL COMMUTATORS. W. R. SYKES Interlocking Signal Co. and R. W. TARRANT. October 12th, 1916. (110,193.)
- 14,768. SEPARATORS FOR ELECTRIC BATTERIES. G. Oldham. October 17th, 1916. (110,204.)
- 14,842. ELECTRICAL APPARATUS CONTROLLED FROM A DISTANCE. Metropolitan Carriage, Wagon & Finance Co., W. G. Wilson, W. A. Tritton & D. K. Morris. October 19th, 1916. (110,207.)
- 15,252. PROCESS OR METHOD OF USING SIMILAR OR DISSIMILAR METALS OR ALLOYS BY ELECTRIC WELDING. H. L. T. Wolfe. October 26th, 1916. (110,214.)
- 16,749. BRAKES ON ELECTRIC TRAMCARS AND LIKE VEHICLES. R. H. Wilkinson & W. H. Turner. November 22nd, 1916. (110,231.)
- 16,760. DYNAMO-ELECTRIC MACHINES, PARTICULARLY ADAPTED FOR STARTING AND LIGHTING SYSTEMS. A. E. White (U.S. Light & Heat Corporation). November 22nd, 1916. (110,232.)
- 17,072. REGULATING DEVICES FOR INTERNAL-COMBUSTION ENGINES COUPLED WITH DYNAMO-ELECTRIC MACHINES. Soc. Auxiliaire des Tramways & Chemins de Fers Soc. Anon. November 29th, 1915. (102,501.)
- 17,993. COLLECTION OF CURRENTS FROM OVERHEAD OR OTHER CONDUCTORS. C. C. Henkes. June 12th, 1917. (110,244.)
- 18,049. ELECTRIC SWITCHES. M. J. Railing. December 15th, 1916. (110,245.)
- 18,065. ELECTRIC MOTOR CONTROL SYSTEMS. British Thomson-Houston Co. (General Electric Co., U.S.A.). December 16th, 1916. (110,246.)
- 18,193. PROTECTIVE DEVICES FOR ELECTRIC CIRCUITS. British Thomson-Houston Co. (General Electric Co., U.S.A.). December 19th, 1916. (110,247.)
- 18,287. APPARATUS FOR THE ELECTRO-DEPOSITION OF METALS. F. R. Tubbs. December 21st, 1916. (110,248.)

1917.

- 872. ELECTRIC CONNECTING DEVICES FOR USE IN INTERNAL-COMBUSTION ENGINES. J. Zeitlin. January 17th, 1917. (110,255.)
- 1,062. SWITCHING APPARATUS FOR ELECTRIC TRANSFORMERS. W. J. Howard and A. Reyrolle & Co. January 22nd, 1917. (110,259.)
- 1,575. CONTACT-BREAKER DEVICES FOR THE IGNITION MECHANISM OF INTERNAL-COMBUSTION ENGINES. Villiers Engineering Co., G. Funck & F. H. Farrer. January 31st, 1917. (110,266.)
- 1,761. DYNAMO-ELECTRIC MACHINES. P. A. H. Mossay. February 3rd, 1917. (110,269.)
- 6,309. ELECTRIC MOTOR CONTROL SYSTEMS. Igranee Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.) May 3rd, 1917. (110,311.)
- 9,267. DYNAMO-ELECTRIC GENERATORS. V. Crabb. June 28th, 1917. (110,329.)
- 10,575. CIRCUIT INTERRUPTING DEVICES. British Westinghouse Electric and Manufacturing Co. (Westinghouse Electric & Manufacturing Co., U.S.A.) July 23rd, 1917. (110,332.)

The Metric System.—The Education Committee of the London County Council has had under consideration the following resolution passed by the Central Consultative Committee of Head Masters: "That the time is now ripe for the compulsory introduction of the metric system," and recommends "That the Council is of opinion, on educational grounds, that the time has arrived for the compulsory introduction of the metric system, and that a communication to this effect be conveyed to H.M. Government."

THE ELECTRICAL REVIEW.

VOL. LXXXI.

NOVEMBER 23, 1917.

No. 2,087.

ELECTRICAL REVIEW.

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SALARIES AND WAGES IN ELECTRICITY SUPPLY.

It is common with the rest of humanity, the central-station man, whether he claim the title of "engineer" or that of "employé," is subject to the great primal law of Nature—the law of self-preservation. He may have no undue craving for gold and silver; in normal times he may even be fairly content with his lot (though we have grave doubts with regard to such a phenomenon); but the fact remains that, as society is organised, an adequate supply of money is essential to his existence, not by virtue of its own intrinsic properties, but because it enables him to satisfy his physical needs. If in time of peace he had barely sufficient money to cover his requirements, it is clear that when the purchasing power of money has fallen by 50 per cent. he has an unquestionable right to a substantial increase in the nominal value of his payment, in order to bring its actual value up to a reasonable amount.

The fact is recognised by the Government, which has intervened in many industries of national importance at the instance of the Trade Unions concerned and awarded to the workers increased wages; in other cases the Trade Unions, without Government aid, have obtained advances for their members; but in the case of electricity supply the conditions are altogether exceptional, for there exists no body which can fairly claim to be representative of the whole of the interests concerned, and to be authorised to act on their behalf. Moreover, the gradation of rank in electricity supply from operative to executive and administrative posts is so gradual and continuous that, while it is impossible to bring all the members together in one society, it is exceedingly difficult to find a line of demarcation. Hence it is that a conflict, or at least a competition, has arisen between two societies, the Association of Electrical Station Engineers and the Electrical Trades Union, each of which claims the right to represent the central-station man and to act on his behalf. During recent weeks we have allowed both parties to set forth their claims and views in our "Correspondence" columns, in order that readers may be enabled to appraise their respective merits and capabilities, and in the hope that eventually means may be found to reconcile their differences and arrive at a satisfactory solution of the problem—the essence of which, as stated above, is to improve the conditions obtaining in the service of electricity supply.

In this issue will be found the report of a meeting of senior technical officers, and a letter from a "Chief Assistant," which, in our opinion, indicates that the solution is near at hand. We commend them both to the attention of readers interested in this subject, and we set forth below our own views on the matter.

In the first place, we regard the settlement of this

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

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OFFICE 1-4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 6d.; Canada, £1 3s. 10d. (\$5.80). To all other countries, £1 10s.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.

AUCKLAND, N.Z.: Gordon & Gotch, Albert Street; The Mining and Engineering Review, 31a, Strand Arcade, Queen Street.

BRISBANE: Gordon & Gotch, Queen St.

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LAUNCESTON: Gordon & Gotch, Cimitiere Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

MELBOURNE: The Mining & Engineering Review, 90, William Street; Gordon & Gotch, Queen Street.

MILAN: Fratelli Treves. NEW YORK: D. Van Nostrand, 25, Park Place.

PARIS: Boyveau & Chevillet, 22, Rue de la Banque.

PERTH, W.A.: Gordon & Gotch, William Street.

ROME: Loescher & Co., Corso Umberto 1° 307.

SYDNEY: The Mining & Engineering Review, 273, George Street; Gordon and Gotch, Pitt Street.

TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.

WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

THE "ELECTRICAL REVIEW'S"

ELECTRICAL & ALLIED TRADES DIRECTORY

(THE RED BOOK),

1917 EDITION.

H. ALABASTER, GATEHOUSE & KEMPE,
4, Ludgate Hill, London, E.C. 4.

question as a matter of urgent importance; controversy is out of place—co-operation and agreement are essential, and some sacrifice of individual predilections is therefore indispensable, lest all should suffer. Secondly, we hold that no one society can possibly answer all the requirements. From the very commencement, the Association of Electrical Station Engineers has been handicapped by the existence of two parties within its ranks, with essentially different views and policies, and while this condition obtains it cannot possibly attain its aims. Reconstitution appears to be the only course that affords any prospect of success, and for this reason we welcome the movement that was set on foot at the meeting of senior technical officials of the London area at Hammersmith last week. The instruction to the Provisional Committee to invite the chief engineers of London undertakings to appoint representatives to meet the committee is particularly commendable; their assistance and support are indispensable to the attainment of the desired result.

In this connection, the suggestion of "Chief Assistant" is interesting—namely, that the chiefs themselves should take action towards forming a comprehensive association embracing all professional electricity supply engineers, whether attached to company or municipal undertakings, throughout the country, for the express purpose of promoting the interests of the members in all degrees. Mr. Wordingham, in his presidential address, pointed out the advantages derived from the formation of such associations, and would no doubt support the movement. The Institution of Electrical Engineers obviously will take no action tending towards the desired result; it rests, therefore, with the central-station men themselves to act. Their cause is undoubtedly just, their grievances are clamant, and they urgently need a representative body to look after their interests.

So far we have only incidentally referred to the non-professional employés, the reason being that they are in far better case than the professional men. Their needs and methods differ from those of the professional engineers; they prefer trade-union methods, and already several such unions exist for membership of which they are eligible, and which would welcome them. *Chacun à son goût*; those who fall within the "No Man's Land," as "Chief Assistant" suggests, could join which and which would welcome them.

There is undoubtedly room in central-station service for both types of society, and there should be no question of rivalry, still less of friction, between them. It is true that there exists as sort of "No Man's Land" to which both sides may lay claim with more or less justification, but, as "Chief Assistant" remarks, it should be possible to arrive at an agreement on this point, based upon definite qualifications.

The standing of any such society, be it an association of engineers or a trade union, is necessarily dependent in a very large measure upon the character and ability of its individual members, and we would earnestly commend this fact to the attention of the organisers; if they desire to secure for their society an unblemished reputation, it is essential that they shall specify appropriate standards of education, character, and technical attainments which must be complied with by all aspirants to membership. If they open the door too widely to all comers, seeking only to increase their numbers and their income from subscriptions, they will inevitably enrol some members who will fail to do them credit, and will lower not only their reputation, but also their influence and efficiency.

With regard to the main question, so far as it affects the members of trade unions, it will be remembered that in September last the Associated

Municipal Electrical Engineers (Greater London) took steps towards arriving at some measure of reform and uniformity throughout the London area. We commented upon this matter at some length in our issue of September 28th, but since then we have heard no more of it. We trust, however, that progress is being made, and that the conclusions arrived at may include some form of classification which will help towards the settlement of the dispute between the E.T.U. and the A.E.S.E.

Electricity Supply Restrictions in Germany.

It is reported from Berlin that the Imperial Coal Commissioner issued an order on November 2nd placing an immediate restriction on the consumption of electrical energy both in the case of customers of electric supply undertakings and in that of those firms or persons who possess their own generating plant. The restriction of the consumption is general, and also applies to establishments engaged on war work. The consumption is limited to 80 per cent. of that which prevailed in the corresponding month in 1916, although another period for the calculation may be accepted as the basis in special cases. If the meters are read on days other than the first day of the month, the hitherto existing reading times are to be adopted for the determination of the limitation. The Commissioner reserves the right of curtailing the consumption by more than 20 per cent. in particular cases. A preferential treatment can be meted out in respect of establishments on war work in exceptional cases.

It is held to be of special importance that consumers who have already curtailed their consumption may claim special consideration in connection with the new regulations. Consumers on a small scale are exempt from the restrictions, provided that their individual use does not exceed 250 kw.-hours per annum, but the communal authorities are permitted to fix a lower limit. New connections and extensions of existing connections can only be made on obtaining special consent, which will only be granted in urgent cases. The order provides for the appointment of honorary advisers, who will co-operate with the War Board departments and the municipal authorities, who must at once come to an agreement with the advisers concerning the limitations and the best method of arranging the distribution of energy, particularly among small consumers.

It is stipulated that consumers who receive a supply from an undertaking must pay an increase of 6d. per kw.-hour for every kw.-hour used in excess of the fixed limit. If, despite special warning, consumers do not restrict their consumption in the prescribed manner, they will be liable to imprisonment for a period of up to one year, or a fine of up to £500, or to one of these penalties. Similar regulations have been made in regard to the limitation of the use of coal gas.

As bearing upon the above question of effecting economy in the use of coal, it is stated that a daily supply of 60 trucks of coal will shortly be saved in connection with the electric lighting of Berlin, by means of a scheme which is expected to be brought into operation in January provided that the weather in the winter is not unfavourable for the completion of the work. This refers to the execution of a scheme which was brought forward prior to the war, for the erection of an overhead high-pressure transmission line between Wittenberg and Berlin, which will now be fed by the Zschornowitz-Piesteritz line, which is supplied from the Zschornowitz (lignite) power station, the generating station for works for the fixation of nitrogen. The overhead line is said to be made of aluminium-covered iron, and is being carried out by the A.E.G.

ABBOTT INSULATING CLOTHS.

On Thursday last, through the courtesy of Messrs. Abbott, Anderson & Abbott, Ltd., of Limehouse, E., and Harpenden, whose connection with the oilskin and waterproof clothing trade goes back, we understand, to Crimean times, we were enabled to visit the Harpenden works of the firm, with a view to inspecting the modern installation which they have provided for the manufacture of the "Abbott" insulating cloths—a branch of business which the firm originally entered in 1902.

It will, of course, be within the knowledge of our readers that prior to the outbreak of war we were, in a large

destroyed by fire. The works have, however, despite the war, been rebuilt on up-to-date lines, and it was this modern plant that the members of the electrical Press were allowed to view last week. Specially woven cambric and silk are employed, and the first operation is that of cutting and re-stitching the pieces, so as to secure a diagonal lay of the warp and weft; the pieces then pass to the impregnating machines, four of which are installed in a special ferro-concrete structure several stories high, while space for two additional machines is available.

Without going into details, we may say that the fabric, after impregnation in the tanks situated in the lower portion of the building, is dried by passing it through a steam heated atmosphere, which is maintained in special chimney structures extending to the top of the building. The machine allows of successive impregnations of the same material, when desired. The material is then examined, measured and cut to the required lengths, or into tape: for shipping purposes, the ends of the rolls are impregnated with paraffin wax.

The linen fabric is supplied in thicknesses of 5 to 15 mils, and the silk in 4 to 6-mil thicknesses: both the transparent yellow and black insulations are supplied, in widths up to 38 in. and lengths of 100 yards or less.

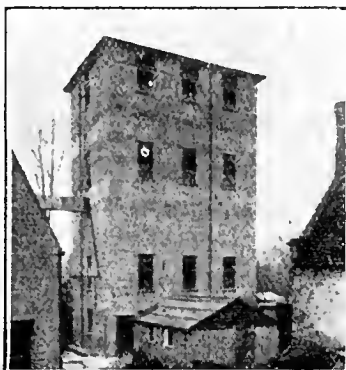
We understand that authoritative tests on a 10-mil sample showed a maximum disruptive voltage of 11,000 volts and a minimum of 8,900 volts: moreover,

Messrs. Abbott claim that their product is superior to the grades imported hitherto.

In conclusion, we need not emphasise the necessity of having a "self-contained" electrical industry in this country, especially at a time like the present. Varnished fabrics and tapes are essential for the heavy electrical machinery industry and varnished silks for the magneto and



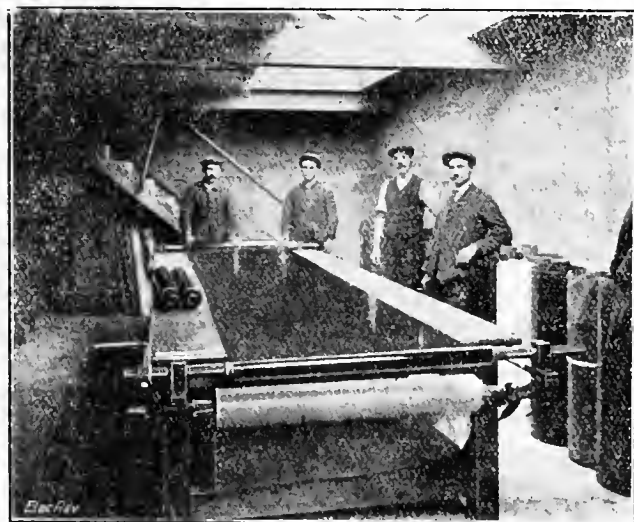
CUTTING AND SEWING FABRIC.



IMPREGNATING HOUSE.

measure, dependent on American and Continental makers for impregnated fabrics suitable for electrical insulation, and our own Customs returns bore witness to the fact that quite a considerable import business had sprung up in these goods, of which, according to available statistics, 1½ million yards were received annually in this country—though whether that amount was used here does not appear so certain.

In any case, Messrs. Abbott can meet requirements up to three-quarters of a million yards per annum in their present buildings, and with the space available could easily double this output if the trade required it. At the outset the problem confronting the firm presented difficulties of both a



INSPECTING FINISHED INSULATING CLOTH.

technical and economic character: it was, for instance, difficult to obtain the right kind of cloth for treatment, and the proper varnish for impregnating it: the design of the necessary machinery was also a matter for much thought and ingenuity.

However, these difficulties were surmounted by Messrs. Abbott, and, in spite of the keen competition of imported material, they had a steadily increasing business up to 1916, when the whole of their Harpenden works was, unfortunately,



INSULATING TAPE CUTTING MACHINE.

instrument trade, and it is to be hoped that Messrs. Abbott, Anderson & Abbott's enterprise in this direction will be appreciated by electrical men, not only at the moment, but in the more strenuous commercial times that lie ahead.

The Whitley Report.—Mr. F. Huth Jackson, presiding last week at a meeting of the National Alliance of Employers and Employed, said, according to the *Times*, that Mr. G. H. Roberts had declared that it was the intention of the Government to appoint a Parliamentary Committee, of which Mr. Whitley would be chairman, to consist of three members from each party of the House of Commons, which, in consultation with the National Alliance, the Industrial League, and other similar bodies, would consider the best means by which the recommendations of the Whitley Report should be carried into effect.

THE SALARIES OF CENTRAL-STATION OFFICIALS.

By G. W. STUBBINGS.

ALTHOUGH the bulk of the discussion regarding the subject of this article has referred to the salaries of charge engineers and switchboard attendants, there is little doubt that acute dissatisfaction is generally felt by all the members of the technical staff. A brief study of a list of the salaries paid in the principal London undertakings will convince anybody that something is wrong, and this is confirmed by the sense of grievance felt by most technical officials, it being fair to state that such officials are of a class not accustomed to grumble without sufficient cause. It is but to state a truism to say that criticism, to be useful, should be constructive, and it is the writer's belief that it is largely due to the fact that central-station officials have never proposed any rational scheme by which their salaries should be determined, and on the observance of which they could insist, that so little has been done. The difficulties in devising such a scheme are very great, both on account of the diversity in the sizes of the various undertakings, and on account of the difference in the responsibilities and scope of the work of officials in undertakings of comparable size having the same official title.

In the case of workmen it is not a difficult matter to fix on an equitable wage. A wireman, for instance, does very much the same work whether he be employed on an undertaking having an output of one or a hundred million units per annum. The responsibilities of the supervisory staff will vary with the output, and, further, the difference in the meaning attaching to some titles in various undertakings introduces a further complication. This difference is most marked in the case of the distribution sections of electricity undertakings. A comparison of the outputs of two undertakings, A and B, will give no certain indication of the duties and responsibilities of the two mains superintendents. At A this official may be nothing more than a mains foreman, the more difficult work being looked after by the chief assistant; while at B the mains superintendent, besides having complete charge of the mains, may be also responsible for the testing, public lighting, and tramways overhead sections. The problem, then, of devising a rational basis for the calculation of salaries is by no means easy.

The first principle to be suggested in this attempt to solve the problem, is that a man's salary should bear some definite relationship to his responsibilities. This is incontrovertible. The simplest application of this principle would be a rule by which the salary would be directly proportional to the responsibility. This is hardly equitable, as placing the small man at a great disadvantage. The second principle that occurs to the writer will obviate this defect. This principle may be briefly described as that of a minimum salary which represents a return for a man's general training and fitness, apart from his responsibilities. The algebraical expression for the salary attaching to a particular post will now be: of the form— $y = a + b x$, y being the salary, x the responsibility, a the minimum wage, and b a constant to be decided upon.

The constant a should be equal to an amount sufficient to cover the bare necessities of living, as most people will concede that a man who is working is, by reason of his working, entitled to this. It is worthy of discussion as to whether this constant should be different in the case of a married man from that of one who is single.

The term x , representing responsibility, is a difficult one to fix. It must obviously be represented by some easily determinable quantity. Such quantity will, however, be different for each official. For the works superintendent the plant capacity is a good indication of the scope of responsibility; but this would be almost irrelevant in the case of the chief clerk, when the number of consumers would be a fitting criterion. The variable part of the formula will, in the case of the mains engineer, include a number of terms according to his responsibilities; one, for example, for his mains work, another for public lighting

work, and so on. Mathematically, the complete equation will be: $y = a + \sum b x$.

The writer suggests the following criteria for determining the responsibilities of the various officials. The particular number in each case, whether KW. capacity or number of consumers will be x in the formula.

Works Superintendent ...	Plant capacity.
Charge Engineer ...	Maximum load.
Draughtsman ...	Plant capacity.
	Miles of cable.
Chief Clerk ...	Number of consumers.

The value of b would vary according to whether or no the rendering and collecting of consumers' accounts were undertaken by the office.

Meter Superintendent ...	Number of meters.
Commercial Assistant ...	Population of the area of supply.
Mains Superintendent ...	Miles of cable.
	Number of meters.
	Number of public lamps.
	Miles of overhead tramway equipment.

Only those items applicable to the particular case being included. In cases where considerable mains extensions are carried out by the mains engineer, he should be paid a percentage on the cost of the job.

When an undertaking reaches a moderate size the problem is complicated by the fact that assistant supervising officials are employed. The responsibility of the chief official will then largely depend upon the ability of his assistant. A man with an assistant who is capable of looking after any section of the work in his absence, has far less worry and anxiety than one who has an assistant confident to carry out routine work of minor responsibility only. The most equitable way out of this difficulty seems to be to calculate the total salary to be paid to the department, the formula being in this case $y = na + bx$, n being equal to the number of officials. Having fixed the total salary, the apportionment of the same can be made by the chief engineer of the undertaking concerned, who would have an intimate knowledge of the capabilities of the officials concerned.

The matter dealt with in this article is a very difficult one, and the writer is well aware that his suggestions may be faulty in many respects. As no previous attempt of the kind appears to have been made, these suggestions may serve as a start. The dissatisfaction of central station officials is certainly not without good cause; but all must remember that to obtain redress it is not sufficient to be dissatisfied, or even to express dissatisfaction. It is necessary to know with certainty what one requires. A set of requirements calculated on some such rational basis as suggested in this article would, in the writer's opinion, be of great assistance and carry great weight. It is hoped that the scheme outlined above, although hastily considered, may assist central station officials in formulating definite requirements.

£100,000,000 a year from State Power.—Speaking at the Aldwych Club recently, Mr. H. Wilson-Fox, M.P., honorary secretary of the Empire Resources Development Committee, stated that the National Debt after the war would probably amount to £6,000,000,000, necessitating an annual revenue of at least £600,000,000. The policy advocated by the Empire Resources Development Committee was the development under State auspices of some of the resources and opportunities of the Empire, under conditions which would give to the State a direct financial interest in the results. The wastage in our power supply was almost incredible. Ten years ago the Witwatersrand goldfields were equipped with the best individual steam-power plants that money could command, and coal was available near by at from 2s. 6d. to 5s. a ton; yet, by the introduction of a central power system a saving of £3,500,000 had been effected in the working of the mines themselves; which saving, added to the sum of £500,000 paid by the Power Co. in dividends and interest on debentures, meant that on the original outlay of £7,000,000 there had been a total return to all concerned of upwards of £1,000,000 per annum, and that without utilising by-products.

In 1907 the total engine capacity in this country was estimated at 10,587,870 h.p., of which about 2,500,000 h.p. was employed in the production of electrical energy. If a considerable proportion of this equipment were centralised, and care were taken to make a profit from by-products, as well as from the sale of power, the State could derive a profit of at least £100,000,000 per annum, while considerably reducing the cost to the consumer.—*Financier*.

DOMESTIC ELECTRIC HEATING PROBLEMS.

(Concluded from page 478.)

Heater Comparisons.—A booklet, published by the Hotpoint Co., who are, of course, strong advocates of the open-coil (or so-called "red-hot") type of heater, contains the results of various tests on these and disk-type hot-plates.

The company's Reflex open-type heater (in which a reflector assists in concentrating the heat rays on the bottom of the utensil), a moulded block open-coil type heater and a disk-type heater, each of 1,000 watts loading, were used, and the curves, fig. 1, were obtained on the basis of raising the temperature of one quart of water from 70 to 210° F. starting from cold.

These show the superior efficiency of the Reflex heater for short boiling periods with average utensils; further tests in comparison with gas gave the following results:—

	Reflex.		Block.		Disk.		Gas.	
	Time, min.	Eff., p.c.	Time, min.	Eff., p.c.	Time, min.	Eff., p.c.	Time, min.	Eff., p.c.
Dish—								
Enamelled	15'14	45'4	18'95	36'3	26'6	38'7	14	34'2
Aluminium	16'12	42'6	20'12	34'2	24'36	42'3	13'25	35'8

The test was made by raising two quarts of water from 70 to 210° F. with a covered utensil, starting from cold; the heater capacities were:—Reflex, 1,500 watts; block, 1,500 watts; disk, 1,000 watts; and a "standard medium-sized gas burner operated with a maximum flame."

Some independent tests carried out by an Indian contemporary on the Reflex heater and a popular type of English hot-plate are of interest. In this case a special block-tin copper-bottomed kettle was provided for the hot-plate or disk-type heater, also an ordinary enamelled kettle, and both were used on each type of heater. The Reflex heater was of 600, and the disk stove of 800 watts capacity; the tests were made with one quart of water at an altitude of 8,000 ft., where the boiling point is, roughly, 197° F.

The results were as follows:—

Disk stove.					Reflex.			
Test No.	Units.	Temperature rise deg. F.	Time in minutes.	Efficiency per cent.	Units.	Temperature rise deg. F.	Time in minutes.	Efficiency per cent.
1	0.292	131.5	20.23	32.69	0.163	137	14.82	61.02
Starting from cold with enamelled kettle.								
2	0.254	135.5	17.42	38.64	0.1874	134	17.02	51.91
Starting from cold with disk stove kettle.								
3	0.166	137	10.53	59.92	0.1470	139	—	68.65
Starting from hot with enamelled kettle.								
4	0.1266	137	8.93	78.56	0.1796	136	15.97	54.98
Starting from hot with disk stove kettle.								
5		148 191	◀ Current switched off at ▶ ▲ Temperature rose to in 10			148 156 in 1.8		
Stored heat test.								
6	0.185	130	23.81	51.02	—	—	—	—

Maximum efficiency test for disk stove from cold, with kettle belonging to disk stove.

In test No. 5 the water was raised to a certain temperature current being then switched off and the further rise in temperature noted till the latter became stationary. Test No. 6 was intended to ascertain the maximum efficiency in use by an experienced person who could judge when to switch off, so as to economise to the practicable limit.

The tests clearly indicate the high efficiency of the Reflex type of heater for intermittent use, and especially with ordinary utensils, but where cooking is carried out on a large scale and the range is in continuous use, the disk type of heater with its special utensils attains a very high efficiency.

Domestic Electric Cooking Costs.—Some data recently published by the Ontario Hydro-Electric Power Commission on energy consumption for domestic cooking, of groups of consumers in Ontario towns, is of considerable interest.

The consumers are divided according to size of family and the monthly energy consumption and bills, both prior to and after the installation of electric cooking are given.

For London (Ont.) data for 252 families is given, and we note that the monthly range consumption increases, roughly, in proportion to size of family from 119 KW.-hours for two people to 256 KW.-hours for nine people; also the monthly range bill similarly increases proportionally from \$1'15 to \$2'38 and the range cost per month per person decreases proportionally from \$'58 to \$'26. The installed range capacity varies from 5'13 to 6'5 KW. per family.

The London (Ont.) tariff is 3 cents per 100 sq. ft. of floor area plus a primary meter rate (3 cents) per KW.-hour for the first three

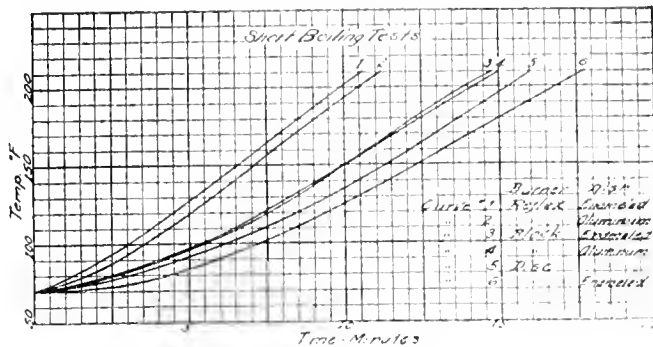


FIG. 1.

	Reflex.		Block.		Disk.	
	Time, min.	Eff., p.c.	Time, min.	Eff., p.c.	Time, min.	Eff., p.c.
Dish	...	...	...	...	...	...
Enamelled	10'56	48'8	11'83	34'7	17'75	29'0
Aluminium	11'2	46'0	15'0	31'3	16'0	32'3

KW.-hours per month per 100 sq. ft. floor area, plus a secondary rate (1 cent) for excess consumption. Taking the average of all the London (Ont.) cooking consumers, the use of the range has increased their energy consumption, roughly, five times (39 KW.-hours to 200 KW.-hours per consumer per month) and their electricity bills by two-and-a-half times (\$1'09 to \$2'67 per month).

In St. Thomas, where similar rates obtain, averaging all consumers the monthly consumption per consumer has increased from 44 KW.-hours to 207 KW.-hours, and their electricity bills from \$1'24 to \$2'78, while in Windsor, where a higher rate is charged, the energy consumption with the range in use is five times as great and the bills 2'7 times as great.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Sub-Station for the Co-operative Wholesale Society.

For the purpose of converting the 100-volt continuous-current supply of the Manchester Corporation to the requirements of its central premises and warehouses in Manchester, the Co-operative Wholesale Society has laid down a neat and attractive looking

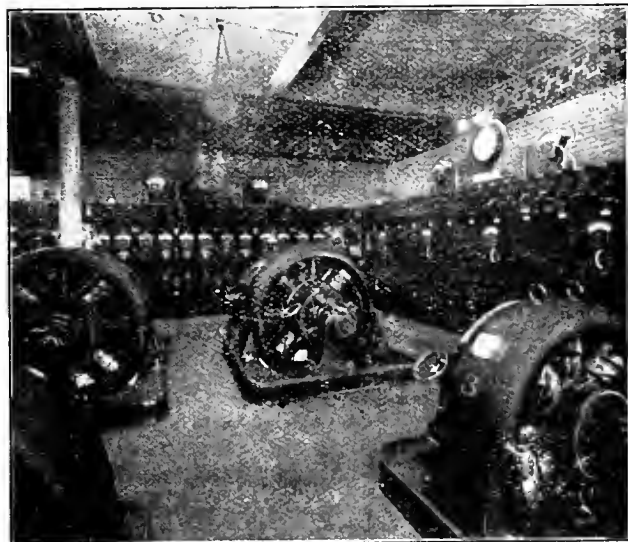


FIG. 1.—THE SUB-STATION OF THE CO-OPERATIVE WHOLESALE SOCIETY AT ITS CENTRAL PREMISES, MANCHESTER.

sub-station containing the necessary converting machinery and distributing switchboard; power from this sub-station is utilised for driving lifts, hoists, &c., and for lighting.

The contract for the plant was placed with the GENERAL ELECTRIC Co., and includes four 90-KW. motors for driving existing generators, two 63-KW. motor-generators, and one 47.5-KW. motor for driving an existing generator. These sets run respectively at speeds of 410, 600 and 300 R.P.M., the motors and generators being mounted on combination heliplates.

The switchboard is arranged in two portions at right angles to each other; one portion devoted to the control of the motor-generators consists of eight panels, seven for the machines and one for the incoming supply. Each panel accommodates the necessary apparatus for starting the motors mounted on the lower slab, while above are the necessary circuit-breakers, ammeters, relays and shunt regulating gear. Paralleling voltmeters are carried on brackets at the end of the board, while on a pediment on the top of the board are mounted an illuminated dial sector pattern ammeter and voltmeter. The distribution switchboard comprises 16 panels, each of which controls six distributing circuits. Every panel is composed of two slabs, both carrying the circuit-breakers for the respective three circuits. On the upper slab is also mounted a sector pattern ammeter with rotary multi-point switch, enabling the shunts on each circuit to be connected to the ammeter. This switchboard is also provided with a pediment, including a sector type ammeter and voltmeter, and a non-magnetic clock.

The lighting is effected by G.E.C. semi-direct fittings, and the sub-station is very neatly laid down and effectively finished.

The complete equipment was supplied by the General Electric Co., Ltd., of Witton, Birmingham, through their local office at Victoria Bridge, Manchester.

Indebtedness is expressed to the Co-operative Wholesale Society, Ltd., for permission to take the accompanying illustration, and to publish these remarks.

Husband Oil-Engine Sets.

Our view, fig. 2, shows one of the new "valveless" oil engines with cooling water tank, &c., mounted on a truck as portable unit, and supplied by MESSRS. F. HUSBAND, LTD., of Craven House, Kingsway, W.C.2. The engine is of the two-stroke cycle type, and its design, though having special features, is along the simple lines associated with that type of engine, the valve gear of the

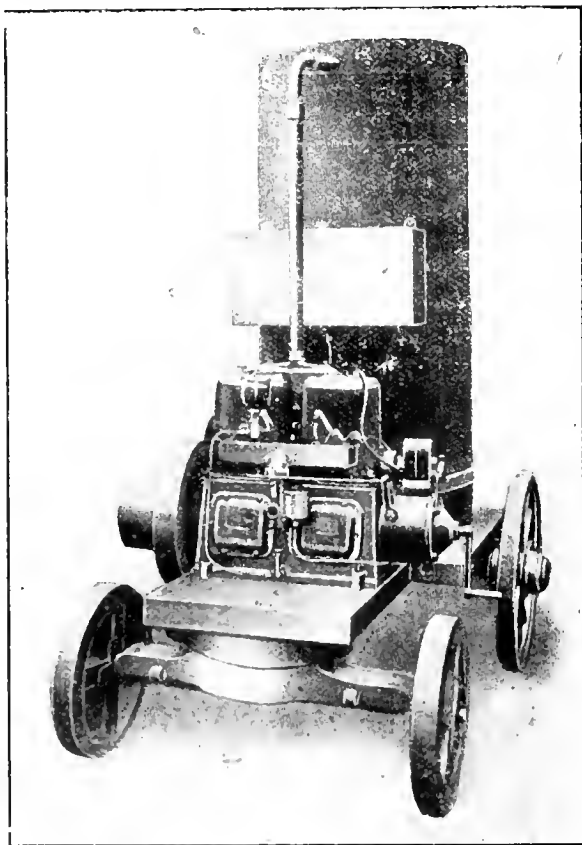


FIG. 2 HUSBAND PORTABLE OIL-ENGINE SET.

four-cycle type of engine being dispensed with. The engine is, however, claimed to be much more efficient than the ordinary two-cycle engine; a positive system of lubrication is fitted, and high-tension magneto ignition, the magneto being mounted on the governor case. The engine is fitted with a flywheel pulley, and is suitable for driving a dynamo, pump, or other machinery.

New Transformers.

MESSRS. JOHNSON & PHILLIPS, LTD., of Charlton London S.E., have brought out an ingenious portable testing transformer, provided with hoops, as shown in fig. 3, which enable it to be rolled along the floor of the workshop or test-room to the place where it is to be used. The device may be open (as illustrated) or protected, or totally enclosed, and is made in sizes up to 25 K.V.A., and 6,600 volts, single or three-phase.

Another useful novelty is the application of the transformer

principle to the heating of shell bands, as shown in fig. 4. This has the advantages that it can be placed in any convenient position, heats the rings uniformly and without producing scale or burning the bands, is free from smoke, flame, and fumes, and is safe from

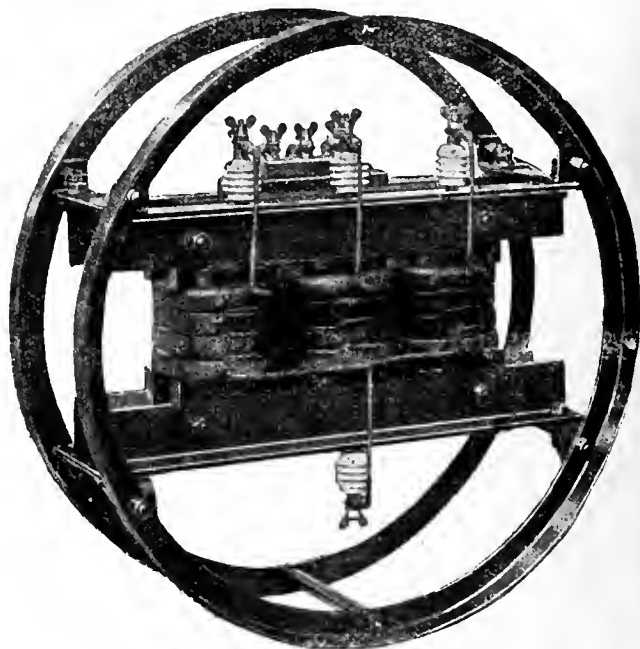


FIG. 3.—J. & P. PORTABLE TESTING TRANSFORMER.

fire risk. It is easy to manipulate, the arm being counterpoised, so that it can be raised to slip the band into place; the heating takes from 1 to 1½ minutes, according to the size of the band, and

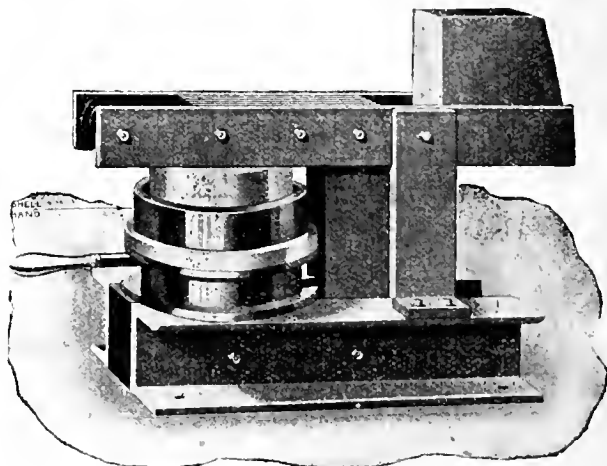


FIG. 4.—J. & P. SHELL-BAND HEATING TRANSFORMER.

From 200 to 400 bands can be dealt with per day. It is wound for any standard frequency and any voltage up to 550 volts. A similar type is being developed for heating steel tires and shrink rings generally.

A New High-Frequency Induction Furnace.

An interesting development in small electric furnaces has been made by Dr. E. F. NORTHROP, of Princeton University, in conjunction with the PYROELECTRIC INSTRUMENT Co., of Trenton, N.J., and under the direction of the Ajax Metal Co., of Philadelphia, Pa.

The furnace uses oscillatory currents for the generation of heat. By the use of a highly effective induction, currents can be set up in the containing crucible in the case of a non-conducting melt, or in the melt itself, if the same has sufficient conductance. It is possible to raise the temperature of a melt in a crucible until its resistance becomes low enough to permit the generation of heat in the substance itself (as in the case of melting glass), after which the temperature producible is limited only by the durability of the insulation and container.

The furnace is especially suitable for alloy research at temperatures above 1,100° C., inasmuch as it makes possible the running of melts in vacuo or in any atmosphere desired, particularly in one free from carbon. With a 20-KW. furnace, which is the largest size so far built, a temperature of 1,620° C. has been easily attained. Theoretically, there is no temperature limit, but practically there is a limit because of the necessity for proper heat insulation between the containing crucible and the outside coil.

What is actually accomplished is to induce countless eddy currents in the melt itself, provided it is a conducting substance, by the use of oscillating current at a frequency of about 12,000 cycles. If the melt is of a non-conducting substance, such as glass, a conducting crucible such as graphite is used. Eddy currents are then induced in the crucible, which in turn heats the

glass, rendering it conducting as it rises in temperature, after which eddy currents are set up in the glass itself. — *Met. and Chem. Eng.*

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

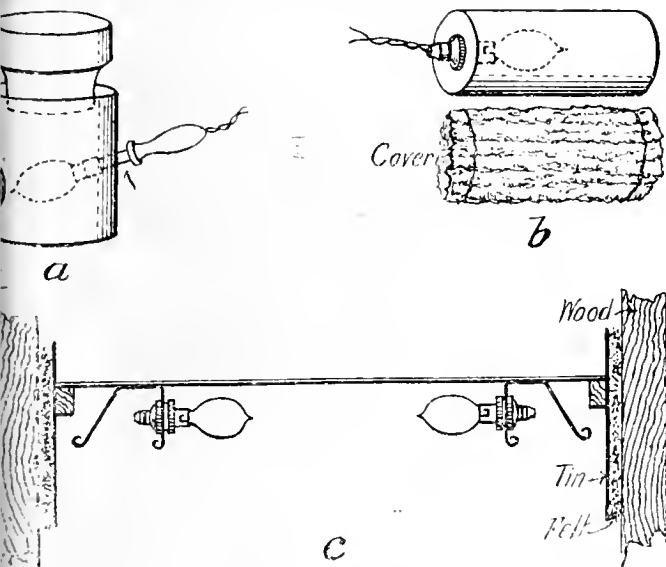
A Portable Electric Lamp Cooking Box.

I am very pleased to see that Mr. Edwards is having a try at the most sensible type of cooking apparatus yet made, and I sincerely wish him success. At the same time, I would ask him to reserve a good share of his ingenuity to use in persuading people to see the good points in his apparatus.

One of the most energetic and prominent advocates of cooking by electricity once told me that any man who wanted people to buy his cookers would make them to look as much like gas cookers as possible if he wasn't a — fool; and I found he was quite right. Gas ovens and electric ovens are so much alike that they can easily be mistaken the one for the other; moreover, to a large extent, they are both made in the same workshops.

Some years ago I made several pieces of apparatus, using lamps as heaters: one was a food warmer for use in the nursery. This was a straight-walled tin pan with a wooden handle, through which the flex wire passed to a S.B.C. holder and a 5-C.P. Edison No. 3 lamp, see fig. *a*. In the side of the pan was a round hole about 1 in. diameter, having a mica window; this enabled the apparatus to do duty as a night light. In the top of the tin pan a porcelain cup with a "well" was fitted, and a cover over this completed the apparatus. I succeeded in keeping only one of those in sight; it completed its duties in the nursery, and was afterwards used by an elderly Lady—(capital L)—for several years.

Another was a foot warmer for use in bed. This consisted of a round straight tin about 9 in. long and 3 in. in diameter, with the



usual slip-on lid. A 1½-in. hole was cut in the bottom, and a Belsize lampholder was used—held in position by the shade carrier ring; a flannel cover, with a tape run in a slot at each end, and drawn up after being slipped over the tin, and an 8-C.P. lamp completed this apparatus, fig. *b*.

This caused trouble, as it was found impossible to convince people that an 8-C.P. lamp was the largest power that should be used; consequently, 16's were used, and scorched sheets resulted. To get over this, three-prong lamps and holders were used; then the lamps were difficult to get.

Another was a wooden hot-cupboard with a tin lining packed with felt, about 20 in. × 20 in. and 24 in. high: the heater was a shelf like a meat tin turned upside down and eight lamps of 16 C.P. were used, fitted inside the tin, fig. *c*. This produced very uniform heating, being a radiator for the lower half and a convector for the upper half. When the air-tight door was kept closed, the heat melted the solder out of the joints of the tin lining in one instance.

There were other things on the same lines, but none of them had the remotest resemblance to gas apparatus, and I found that the description of people who didn't make their apparatus look like gas things fitted me rather too well. Better luck to Mr. Edwards.

J. JACKSON.

Harrow, November 12th, 1917.

The Association Movement.

Mr. Atkinson's letter in your last issue is not satisfactory. In his letter to you of October 18th he made the following statement:—

"From inquiries made since Mr. Berry's article appeared it would seem that he certainly had the idea to found a trade organisation, and took some steps in that direction, but these came to nothing."

In his letter of November 14th he says:—

"I am authorised to state that, in the opinion of those present, my letter of October 18th correctly sets out the position."

I regret to have to state plainly, but firmly, that that statement, now persisted in, is untrue, and I propose to prove it. I agree the matter is one which is probably of little interest to the majority of your readers, but Mr. Atkinson, by an ingenious dislocation of the facts as they occurred, has contrived to discredit some of my statements. That is a situation I cannot tolerate for a moment.

Without vouchsafing any proof, Mr. Atkinson fires a parting shot wide of the mark, and, adopting the tactics familiar to us, endeavours to obscure the issue by a cloud of generalities; in effect he says:—"As far as I am concerned, I now propose to disappear in the fog." That self-effacement, however, cannot be permitted without protest.

The proper course for the Association to pursue, in my opinion, was to accede to a request I have lodged for an impartial investigation. That course they have decided not to adopt. The reason is obvious: they have no case. I have, however, already said that Mr. Atkinson has not adhered to the facts. I now propose to produce the evidence to prove it.

The following letter, of which the enclosed is a copy, has been carefully kept by Messrs. Siemens Bros. & Co., and sent to me by Mr. A. J. Easton. It was written by me on December 9th, 1898. The Cable Makers' Association have been duly furnished with a copy. It reads:—

(Copy.)

"The Arts Club, Manchester.

December 9th, 1898.

"DEAR MR. EASTON,—With reference to my conversation with you on Monday and Tuesday last, I have independently visited the two largest manufacturing firms in the North of England to ascertain their views on the subject of our discussion, and I found them most ready to enter into the question. Both firms have expressed their entire willingness to support any concerted steps which may be taken to further an object which they consider it is absolutely necessary should be brought about with as little delay as possible. They agree that the matter is one of vast importance, and they believe it is possible to constitute a combined movement which should be a lasting benefit to the comparatively small community whose interests are so much at stake.

"In the present state of the raw material market, I gather that these manufacturers are, as you surmised, selling wires and cables at the present moment *below* cost price in many instances, and they consider such a state of things, existing in an enormous industry where the actual number of manufacturers is so limited, to be highly disastrous. I may add that they would be willing to attend a meeting, called in London or elsewhere, immediately, to discuss the most practical way of dealing with the difficulty. I have not time at present to send you any further information upon this subject, but I should like to add that I have been careful to suppress Messrs. Siemens Bros. & Co.'s name throughout, except to say, as you suggested, that I was *under the impression* that you were as anxious as they were to consider this matter. I would further remark that I have consulted with principals only upon each occasion, and they sufficiently realised the gravity of the question to suggest the most rigid secrecy, and the inadvisability of sending any official written communication whatever about this matter until such time that it would be safe to do so. I should like if possible to have an opportunity of talking this matter over with you and Mr. Siemens, and I would suggest Monday, at 11 o'clock, if convenient. I will call then unless I hear from you to the contrary. Meanwhile, believe me, yours faithfully,

(Signed) HERBERT BERRY."

One of the principals referred to in that letter was Mr. Taylor of Helsby, who discussed with me an earlier effort he had been interested in, and to which I shall refer later. He agreed to attend the meeting to be called in London, or elsewhere. Shortly after that, the other conferences took place to which I have already referred, and finally I laid my plans, for the first time, before Mr. Henry Edmunds, then chairman of Messrs. Glovers, Ltd. Almost immediately afterwards the suggested meeting took place.

It was agreed that Mr. Edmunds should complete the arrangements, and he was elected to the chair. I am not concerned with Mr. Edmunds's subsequent constructive proposals; I have never claimed any interest in them. They may, or may not, have differed from the proposals which figured at the first, but by then defunct, Cable Makers' Association. It can be assumed with certainty that the proceedings were ably conducted.

My whole point is that I conceived the idea to found the second Cable Makers' Association. I did the spade work, and obtained the consent of the principal parties concerned to attend a meeting in London, and they did so. If that is not laying the foundation stone, then perhaps Mr. Atkinson will tell us what is.

The point, however, which I now wish to clear up is Mr. Atkinson's statement, which I here repeat:—

"From inquiries made since Mr. Berry's article appeared, it would seem that he certainly had the idea to found (a) trade organisation, and took some steps in that direction, but these came to nothing."

Let there be no mistake about that remark, because Mr. Atkinson now says:—"He is authorised to say that he has correctly set out the position." I say definitely that it was the first Cable Makers' Association which came to nothing. I had nothing whatever to do with that. It was, as a matter of fact, inspired by Mr. Henry Edmunds and others. I have reason to know it, because he told me so at my interview. Every old-established wiring contractor, and there are hundreds of them, remembers the first C.M.A. It flourished for a short while, but suffered a premature death. Does Mr. Atkinson propose to deny that? If so, let him come forward and furnish dates.

It was remarked to me by a member a few years ago that the existence of the Association had probably meant at that time an increase to the members' joint coffers amounting to a million pounds sterling. If that figure was not over-estimated, it will be a matter of small surprise that the credit for the origin of the second Cable Makers' Association is much coveted, especially by those who, figuratively speaking, are wallowing in their accumulated wealth.

I admit that it must be galling for the Association to be called upon to apportion the credit according to its due, when by so doing it involves including someone situated outside the charmed circle; but surely that course would have been more dignified and sportsmanlike.

With regard to Lieutenant Paterson's letter, I am quite content with his statement that, so far as Messrs. Johnson and Phillips's Cable Works are concerned, it is a fact that he was first approached by me. If Mr. Atkinson gets comfort out of the fact that, in spite of that, Mr. Edmunds was referred to often as the "father," he is welcome to it.

In conclusion, I would add that, in carefully chronicling the genesis of the second C.M.A. in so far as my share of it is concerned, I was completely unconscious of the fact that, in so doing, I was shaking the foundation of a Golden Image which Nebuchadnezzar, their King, had set up.

Herbert H. Berry.

London, W. 1, November 19th, 1917.

The E.T.U. or the A.E.S.E.?

The station engineers are at last waking up to the benefits to be obtained by united action, yet they are straightway making the serious mistake of dividing into two camps.

Let the members of both organisations bridge the split at the outset, or else examine impartially the policy of both, and join the one that is the stronger to obtain what we want, *i.e.*, more pay and better conditions of employment.

E. T. U. Ease.

Up to recently (I have read your paper for the past 25 years) the "Correspondence" columns of the REVIEW were invariably sought after for information, and were considered to be edifying and beneficial. The correspondence in your present issue with reference to the exults of the E.T.U. is hardly so, however. I am not myself interested in any trade union or society, and personally have not the pleasure of knowing Mr. Napier, but whatever good is served by publishing the aimless generalities of W. J. Webb, or the senseless drivel of H. H. Morton (who, with all his sneers, does not deny any statement made by Mr. Napier) I fail to see. In the past, when correspondents lapsed into slang and personalities a small footnote invariably appeared somewhat to this effect, *viz.*:—"This correspondence must now close," and I think your paper would be considered to be the cleaner if this were done now.

X.Y.Z.

[None know better than Editors that it is impossible to please everybody; on the other hand, the public ventilation of such questions as the subject of this correspondence is a duty which must be fulfilled, and in performing it we have endeavoured to be scrupulously fair to all parties, at the cost of space which, we must admit, we have grudged. As regards the ban on slang and personalities (which are not wholly absent from "X.Y.Z.'s" letter), it is evident that our critic has overlooked the "small footnote" which appeared on p. 467 of our last issue.

In justice to ourselves, we must point out that the fundamental question which underlies this correspondence—namely, the method by which the staffs of electricity supply undertakings, from the chief to the humblest employé, shall obtain the adequate remuneration for their services to which they are justly entitled—is one which is of absorbing interest to some thousands of men; there may be many, like "X.Y.Z.," who are not concerned with this subject, but we trust that, in the interests of their fellows, they will exercise a generous patience for a time. The matter has now apparently come to a head, and in our leading columns to-day we comment on it—Eos. Elec. Rev.]

An Electricity Supply Engineers' Association.

It is to be regretted that your valuable pages are occupied weekly by letters relating to the contest between the E.T.U. and the A.E.S.E., and the excuse for adding one more to the number is the hope that it will tend towards a settlement, not only of this small issue, but some matters which are perturbing the minds of electricity supply engineers generally at the present time.

It is admitted there are capable men in both the E.T.U. and the A.E.S.E., and they ought to get together and determine as regards their members where the E.T.U. finishes and the A.E.S.E. begins. If that is difficult, they could leave the junior charge engineers as a sort of "No Man's Land," and let them decide for themselves which they will join, as it appears to be there where the most divided opinion exists. As the parties are going on at present, both sides are wasting a lot of time and money without any good results.

The root cause of the trouble is the increase in the cost of living, and the inability to exist on the salaries which were too low even in peace-time, and the reluctance of the authorities to grant justified increases. This has resulted in the juniors, and, in fact, some seniors, being anxious to obtain the increase of wages awards which were primarily intended for workmen. The awards are more easily obtained through trade unions, but the professional engineer does not like the idea of joining a trade union, and quite right, too; but how can he obtain his due otherwise, as there does not exist at present a professional association that can assist him?

The A.E.S.E. has taken up the case for the juniors, and a few seniors have thrown in their lot with them, but they are so few that the Association could not put in a plea for the seniors. An attempt, therefore, is being made to obtain more senior members for that Association, but it appears to be starting from the wrong end for a junior association to be setting about organising the seniors, and therefore very little support is expected.

What else, then, have we got? There is the Chief Technical Assistants' Association for municipal seniors, but I believe there are a few of those who are not in the Society. As for the company seniors, they do not appear to have an association at all, and there are separate associations for company and municipal chief engineers. Now, so far as I know, all these associations were formed ostensibly for the purpose of interchange of technical and administrative knowledge, and not one offers assistance in the question of remuneration.

This is the paramount question to-day, as it is difficult to make ends meet on the old salaries, and when the engineers are working strenuously, as, of course, they should be in these times, they feel the differences in remuneration existing for similar posts in stations of the same capacity, and the matter ought to be put right without delay.

The Institution of Electrical Engineers, which comprises all the grades, is purely a scientific society, and it should remain so, far above commercialism. What we need, then, is a comprehensive association for all professional electricity supply engineers in the Kingdom (chief engineer to junior inclusive), solely for dealing with questions of professional status, remuneration, and matters of common interest, and able to make its presence felt if need be. This should be quite distinct from the existing technical associations, and should have an executive committee, consisting of chiefs, seniors, and juniors, meeting, say, monthly, or oftener if need be, and an annual general meeting.

Will our chief engineers, company and municipal, London and provincial, get together in our mutual interests and arrange a meeting, say at Westminster, to thoroughly discuss the question, and invite our I.E.E. President, Mr. Wordingham, to kindly consent to take the chair? I feel sure they would find the time would not be wasted.

Chief Assistant.

The Teaching of Electrical Installation Work.

In view of the adverse criticism of the tuition given to students desirous of acquiring knowledge of electrical installation work, it occurs to me that some of your readers may be interested in the Wireman's Class at the Trades Training Schools, Great Titchfield Street.

This is probably the best equipped and best attended class of its kind in the London district, and numbers among the students not only boys and improvers, but men of mature years anxious to improve their knowledge of this class of work.

A full complement of tools has been provided, with ample material, and, furthermore, to enable power work to be taught, a small but complete electrical factory equipment has been purchased, and is being installed by the students this session.

If anyone interested in the subject is inclined to visit the schools on class nights, Monday, Wednesday, or Friday, I shall be pleased to show him the facilities we have at hand for teaching this important subject.

S. Nichols,
Instructor.

London, W., November 19th, 1917.

AN INSTITUTION OF ELECTRICITY SUPPLY ENGINEERS.

A CONFERENCE of senior technical officers drawn from company and municipal electricity supply authorities of the London area was held at the Hammersmith Electricity Works on the evening of Thursday, 15th inst. The meeting was convened by the Executive Reconstruction Committee of the Association of Electrical (Station) Engineers of London.

The chair was taken by Mr. F. HILL, chief assistant electrical engineer to the Hammersmith Borough Council, who, in his opening remarks, briefly stated the objects of the conference. No one who had followed recent developments could doubt the necessity for concerted action on the part of central-station engineers, and it was proposed to place the true facts of the situation before that meeting in order that they might be in a position to judge of that necessity. He called upon Mr. H. W. Healy, President of the London Committee of the A.E.S.E., to outline the history of the Association movement and the recent developments.

Mr. HEALY first expressed the thanks of himself and those of the junior men associated with him to Mr. G. G. Bell, the chief engineer and manager of the Hammersmith electricity works, for the encouragement of his practical interest in their efforts. After dealing with the early history of the A.E.S.E. and its development to date, he gave a detailed report of the action taken by the junior staffs of the London power stations to ensure that their interests were not represented by outside bodies. Steps had been taken to get together a representative committee of six men to prepare schemes of reconstruction, and with that end in view they had issued invitations to the senior technical officers. It did not appear beyond the range of practical politics to agree upon definite lines of concerted action which would place all questions affecting the financial interests of central-station engineers, from chief to junior, above the level of barter. On the broad questions—standard of efficiency, status of the profession, and adequate remuneration—there was no division of opinion. On those matters the interests of seniors and juniors were common. The existing associations did not, as at present constituted, meet the needs of the case, and he would suggest as a basis of discussion that perhaps a new body could be formed to deal with these broad questions, leaving the existing associations to develop until the time was ripe for them all to be embraced.

In the discussion which followed, Mr. A. P. MACALISTER (Islington), speaking from considerable past experience of organisation of associations, emphasised the difficulties of securing co-operation between seniors and juniors, and held that it was not always possible for company and municipal engineers to meet for mutual discussion. He had many times suggested to the senior men of the company undertakings that they should form an association. He suggested that a solution of the difficulties could be found in affiliating the sectional associations.

Mr. F. D. NAPIER (North Met. E.S. Co.) reviewed the remarks of the previous speakers, and expressed himself as in entire agreement with the necessity for concerted action. If that course were followed, all questions affecting the interests of any grade could be settled by constitutional procedure. He then moved the following resolution:—

"That this Conference of Senior Technical Assistants appoint a committee of nine to confer with the existing Association of Electrical Station Engineers' Committee on the questions of construction and reconstruction. The representatives appointed to be three from the companies' staffs, three from the C.T.A.A., three from municipal staffs. The recommendations of the combined committee to be placed before a general meeting to be held in due course."

Mr. H. F. J. THOMPSON (chief assistant engineer, Battersea) moved a resolution in similar terms, subsequently seconding the original resolution. Speaking from a lengthy experience in the service of both company and municipal supply authorities, he could not see where the staff interests clashed, although it was quite possible that there might be something in the suggestion. He endorsed the remarks of previous speakers regarding the need of a comprehensive association.

Mr. W. YOUNG (chief assistant engineer, Stepney) supported the suggestion, and pointed to the work done by the C.T.A.A. It had been formed for academic purposes, and had undoubtedly achieved excellent results.

The resolution was then put to the meeting and carried unanimously. Nominations followed, and a provisional committee was elected as under:—

Mr. C. O. GRIMSHAW, Westminster E.S. Co.; Mr. F. D. NAPIER, North Met. E.S. Co.; Mr. W. E. A. ROLAND, St. James's and Pall Mall E.L. Co.; Mr. A. P. MACALISTER, Islington; Mr. H. F. J. THOMPSON, Battersea; Mr. W. YOUNG, Stepney; Mr. GATTRIL, Finchley; Mr. F. HILL, Hammersmith; Mr. G. C. LAW, Barnes. Mr. H. W. HEALY (Battersea) was elected hon. secretary.

It was resolved that the hon. secretary be instructed to approach the Associations of London Company and Municipal Chief Engineers, inviting them to appoint three representatives from each association to meet the provisional committee.

The meeting closed with a hearty vote of thanks to the chairman, Mr. F. Hill.

No fewer than 75 station engineers (senior technical officers) were present; never in the history of central stations has there been so representative a gathering. From the course of events, it would appear that the time may not be far distant when an Institution of Electricity Supply Engineers will be an accomplished fact.

WAR ITEMS.

Exports to China.—The "London Gazette" for November 20th contains names of further persons and bodies in China to whom exports may be consigned.

Railways After the War.—Last week, Sir A. Stanley stated that the Board of Trade, in consultation with the Ministry of Reconstruction, was giving close attention to the problems that would arise when the present war control of railways ceased. The Board was being advised by a number of gentlemen possessing expert knowledge or experience, but they did not constitute a formal committee, and there were therefore no terms of reference.

British Homesteads.—The staff and workmen of Messrs. Thomas Firth & Sons, Ltd., have subscribed £25 to the British Homestead Association in response to an appeal in the Northern Press. As this is regarded as an indication that those employed in the other great engineering works throughout the country are likely to be equally interested in the movement, we are asked by the President (the Hon. Mrs. Murray) of the Association, whose offices are at 47a, Portland Place, London, W.1, to state its objects. The work which it has set itself to do is to look after discharged officers and men of all His Majesty's Services whose state of health may not be such that they may reasonably expect to follow their calling directly they are discharged, and to provide them with comfortable homes and an opportunity of healthy exercise on the land, so that they may fit themselves either for work on the land in some form or other, such as small-holdings, or for some handicraft, trade, or profession. Up to the present time two homesteads have been acquired, one at Congleton, in Cheshire, called the David Little Memorial, and the other near Bexley, in Kent, known as the Kinnison Memorial. Although the State grant of 27s. to men who are being trained in an approved scheme is sufficient to keep them, it does not give a man facilities for getting the best kind of training possible, such as they deserve. Nor is it likely always to give them opportunity for complete development of their powers. We commend this very worthy movement to the interest of readers who may be able to contribute to the funds, and so help to set up in life again those who have sacrificed so much.

Exemption Applications.—The case mentioned last week as being before the Hants Appeal Court (the Military appeal against exemption given to a young man of 18) was in- correctly stated. We understand that no such appeal has been made in respect of the Winchester Corporation electricity department, and that there is no assistant aged 18 on the staff.

At the Shoreditch Tribunal, Messrs. E. & C. Whitney, of City Road, E., electrical engineers, appealed for James Green, aged 39, classed B3, an electrical fitter, for the third time. Captain Fisher said this was an electrical toy shop, but Mr. Whitney said this man had nothing to do with that; he was doing work for outside customers, wiring, and so on. They could only do work of national importance, as they could not get the materials themselves for private work, and could, therefore, only do the work for firms who got A certificates. Captain Fisher said these men were very badly wanted in the Army, and they were being called up. Mr. Harwood asked why it was that he had not got a M.A.R.O. (Munition Area Recruiting Officer) certificate if he was doing national electrical work, and Mr. Whitney said he did not think there would be the slightest difficulty, as the other men had got it. The hearing was then adjourned for him to get one, and the Chairman said that if he could not do so he might have to go into the Army.

At Accrington Tribunal, the Military Representative appealed for the cancelling of the exemption given to a man of 38, married, engaged on electrical work connected with the making of shells and fuses. Asked as to his exact occupation, the man replied that he was an electroplater. The Town Clerk: You are put down in the papers as an electric "motor." The certificate was cancelled, temporary exemption being given to January 31st.

At Torquay, an appeal was made by J. W. Lane (27, B2), electrical fitter, and he was given until March 1st.

At Lonsdale Appeal Tribunal, the case of an electrical engineer (26) was considered. He was in business with his brother at the outbreak of war, but joined up and served six months, being discharged as medically unfit on the eve of going to France in 1915. His brother went to munitions on his return, and another brother had been on munitions at Sheffield. After being called up for medical examination he passed B3. They had 470 customers, whose electrical instal-

lations of motors required supervision. Colonel Robinson said that such men were needed in the Army. The Tribunal ordered him to join up again on December 31st.

Before the Northants Appeal Court, the Peterborough Electric Traction Co. appealed for J. G. Manning (29, Class A), electrician. The company's representative said that they were given to understand by the Ministry of Munitions that no more men would be taken from the trams, but they had since withdrawn this, and left all appeals to the Tribunal, who would know the local conditions. Manning was the only man left to do repairs, and they had failed to obtain a substitute. Complaints had been made from various munition works that there were not sufficient cars run, and that was because they could not keep up with the repairs. Three months were conceded.

At Gloucester, the County Appeal Court heard a Military appeal against the decision of the Tribunal at Stow respecting an appeal for an electrician (25, B 1), engaged with the Electric Light Co. It was stated that the man was engaged after rejection, and was since classified B 1. The Court considered the man to be indispensable, and, giving exemption until March 31st, requested the employers to do their best in the meantime to replace him.

Lancashire Appeal Court has gone into appeals for 22 employees of the St. Helens & District Tramways Co. Eleven drivers and three inspectors are not to be called up until substitutes are found; another inspector was refused exemption, and temporary exemption until February 8th was allowed to a winder, an armature mechanic, a joiner and S.D., a controller attendant, a handy man, and a fitter's labourer.

At Oxford, Messrs. Wyatt & Son appealed for E. Green (36, C 1), electrician. He is passed for trade only, and Captain Sheild said that if taken for the Army he would be put to his trade. Two months' temporary exemption was allowed.

Essex Appeal Court has granted exemption until January 1st to R. Jefford (18), electrical engineer, of Leyton.

On the recommendation of the Advisory Committee, the Rochdale Tribunal has given exemption until March 31st to H. Smethurst (36, Class A), overhead wireman, appealed for by the Corporation tramway department.

At Northamptonshire Appeal Tribunal, on Monday, Mr. J. Cameron, the manager of the Northampton Corporation tramways, resisted the Military appeal for the open exemption to January 1st, 1918, of G. T. Webb (38, married, B 1), a traffic inspector. Mr. Cameron said Webb had been in the employ of the Corporation since 1901, and the duties of an inspector were much more onerous than they used to be. During the past two and a half years there had been 200 changes in the staff, including the introduction of 120 women conductors, and in view of these wholesale alterations it was absolutely essential that competent inspectors should be in charge. Sir Charles Knightley remarked that some of the cars did not carry anything like their full complement of passengers. Mr. Cameron replied that in the first six months of the present financial year the passengers totalled five and a half millions. The Chairman said there was no reason why tramway traffic should not be reduced, as other traffic had been cut down by the shortage of petrol. The Tribunal would allow the Military appeal to the extent of attaching finality to the certificate.

At the Hull Tribunal, a C 2 man, 33, said that he was an electrician by trade, but owing to an injury to his arm he had acted as a laundry vanman. Recently he had returned to his trade. The Military Representative said that electricians were wanted in the Army, and such men had to be sent to undergo the trade test. The application was refused.

BUSINESS NOTES.

Imports Prohibited.—A Royal Proclamation, dated November 16th, prohibits the importation except under special licence, of the following:—

Brass rod and brass wire,
Electric meters,
Electrical motors over $\frac{1}{2}$ h.p.,
Electric hand lamps and torches,
Magneto's,
Measuring tapes and rules of all descriptions, including verniers,
Micrometers.

An Electrical Works Institute.—We have received a copy of the E.C.C. Works Institute membership card for 1917-18. The Institute is, of course, connected with the Rushbury Wolverhampton Works of the ELECTRIC CONSTRUCTION CO., LTD., being provided for the recreation of the employees. Provision is made for tennis, bowls, billiards, pool, snooker pool, a lending library, physical culture, dancing class, and a holiday savings bank. The rules are delightfully brief, and cannot be described as irksome, for they read thus: "None, except those which ordinarily govern decent conduct and good sport-manship." Mr. W. M. Furniss, the manager, is president, and three of the directors (Messrs. P. E. Beacheroff, chairman; James Gray, managing director; and David Willock) appear as vice-presidents.

Book Notices.—*Lloyd's Diagram of Calculations.* By H. G. Lloyd. London: E. & F. N. Spon, Ltd. Price 2s. 6d. net (2s. 8d. post free).—This is an ingenious diagram, with which multiplication, division, proportion, involution and evolution, &c., can be performed: it is printed on a card measuring $8\frac{1}{2} \times 13$ in., and consists of logarithmic co-ordinates, together with a system of diagonal lines. Scales are printed on the four margins, and by following the lines to their intersections in accordance with the instructions, which are printed on the card, the operations above mentioned can be quickly carried out to a fair degree of accuracy. The divisions of the scale can be read to the third significant figure, giving a possible attainable accuracy of about one part in 1,000, which is maintained over the whole area of the diagram owing to the logarithmic subdivision; we have made various trials of simple operations, the greatest error made being 1 in 1,000. Inspection of the fine lines is somewhat trying to the eyes, and the diagram is, of course, not comparable in convenience with a slide rule: it is, however, easy to use, and certainly is very clever and interesting.

"The Work and Training of the Royal Flying Corps." London: Illustrated London News and Sketch, Ltd. Price 2s. 6d. net.—This work, which was published on Monday last, has been issued on behalf of the Royal Flying Corps, and consists almost wholly of views of the Corps at work, printed in photogravure; the subjects dealt with cover all branches of the Corps's activities, and are exceedingly interesting in themselves, while the reproduction reaches the highest grade of excellence. There is a short introduction by Lord Hugh Cecil, the rest of the issue being pictorial. While it contains little of purely electrical interest, except some views of the training school for wireless telegraphy, the illustrations are of fascinating interest to all admirers of the work of this wonderful organisation, and the volume is well worth the price. A companion volume dealing with the sister service—the Royal Naval Air Service—is in preparation.

"Industrial Engineering, Present Position and Post-War Outlook." By F. W. Lanchester. Presidential address delivered before the Junior Institution of Engineers. London: Constable & Co. Price 1s. net.

"Training and Work of the Chemical Engineer." Reprinted from the *Transactions* of the Faraday Society. Vol. XIII. September, 1917. Price 3s. 6d.

"Science Abstracts, A and B." Vol. XX. Part 10. No. 238. October 31st, 1917. London: E. & F. N. Spon, Ltd. Price 1s. 6d. each.

Standardisation of Petrol Gauze.—At the instance of the Air Board, the Royal Aircraft Factory experts have made experiments, which have resulted in a standardised gauze being agreed upon. This will greatly facilitate manufacture, and will enable the material to be produced in Great Britain in adequate quantities to meet the demands from aircraft factories. The gauze will be known as "Air Board Standard Petrol Gauze," and all orders and inquiries should be sent to the Air Board Office, S. (H.A.) 5, Room 609, Strand, W.C. 2.

British Magneto's for British Users.—As a result of co-operation on the part of the members of the British Ignition Apparatus Association, purchasers of magneto's made by them will enjoy the many advantages which arise from standardisation in production. The complete magneto's are interchangeable, not only with one another, but with the best-known pre-war types, for every one of which there are now one or more British magneto's of similar purpose and capacity. Further, many of the essential parts are standardised and interchangeable. Screws, for instance, will be used of standard dimensions, and the different sizes of brushes are being standardised and reduced in number to one-tenth. Other parts are being dealt with in a similar way. This means, first, that spare parts will be much cheaper; secondly, that they will be easily and quickly procurable, because agents and garage proprietors will be able to supply from stock. The advantages thus secured are increased by the fact that certain firms are concentrating on particular types in order to secure for the public the benefits which arise in efficiency and economy from quantity production.

The following list of British standard types of magneto's for the motor trade shows the corresponding pre-war types—where such exist—and the number of British firms now making them:—

British standard type.	Size and purpose.	Pre-war type.	Now being made by—
M.1	1-cyl. light weight motor cycle	Z.A.1	4 British firms
M.2	2-cyl. opposed motor cycle	Z.A.2	3 British firms
M.V.	2-cyl. V. light weight motor cycle	Z.A.V.	1 British firm
K.1	1-cyl. standard $3\frac{1}{2}$ h.p. motor cycle.	Z.E.1	4 British firms
K.V.	2-cyl. V. $6\frac{1}{8}$ h.p. motor cycle	Z.E.V.	2 British firms
K.2	2-cyl. (opposed) $6\frac{1}{8}$ h.p. motor cycle.	Z.E.2	2 British firms
G.1	1-cyl. for light cars	Z.F.1	4 British firms
E.1	1-cyl. for large cars and lorries	Z.U.4	5 British firms
E.6	6-cyl. for cars and lorries	Z.R.6	4 British firms

All of these types are being supplied in large quantities to the British and Allied Governments.

In addition, there are full ranges of standardised British magneto's for aero, stationary, and marine engines, for agricultural work, and for all kinds of gas engines.

Spain.—The Sociedad Lamparas Rex has been formed at Barcelona, with a capital of 50,000 pesetas, for the manufacture of electric glow lamps.

Italy.—With its seat at Genoa, a joint-stock company has been established under the style of the *Fabbrica Nazionale Lampade Elettriche ad Incandescenza*, having for its object the manufacture and sale of electric glow lamps and kindred accessories. The capital of the company is 60,000 lire.

Trade with Italy.—The British Chamber of Commerce for Italy (Inc.), Genoa, in its latest list of openings for British articles in Italian markets, mentions the following :—

No. 1,436.—Travelling representative would take up agencies for Italy and Colonies for beltings, lubricants, engineering articles in general, small machinery, machine tools, ironmongery, steel, household articles, &c. A.G.V.

No. 1,439.—Engineering office at Genoa would import for own account or on commission :—Machinery for steel works and rolling mills, machine tools for large engineering and shipbuilding works. G.F.S.A.

British Industries Fair.—As certain Trade Associations connected with trades eligible to participate in the British Industries Fair, 1918, have until recently been unable to hold meetings to discuss concerted participation, and in order to suit the convenience of a section of the Trade Press, the Board of Trade have decided to extend the final date for the receipt of applications for space until November 30th. The difficulties of organisation due to the war make it of the highest importance, however, that all applications should be sent into the Director, British Industries Fair, 10, Basinghall Street, London, E.C. 2, at the earliest possible moment. The applications for space so far received from manufacturers point to the coming Fair being greatly increased both in size and importance.

Catalogues and Lists.—THE PARSONS MOTOR CO., LTD., Town Quay Works, Southampton.—Seventy-two-page catalogue giving full information respecting their marine and stationary oil engines. Stationary petrol-electric sets, from 7 H.P. to 90 H.P., are detailed with price, code-word and shipping particulars. This side of the firm's business has been largely developed during the last few years.

MESSRS. VICKERS, LTD., 57, Victoria Street, Westminster, London, S.W. 1.—A series of excellently produced foreign publications. The first gives a description, also a full specification, in English, of Vickers rotary converters. The second describes the same plant in French. The third (of 30 pages) gives the same information in Russian. The fourth (24 pages) covers the ground in Spanish. Three separate publications of four pages each deal briefly in English, French and Russian, and with illustrations charmingly executed in colour, with the firm's electric crane equipments (motors, controllers, resistances, brake magnets and switchboards). These publications are prepared in such a creditable style as to make a substantial impression upon the recipient, a merit which, for foreign trade, can hardly fail to bring its reward. For all of them a thick art paper is used, and half-tone illustrations and diagrams are effectively printed.

France.—Under the style of "Automatisme et Appareillage," has been formed at Paris, a company for the development of the business of electric switches and the taking up of all patents, licences, and industrial processes relating to automatic apparatus. The capital of the company is 150,000 fr.

Dissolutions and Liquidations.—MICA MANUFACTURING CO., Volta Works, Cazenove Road, Stoke Newington.—R. G. Whiffen has retired from the partnership, which has been dissolved. Messrs. P. Freeman, T. J. Sack and G. H. Hadder will attend to debts, &c.

KORTING BROS., LTD.—A meeting is called for December 21st, at 53, Victoria Street, S.W., to hear an account of the winding up from the liquidator, Mr. A. G. Parker.

Trade Announcements.—We are informed that the Board of Trade have now given formal sanction to a new company, with works in London and Liverpool, and known as the *BRITISH BARIMAR-THERMIT WELDING CO., LTD.*, to take up and exploit the Thermit welding process, which, prior to the war, was exclusively in German hands. Thermit is especially applicable for tramway welding and for the repair of heavy castings and machine parts, and it is the intention of Mr. C. W. Brett, the managing director and general manager of Barimar, Ltd., scientific welding engineers (who is largely responsible for the formation and management of the new company), to train disabled British soldiers and sailors to carry on the work. The registered offices of the new company are at 10, Poland Street, London, W. 1.

With reference to the above, we are also asked to point out that the above company must not be confused with Thermit, Ltd., 675, Commercial Road, London, E. 14, who are the owners of the Alumino-Thermit Process Patents, and in no way connected with the new company above referred to, who merely hold a licence to work certain of the patents belonging to Thermit, Ltd. Messrs. Thermit, Ltd., were originally established in 1904, and about 18 months ago the whole of the shares were sold to the Birmingham Metal and Munitions Co., Ltd., Birmingham. Thermit, Ltd., continue their manufacture of various Thermit compounds, and are at present especially engaged upon the manufacture of certain metals and alloys in connection with munitions of war.

The Caxton House offices of the *IMPERIAL UNITED LAMP CO., LTD.*, having been commandeered by the Government, their new address is Thanet House, 231-2, Strand, London, W.C. 2. Telephone number: Central 3016-7-8. Telegraphic address: "Unilamcom, Estrand, London."

LIGHTING AND POWER NOTES.

Acton.—The Finance Committee is protesting against the continuance of increased charges in the area by the Metropolitan Electric Supply Co. The latter considers that no reduction can be made under present conditions, and states that the total profit earned by the Acton undertaking from 1911 to 1915, inclusive, was barely sufficient to meet depreciation. It was decided to acquaint the company with the Council's views, before taking other steps to have the increased charges modified.

Ashton-under-Lyne.—PRICE INCREASE.—The Electricity Committee proposes to increase the charges for electricity after the next quarter, owing to the increased cost of coal, wages, &c. The extent of the increase has not yet been fixed.

Australia.—Murrumburrah (N.S.W.) Council has decided to install an electric lighting plant, and is obtaining plans and estimates of a suitable scheme.

Barnes.—The Electricity Committee, in recommending the laying of a new cable to a local works, suggests that the firm pay £2,000 as part cost of the installation and pay the Council's current rate for power supply in the district, the firm to take a minimum supply of 500,000 units per annum for five years, and, instead of paying down the £2,000, to give security for payment and pay in addition to the charges mentioned above a charge of 1½d. per unit, until the sum of £2,000, together with interest thereon, is paid.

The Electricity Committee recommends the following revised electricity charges :—Lighting, 4½d. per unit; heating and power, 1½d. per unit; that all lighting charges be abolished, and that the alternative rateable value tariff be 1½d. and 1d. instead of 1d. and ¾d.

The increased coal prices under the recent award represent an additional cost of £2,000 a year.

The electrical engineer reports that the maximum load to be handled this winter is expected to be not less than 1,300 kW., and as the total capacity of the plant installed is 1,750 kW., the margin of safety has long been passed. The Committee has decided to consider a special report as to the provision of additional plant for immediate use.

Belturbet (Co. Cavan).—STREET LIGHTING.—The public electric lighting contract has been taken up by Mr. J. Stewart, at £70 for the season.

Brimington.—The P.C. has under consideration a co-operative scheme for electric lighting in this village.

Bradford.—WAGES.—The Corporation War Wages Committee, in response to an application on behalf of over 3,000 workers in various departments, including the electricity department, has decided to increase the men's war bonus from 12s to 15s. per week, and that of the women from 6s. to 8s.

Deal.—The Board of Trade has extended for a year the powers relating to certain distributing mainlaying under the Deal and Walmer Gas and Electricity Act, 1911.

Derby.—The Electricity Committee has appealed to consumers to economise in the use of electricity during heavy load periods.

Dundee.—A suggestion was made at a meeting of the Corporation Committee that Mr. Richardson, the burgh electrical engineer, who is at present on Active Service, should be demobilised. It is explained that the department cannot take on any new consumers just now, and that it will require another great extension of the works. It was pointed out that the makers of generating machinery were getting full up with orders for after the war, and Dundee might have to wait for two or three years. A Sub-Committee is considering the matter.

Halifax.—WAGES.—The award of the Committee on Production, after arbitration on the demand of workmen in certain departments—including the electricity department—is for a further advance of 3s. per week to adults, making a total of 12s. above pre-war rates. Youths under 18 years of age are awarded 1s. 6d. a week advance.

Hove.—Owing to inability to obtain apparatus, material, and labour, the T.C. has decided, until further notice, to take no orders for the supply of electricity for radiators, heaters and cookers. Only a limited number of orders for new supplies for lighting will be accepted, and then only where the length of new mains required is very short, and this not to include a road crossing.

Hucknall.—ELECTRICITY SCHEME.—The Sherwood Co. has informed the Council of its willingness to supply the town with electricity, but in view of the fact that the Nottingham Corporation has decided not to proceed with its prov. order this session, it was decided that the Council's scheme should not be proceeded with until after the war. A Sub-Committee was appointed to take the necessary steps.

Kingston-on-Thames.—YEAR'S WORKING.—At the last meeting of the Council, the Lighting Committee reported that it had considered an offer from Edmundson's Electricity Corporation, Ltd., to take over the Corporation electricity works, and recommended that it be not entertained, but that if the company makes

a more satisfactory offer the Corporation will give it careful consideration.

The twenty-third annual report of the borough electrical engineer, Mr. J. E. Edgcombe, for the year ending March 31st last shows a deficit on the year's working of £6,790, as compared with a deficit for the previous year of £629. The principal reason for this deficit is the greatly increased cost of fuel owing to the larger proportion of coal which has been consumed compared to fuel oil, as on account of the fracture of the crankshaft of the two-cycle Diesel engine that plant was out of commission during the whole of the year and the larger portion of the units supplied were generated by steam plant. The comparison of the quantities generated is set out herewith:—

	1915-16.	1916-17.
Units generated by coal ...	181,987	757,980
Units generated by fuel oil ...	974,220	492,605
Total ...	1,156,207	1,250,585

The 757,980 units generated by steam cost in fuel £8,265, equal to 2'617d. per unit, while the 492,605 units generated by the four-cycle horizontal Diesel plant cost in fuel £865, equal to 0'421d. (or less than ½d.) per unit. The cost per unit generated increased from 3'622d. in 1915-16 to 4'618d. in 1916-17, while the receipts per unit sold declined from 3'491d. in the previous year to 3'311d. in 1916-17. The number of consumers totals 1,953, an increase of 78: the total of lamps, motors, heating, cooking, and other apparatus in terms of 32-watt lamps connected to the mains has increased to 90,312. The amount of capital expenditure outstanding at March 31st last was £66,132: the total capital expenditure on the undertaking has been £130,700. On three occasions only has there been any credit balance (amounting in the aggregate to £1,682), whilst in the other 20 years the deficits have totalled £27,217, showing a net demand on the ratepayers of £25,535. The Council decided that, having regard to the adverse balance appearing in the report and balance-sheet, 1½d. per unit be added to the existing scale for power in lieu of the increase of 20 per cent. on the scale, as from December 1st. — *Surrey Comet*.

Leeds.—PRICE INCREASE.—The Electricity Committee has decided to recommend an increase in the charges for electricity by 10 per cent., to date from April 1st next.

Lincoln.—PRICE INCREASE.—The T.C. has increased the price of current to consumers, other than those for power under agreement, by 10 per cent., as from the reading of the meters for the September quarter accounts; and has asked consumers under agreement to pay 5 per cent. increase.

London.—POPULAR.—The Finance Committee reports the sanction of the L.C.C. to the borrowing of £27,825 for a new turbo-alternator and accessories, and that the County Council is prepared to advance the amount at 5½ per cent. interest.

The Electricity Committee reports a deficiency on the working of the electricity undertaking for the June quarter of £1,106, as against a surplus of £1,715 in the corresponding period of last year.

Owing to the advance in the price of coal, the Committee recommends a further advance of 15 per cent. on pre-war charges for power and public lighting from November 30th next, and 10 per cent. advance on private and domestic supplies from January 1st next. The electrical engineer recommends the provision of two additional 1,000-KW. converters for sub-stations.

The Committee has considered the resolution of the Wages Conference of local authorities owning electricity undertakings in Greater London, and recommends the adoption of the award of 15s. increase upon the pre-war wage to all employés affected by the awards of the Committee on Production, and to the technical staff, to date from September 1st, such 15s. to be inclusive of any increase granted since August, 1914, as war bonus or war wages.

The Hammersmith and Battersea B.C.s have also adopted the above award.

HAMMERSMITH.—Owing to the demands for electricity in the northern part of the borough, and especially at the White City, negotiations have been entered into with the Kensington and Notting Hill Co. for a supply of three-phase E.H.T. current, which the company is prepared to furnish at the rate of 9d. per unit. The total capital cost, including transformers, will be about £1,500.

The Electricity Committee recommends the appointment of an additional engineer-in-charge at the generating station, with the object of improving the supervision to be exercised over the repairing staff.

The Committee reports that the B. of T. award in the matter of the linking-up scheme between Fulham, Hammersmith, and Battersea is as follows:—

The cost already incurred by the Battersea and Fulham Councils to be borne in equal proportions by all three Councils.

The cost of the main or mains required to be laid between the generating stations of the Fulham Council and the Hammersmith Council to be borne:—

1. As to the amount that the said main or mains would have cost had the agreement which was negotiated in 1915 been completed and the said main or mains had been laid in pursuance therefrom by the Battersea Council, the Fulham Council, and the Hammersmith Council respectively in equal proportions; and

2. As to any excess over that amount, in the following proportions—that is to say by the Battersea Council one quarter, by the Fulham Council one quarter, and by the Hammersmith Council one half.

The award of the B. of T. settles the question of the proportions

in which the cost of laying the connecting main throughout the whole length from Battersea to Hammersmith shall be borne. This point having been settled, the Committee has authorised the town clerk to communicate with the Battersea and Fulham Councils with the object of completing the negotiations.

The Finance Committee recommends that application be made to the L.C.C. for sanction to the borrowing of £3,000 for transformers, &c.

WOOLWICH.—The B.C. has, owing to the continued increase in the price of coal and the abnormal rise in working costs, increased the charges for energy by 1½d. per unit net for lighting other than for factory use, by ½d. per unit for power users under £200 a year, and ¾d. for power users beyond that value; the increases are not to apply to consumers with a coal clause in their contracts.

Londonderry.—The Corporation has decided to seek Parliamentary powers for the development of the electricity undertaking.

Lynn.—PRICE INCREASE.—The Electricity Committee recommends that the charges for lighting be increased by ½d. per unit, and for power and heating by 7½ per cent.

Meltham.—PROPOSED PROVISIONAL ORDER.—The U.D.C. has received offers from the Huddersfield Corporation and the Yorkshire Electric Power Co. to supply electricity in the area of the township. The terms of the Corporation are 10 per cent. above the rates in the borough, but the company has not given any definite terms. At an interview between a deputation appointed by the U.D.C. and the Corporation, it was pointed out that though the Corporation was anxious to supply electricity, it did not agree to run electric cars even if electric power was supplied to the Meltham area. At the same time, however, if the Corporation secured the supply of electric power, this would be an inducement to consider favourably the question of running cars to Meltham at some future date. The U.D.C. has approved the report of the deputation, and decided to support the Huddersfield Corporation in taking the necessary steps to obtain a Provisional Order for carrying out the work. Since the Council meeting a communication has been received that the B. of T. cannot allow the application for the Provisional Order to proceed in the ensuing session, owing to the political situation.

New Zealand.—Waihi B.C. has decided to negotiate with the Waihi Gold Mining Co. for a supply of electricity for street lighting from the Horahora power plant.

Licences have been granted to the Hamilton and Patea B.C.s to install electrical systems for lighting and power.

Rotherham.—PROV. ORDER.—The Corporation has given notice of its intention to make application to Parliament in the ensuing session for an Act, among other proposals, to confirm an agreement between the Mexborough and Swinton Tramways Co. and the Corporation for the transfer to the Corporation of the Tramway Co.'s electricity undertakings, authorised by the Rawmarsh Electric Lighting Order, 1898, the Swinton Electric Lighting Order, 1899, and the Mexborough and Swinton Tramways Acts, 1902 and 1905; to empower the Corporation to supply electricity to the Tramway Co. in bulk or otherwise, and to extend the area of the Corporation for the supply of electricity, so as to include (in addition to the borough and the urban districts of Rawmarsh and Swinton) the urban district of Greasborough, the rural district of Rotherham, and the parish of Ecclesfield, in the rural district of Wortley.

St. Helens.—The income of the electricity department for the past year amounted to £40,656, and the expenditure to £41,158, leaving a deficiency of £501.

Southport.—Improvements effected at the Corporation electricity works during the past three years in connection with the fuel plant, have resulted in a reduction of the amount of fuel used by 50 per cent. But for this the price of energy would have been considerably increased.

Stockbridge.—PROV. ORDER.—The U.D.C. proposes to apply to the B. of T. for a provisional order for electricity supply within the urban district.

Stratford-on-Avon.—The Electricity Committee has refused the request of the Electricity Co. for permission to increase the charges for energy, and the Council has confirmed this decision.

Tasmania.—The *Hobart Mercury* says that the State Government intends to create a Water Commission to control the water supplies of the island, concerning which reports are at present being obtained.

Walsall.—The local Chamber of Commerce has passed a resolution expressing concern at the 20 per cent. increase in electricity charges. A member of the Electricity Committee defended the increased charges, which were necessitated by the increased expenses of the undertaking.

W. Yorks.—PROVISIONAL ORDERS.—The Electrical Distribution of Yorkshire, Ltd., is proposing to apply to the B. of T. for Provisional Orders for electricity supply in Luddenden Foot and Mytholmroyd.

TRAMWAY AND RAILWAY NOTES.

Argentina.—**RAILWAY ELECTRIFICATION.**—At the annual meeting, last week, of the Central Argentine Railway, Sir Archibald Williamson, Bart., M.P., stated that they had only about one-third of their suburban electrified undertaking equipped and working; the other two-thirds, when circumstances permitted of their being finished, would cost a small sum as compared with the first section. Although the main-line passenger traffic showed decreases, they had increases in suburban traffic wholly due to that part of the line where electric traction was in use.

Australia.—On the second reading of the Victorian Government's Melbourne and Metropolitan Tramways Authority Bill, Sir Alexander Peacock (the Premier) said that on a date to be fixed the duties of the Melbourne Tramways Board would pass to the new authority under the Bill, and not more than six months later the following would be taken over by the authority: The Prahran and Malvern Tramways Trust, the Hawthorn Tramways Trust, the Melbourne, Brunswick, and Coburg, Fitzroy, Northcote and Preston, South Melbourne, Footscray, and Melbourne and Essendon tramway systems. Power would also be given to lease or acquire the St. Kilda-Brighton and Sandringham and Black Rock street railways. One controlling authority would mean economy, and any extensions would then be carried out in accordance with a general plan.

The tramway area would be divided into 12 districts: each would return one member to the Board, while the chairman and one other member would be nominated by the Governor in Council. The working expenses, interest, &c., would be apportioned to the car-mileages of the various systems. The members of the Board appointed by the Governor in Council would hold office for five years, the other members would be elected for three years.

The authority, with the consent of the Governor in Council, could borrow up to £750,000, exclusive of any principal sums transferred to it from the existing authorities. One of the first duties of the authority would be to prepare a general scheme for the future development of metropolitan tramways. Any new tramway services would be considered in connection with the services provided by the suburban railways. Out of the tramway revenue every year was to be paid a sum to be determined to recoup the loss caused to the railways by any tramways of the authority constructed within five years before the commencement of the Act, or constructed thereafter, and the construction of which was objected to by the Railway Commissioners.

When the Melbourne and Essendon tramway and electrical undertakings were acquired, the authority must have power to operate them. For this and other undertakings the authority would be authorised to purchase, generate, and supply electricity—and to supply it to municipalities to light any roadways along which the authority's tramways ran. Before the erection of new power houses and installation of new electric plant by the authority the approval would be necessary of the Railway Commissioners, or such body as Parliament decided would control metropolitan electric supply. The principal electric supply undertakings were controlled by the Melbourne Electric Supply Co., the City Council, and the North Melbourne Electric Tramway and Lighting Co., Ltd. The tramway authority might acquire a Council's undertaking by agreement, and a private undertaking either by agreement or compulsorily. The capital cost of the undertaking was to be the basis for municipal rating. Capital cost of the works and undertakings would be on the original construction cost, and the rateable capital cost would be the capital cost of so much of the authority's properties as were rateable to municipalities.—*Australian Mining Standard*.

Birmingham.—The number of passengers on the tramways has increased by over half a million per week as compared with this time last year. The increase last week was 859,360. Mr. Harrison Barrow, the chairman of the Corporation Tramway Committee, states that when the war is over the following schemes should engage immediate attention:—Tramway track repairs, provision of single-deck cars with trailers (the experiment has been thoroughly successful), the construction of the lines authorised in the 1914 Act, to show the advantage of the separate track, and the extension of the system for carrying heavy goods.

Blackburn.—**FEMALE DRIVERS.**—The quarterly meeting of the Lancashire and Cheshire Tramways Managers' Association was held at Blackburn on November 16th. Mr. J. H. Cowell, manager of the Corporation tramways, presiding. During the transaction of business several topics were discussed, considerable interest being taken in the question of the suitability of female drivers; Blackburn was one of the pioneers in this matter. The delegates were given a practical demonstration of the efficiency of such drivers by Miss Nellie Sharratt, who drove the delegates over certain routes, during which a call was made at the depot at Intak, which was thoroughly inspected.

Continental.—**ITALY.**—The Società Anonima Idroelettrica dell'Appennino has been formed at Bologna, with an initial capital of 1,000,000 lire, and an eventual capital of 6,000,000 lire, for the utilisation of the water-power of the Apennines for the electrification of railways and tramways. An influential council of administration has been nominated.

India.—**RAILWAY ELECTRIFICATION.**—According to the *G.I.P. Magazine*, for some time past the question of electrifying parts of the G.I.P. system has been under consideration, and

although nothing definite has been decided upon it is highly probable that on the conclusion of the war an electrification scheme will be carried out.

London.—**CENTRAL LONDON RAILWAY.**—The B. of T. has extended by one year the time under the Central London Railway Act, 1913, relating to the construction of certain railways and works.

Musselburgh.—At the local Town Council the condition of the electric tramways came in for criticism, surprise being expressed that the B. of T., to whom the Council had addressed several complaints about accidents on the tramway system, had written that "the responsibility for the proper maintenance of the tramway undertaking rested with the promoters, and that the Board did not carry out any system of periodic inspection of tramways." It was suggested that Edinburgh T.C. might be approached, to consider taking over system, but no motion was made.

Tramway Workers and Christmas Holiday.—Members of the Amalgamated Association of Tramway and Vehicle Workers are agitating for a general holiday on Christmas Day. It is stated that a request has been sent to all the tramway concerns in the country asking for this concession. Some Tramway Committees are in favour of granting the request, but a good many are against, amongst the latter being Manchester and Salford. The employees, however, are going forward with the movement.

Wharfedale.—**RAILLESS TRACTION.**—The Otley T.D.C. is in negotiation with the Councils of Guiseley and Menston with a view to sending a joint deputation to Mr. J. B. Hamilton, the Leeds tramway manager, to try to secure a better service of the railless cars in Wharfedale and the erection of shelters at the exposed country termini.

TELEGRAPH AND TELEPHONE NOTES.

Brazil.—The Government has opened a credit of 1,000,000 milreis to complete the work of establishing new radio-telegraphic stations and increasing the telegraphic lines for the Army and Navy.

Unknown persons have attempted to set fire to the radio-telegraphic station connecting Monte Babilonia with Rio de Janeiro.—*Financier*.

United States.—The War Income-Tax Bill, which took effect on November 1st, places a tax of 5 cents upon each telegraph, telephone, or wireless message or conversation which originates within the United States, and for the transmission of which a charge of 15 cents or more is imposed.—*T. and T. Age*.

CONTRACTS OPEN AND CLOSED

OPEN.

Australia.—**PERTH.**—December 5th and 12th. Postmaster General's Department. Telegraph and telephone instruments and parts, battery material and telephone switchboards, parts, &c. See "Official Notices," November 16th.

ADELAIDE.—December 12th. P.M.G.'s Department. Telephone material. Schedules 478 to 482. See "Official Notices" to-day.

Carlisle.—December 11th. Electricity Department. One 1500/2000 KW. turbo-alternator and one surface condensing plant. See "Official Notices," November 16th.

Enniskillen.—December 1st. Sligo, Leitrim & Northern Counties Railway Co. Telegraph material for 12 months. Mr. J. Duff, Secretary, Enniskillen.

France.—**LYONS.**—Tenders are invited for the supply of two batteries of accumulators of 12 elements each (capacity 1,080 ampere-hours), and of sundry machines (motors, dynamos, switchboards, &c.) for the central telephone exchange at Lyons. Particulars from the Direction des Postes et Télégraphes du Rhône, 33, bis, Rue Vauveconr, Lyons.

Grimsby.—November 30th. Electricity Department. Twelve months' supply of coal. Deputy Electrical Engineer.

Manchester.—December 12th. Three fan draught cooling towers at the Stuart Street station, for the Electricity Committee. See "Official Notices," November 16th.

Rathmines.—November 28th. U.D.C. 500 tons of coal for the electricity works. Electricity Engineer.

CLOSED.

Bury St. Edmunds.—T.C. 100 tons of 2-in. Mapperley slack coal, for the electricity works; Carr Bros. & Co., 25s. per ton.

Government Contracts.—List of new contracts placed October, 1917:—

WAR OFFICE.

Dynamos, switchboards, &c.—Lancashire Dynamo Co., Ltd.
Generating sets and spares.—Austin Motor Co. (1914), Ltd.; Coventry Simplex Engines, Ltd.; Electric Construction Co., Ltd.; R. A. Lister and Co., Ltd.; Phoenix Dynamo Manufacturing Co.
Insulators (field).—Bullers, Ltd.; F. W. Cotterill, Ltd.
Petrol-electric vehicles.—Stevens Petrol-Electric Vehicles, Ltd.
Motors.—E. Brook, Ltd.; Crypto Electrical Co.; Macdonald, Syer & Co., Ltd.; F. Parkinson & Co.
Works services "electrical."—Parsons Motor Co.

INDIA OFFICE STORE DEPARTMENT.

Accumulator plates.—Chloride Electrical Storage Co.
Bells.—Peel-Comer Telephone Works, Ltd.
Cells.—General Electric Co., Ltd.
Fittings for telephone parts.—Siemens Bros. & Co.
Wire.—R. Johnson & Nephew; Johnson, Matthey & Co.

H.M. OFFICE OF WORKS.

Engineering services.—Barry Dock Grain Stores electric generating plant; Crompton & Co., Ltd.
Cardiff Grain Stores electric supply.—Harland Engineering Co.
Avenmouth, Barry, Cardiff, and Newport conveyor weighing plant.—Spencer & Co.
Grain Stores generally, flexible cables.—B.I. & Helsby Cables, Ltd.
Ordnance Survey Office Overseas.—Electrical motors and starters; Crompton & Co., Ltd.
Swansea King's Dock.—Electric light and power wiring; Lund Bros. & Co.
Key switch holders.—General Electric Co., Ltd.

POST OFFICE.

Protective apparatus.—L. M. Ericsson Manufacturing Co., Ltd.
Telegraph apparatus. Automatic Telegraph Manufacturing Co., Ltd.; India-Rubber, Gutta-Percha, and Telegraph Works Co., Ltd.
Telephone apparatus.—British L. M. Ericsson Manufacturing Co., Ltd.; Peel-Comer Telephone Works, Ltd.; Western Electric Co., Ltd.
Insulator covers and bodies.—Bullers, Ltd.
Submarine cable.—Siemens Bros. & Co., Ltd.; Telegraph Construction and Maintenance Co., Ltd.
Telegraph cable.—B.I. & Helsby Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; Connolly Bros., Ltd.; W. T. Glover & Co., Ltd.; Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Union Cable Co., Ltd.
Telephone cords.—London Electric Wire Co. & Smiths, Ltd.; Western Electric Co., Ltd.
Telephone plugs.—Automatic Telephone Manufacturing Co., Ltd.; British L. M. Ericsson Manufacturing Co., Ltd.; Western Electric Co., Ltd.
Telegraph poles.—Bullers, Ltd.
Insulator spindles.—Bayliss, Jones & Bayliss, Ltd.
Telephone terminals.—D. Gibson & Co., Ltd.
Bronze wire.—T. Bolton & Sons, Ltd.; B.I. & Helsby Cables, Ltd.; F. Smith & Co., incorporated with the London Electric Wire Co. & Smiths, Ltd.
Galvanised iron wire.—R. Johnson & Co., Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co., Wire Manufacturers, Ltd.; Whitecross Co., Ltd.

Sunderland.—T.C. Tenders accepted:—

Dewhurst Engineering Co., Sheffield.—Steel tubes.
Minton & Hollins, Ltd., Stoke-on-Trent.—Tiles.
B.I. and Helsby Cables, Ltd.—E.H.T. box compound.

FORTHCOMING EVENTS.

Institution of Electrical Engineers (Student's Section).—Friday, November 23rd. At 7 p.m. At the City and Guilds (Engin.) College, Exhibition Road, Kensington, S.W. Opening meeting. Address by Sir Oliver Lodge, F.R.S., on "Astronomical Applications of the Electrical Theory of Matter."

Manchester Local Section.—Tuesday, November 27th. At the Engineers' Club. At 7 p.m. Paper on "Gas Firing Boilers," by Mr. T. M. Hunter.

Junior Institution of Engineers.—Friday, November 23rd. At 39, Victoria Street, S.W. At 8 p.m. Paper on "Housekeeping in Workshops," by Mr. D. W. Woods.

Physical Society of London.—Friday, November 23rd. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Ordinary Meeting.

Royal Society of Arts.—Wednesday, November 28th. At 4.30 p.m. At John Street, Adelphi, W.C.2. Paper on "Aerial Transport after the War," by Mr. G. Holt Thomas.

Greenock Electrical Society.—Thursday, November 29th. At 7.45 p.m. At 24, West Stewart Street. Open night for discussion.

Institution of Municipal and County Engineers.—Friday, November 30th. At 5 p.m. At Burlington House, Piccadilly, W. Discussion on the "Supply of Power or Fuel to Vehicles on Public Highways."

Institution of Mechanical Engineers.—Friday, November 30th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. The Thomas Hawksley "Lecture on Heat Engines," by Capt. H. Riall Sankey, C.B., R.E.

Salford Technical and Engineering Association.—Saturday, December 1st. Visit Manchester Corporation Hydraulic Pumping Station. At 7 p.m. At the Royal Institute. Annual Meeting.

NOTES.

The Red Book.—In consequence of the increased cost of production and other difficulties due to the war, the proprietors of this Electrical Directory do not propose to issue the usual annual edition, at least until more normal conditions obtain.

Whist Drive.—The annual whist drive and dance arranged by the employees of the Blackpool Corporation electricity and tramways department took place on November 15th, and proved very successful. Between 2,000 and 3,000 people were present.

Belfast Electrical Employees' Award.—The following award in respect of the difference between the Belfast Corporation and the Electrical Trades Union with regard to certain men formerly in the employment of the Corporation has been issued:—

- The Committee on Production, to which the matter was referred, finds:—
1. That the transfer of the work of overhead tramway line maintenance from the electricity department of the Corporation was part of a *bona fide* scheme of reorganisation which the Corporation were entitled to carry out.
 2. That the employment by the Corporation of skilled electricians to do the work of overhead line maintenance during the period whilst that work was in charge of the electricity department did not debar the Corporation from adopting, and that they were entitled to adopt, after the transfer to the tramways department, the practice followed by many tramway authorities in different parts of the country of employing linesmen or handy men to do the work of overhead line maintenance.
 3. That the dismissal of the seven men concerned in this reference along with other men who were discharged at the same time was carried out in consequence of the improved organisation adopted, and was not carried out merely with a view to reduce the wages of the seven men concerned.
 4. That the contract of service of the seven men concerned was duly terminated on August 23rd, 1917, after adequate notice, and the men were not illegally dismissed.
 5. That the claim for reinstatement of the seven men concerned has not been established.
 6. That in consequence of the pending dispute as to the respective rights of the Corporation and the men concerned, the men had some reasonable ground for claiming that termination of their conduct of service should be suspended until the difference were settled by arbitration, and the Committee think that on this ground the Corporation should pay, and they award that they do pay, wages at the rates in operation on August 23rd, to the seven men concerned up to the date of this award.

Legal.—**BOSCH MAGNETO CO., LTD.**—The Board of Trade petitioned, in the Chancery Division, on Tuesday, before Mr. Justice Younger, for the winding up of the Bosch Magneto Co., Ltd., under the Trading with the Enemy (Amendment) Act, 1916.

Mr. Austin Cartmell, who supported the petition, said this was as German a company as they well could have. At the outbreak of the war over 49,900 of the shares were held by Germans and 50 by one gentleman in London. This was essentially a German-owned company, and it was formed for the purpose of carrying on a German business. Messrs. Bosch & Klein and the English gentleman to whom he had referred were the only directors. After the outbreak of war the German directors transferred certain large powers to the English gentleman. The company had now been ordered by the Board of Trade to be wound up. The funds now in the hands of the Controller amounted to nearly £200,000. There were certain questions affecting the London Corporation which could only be dealt with in the winding up of the company.

Mr. Galbraith said the London Corporation claimed to be creditors for a very considerable amount, and they desired that the winding up should take place at an early date.

His Lordship made the order.

Foreign Trade.—**OCTOBER FIGURES.**—The official returns of imports and exports during last month contain the following electrical and machinery figures:—

	October, 1917.	Inc. or dec.	10 months, 1917. Inc. or dec.
IMPORTS.			
Electrical goods ...	111,272	- 24,294	- 214,249
Machinery ...	914,756	+ 363,117	+ 299,804
EXPORTS.			
Electrical goods ...	216,687	- 118,101	- 1,003,983
Machinery ...	1,441,594	- 379,335	+ 17,321

Parliamentary.—The following applications for Parliamentary powers appeared in the *London Gazette* for November 20th:—

Leicester Corporation.—Electric lighting prov. order covering various powers.
Crompton U.D.C.—Electric lighting prov. order, bulk supply from Oldham Corporation.

Royton U.D.C.—Electric lighting prov. order, bulk supply from Oldham Corporation.

Greasborough (near Rotherham) U.D.C.—Electric lighting prov. order, powers to take bulk supply.

Braintree.—Crittall Manufacturing Co., Ltd.—Electric supply prov. order for urban district, bulk or otherwise.

I.E.E. Discussion on the Metric System.—As the subject of the metric system was fully discussed at the Institution of Civil Engineers in the early part of the year, more especially from the standpoint of the relative merits of that system and the British, we are informed that the main object of the I.E.E. discussion, which is to take place on Thursday, December 13th, is to consider the effect on the British electrical trade of the introduction of the metric system at the present time, more especially in those markets in which the British system is at present in vogue, with a view to determining whether the compulsory introduction of metrical measures should be pressed for or resisted. It is hoped that it may be found possible to take steps after the discussion to obtain some authoritative pronouncement on the matter from the trade as a whole that will put an end to the present hesitating and unsatisfactory attitude towards the question.

The L.C.C. Education Committee has revoked its recommendation in favour of the compulsory introduction of the metric system.

Control of Tramway Labour, &c.—In connection with the B. of T. Committee on Tramway Labour and Materials, the Executive Council of the M.T. Association has nominated Messrs. A. R. Fearnley, J. B. Hamilton, and J. M. McElroy to serve on that Committee; Mr. A. L. C. Fell will represent the L.C.C. tramways, and two members will be nominated by the T. and L.R. Association to represent, principally, company undertakings, while the chairman, Mr. Jas. Devonshire, has been nominated by the Board of Trade.

Inquiry.—Makers of the "Acme" engine governor are asked for.

Institution and Lecture Notes.—Physical Society of London.—At the meeting held on October 26th a paper on "The Radius of the Electron and the Nuclear Structure of Atoms" was read by Prof. J. W. Nicholson. The electron is usually regarded as a globule of electricity with a definite radius. This conception has proved valuable, but involves difficulties in connection with the nuclear structure of complex atoms. On the view that the electron consists of a region of strain in the aether, such line constants should have some significance throughout the whole aether; which may, in fact, be in some manner cellular with these linear magnitudes involved in the specification of the cells, and therefore in any strained structure composed of them. The electron would be regarded as a state of strain which for practical purposes is concentrated at its centre, rapidly diminishing outwards according to some very convergent law involving some line constant in its specification. By way of illustration the idea is worked out mathematically on the assumption that the strain varies as $e^{-\lambda r}$, on which hypothesis λ^{-1} is the "radius." It can be shown that the Lorentz formula for mass as a function of velocity can be obtained for this type of electron. The charge on the electron is regarded as a fundamental property of the aether, and is related to Planck's constant h .

Dr. H. S. Allen said there could be little doubt of the existence of a relation referred to by Prof. Nicholson between Planck's constant h and the charge of an electron e . Taking Millikan's latest value for e (4.774×10^{-10}), $h = 6.558 \times 10^{-27}$. All the principal radiation constants could be expressed in terms of e . On the lines suggested in Prof. Nicholson's paper it would seem as if most, if not all, of the important constants of nature might be referred to some fundamental property of the aether.

Sir Oliver Lodge wrote that he was much interested in Prof. Nicholson's ingenious plan for doing away with the definite boundary of an electron, and devising a mathematical scheme which should enable them to regard it as a point-centre of strain decreasing exponentially in every direction without limit, so that the linear dimension associated with it should be like many time-constants—the distance at which the density was reduced to $1/e$ th of what it was at the centre. This plan, if it could be developed properly, seemed to get over many of the difficulties about the coherence of parts of a charge, and about the extraordinary properties of a nucleus, which though, from some points of view, an extremely small and highly-charged unit, yet necessarily had a complexity which enabled it to be disintegrated and fired off in fragments. Prof. Nicholson's suggestions seemed to him helpful and valuable.

Association of Mining Electrical Engineers.—On October 13th, the president of the West of Scotland Branch, Mr. H. A. McGuffie, delivered his address, and on November 10th the works of the North British Welding Co. at Finnieston were visited, a demonstration of electric welding being given. The other arrangements for the session are as follows:—

- December 15th.—Visit to the works of Mavor & Coulson. Social evening.
- January 12th, 1918.—"Cable Complaints," by J. H. C. Brooking.
- February 16th.—"Steam Turbines as Applied to Colliery Work," by P. J. Pliven.
- March 9th.—"Conservation of Exhaust Steam and its Utilisation," by J. Watson.
- April 6th.—Inspection of mechanical and electrical models at the Art Galleries, Kelvingrove.
- May 6th.—"Organisation of Electrical Repairs," by J. McCann.

Members of the North of England Branch, on November 3rd, visited Washington Colliery, County Durham, and inspected the electrical equipment at the "F" and Glebe Pits. There is an extensive electrical installation at these pits, which was commenced in 1907 by the fixing of a Sirocco fan. Current from the County of Durham Electrical Power Distribution Co. is received at the pit yard at 6,000 volts, and reduced to 600 volts by two 500-K.V.A. transformers. The fan above mentioned is belt-driven by a motor of 150 H.P., and, running at 164 R.P.M., supplies 120,000 cb. ft. of air at $2\frac{1}{2}$ in. W.G. This displaced a 36-ft. Guibal fan, steam driven, and the successful result of the conversion led to the elimination of a good deal of steam plant at the "F" Pit. Underground at the "F" Pit there are four main and tail haulage sets converted from steam drive; the change-over from steam to electricity caused so little trouble that not one ton less coal was drawn during the whole operation. Other plant is:—Air compressor, 900 cb. ft. capacity, motor 150 H.P.; air compressor, 300 cb. ft., 60 H.P.; main and tail haulage set, 25 H.P.; endless rope set, 27 H.P.; endless rope set, 10 H.P.; "creeper," 5 H.P.; pump, 110 H.P. At the Glebe Pit there is on the surface an air compressor of 2,000 cb. ft. capacity, driven by a 350-H.P. motor. Underground there are two main and tail haulage sets, driven respectively by 75 and 80-H.P. motors, an air compressor, and a three-throw pump, 110 H.P.

Institution of Mechanical Engineers.—At the meeting, last Friday, Mr. A. W. PURCHAS read a paper on "Air-lift Pumping," in the course of which he endeavoured to supply a satisfactory theory of the working of this type of pump, to show how the efficiency could be improved, and to point out the data that should be recorded in testing such pumps in order to provide the information necessary to the correct interpretation of the results.

The paper included details of the equipment and methods employed in making a number of tests, and laid stress on the liability to serious errors incurred if the volume of air was calculated from piston displacement—errors of 10 to 60 per cent. The greatest loss, he said, was in the air-compressor; the next greatest was the loss of head at entry to the suction pipe. A pump efficiency of 70 per cent. should be attainable on all lifts up to 300 ft.

Institution of Electrical Engineers.—The opening meeting of the MANCHESTER LOCAL SECTION was held on the 13th inst., when the chairman (Mr. C. J. Beaver) delivered his inaugural address. He dealt with the effects of the war on the world's in-

dustry in general and on industrial progress in this country in particular and, after reviewing the trend of opinion amongst various classes, he detailed a series of reforms which appeared to be necessary, and indicated the important part that should be played by the Institution in connection with their realisation.

On November 11th, Mr. S. T. Allen, chairman of the BIRMINGHAM LOCAL SECTION, delivered his inaugural address, dealing mainly with the future course of the manufacturing industry in this country and the part that might be played by the Institution in connection therewith. In particular, he referred to the remarkable developments in electrometallurgy and in the use of the electric furnace which had taken place in the Midlands, and emphasised the necessity for a cheap supply of electrical energy to enable the new industries to compete with foreign countries after the war. The waste at present incurred through the transport of fuel and the removal of incombustible materials, and other sources of loss, were mentioned, and the chairman concluded by pointing out the necessity of utilising the inventive capacity of everyone interested in the electrical industry.

Royal Institution of Great Britain.—Prof. J. A. Fleming, D.Sc., F.R.S., will deliver a Christmas course of six illustrated lectures (adapted to a juvenile auditory) on "Our Useful Servants: Magnetism and Electricity":—

- Thursday, December 27th, at 3 o'clock.—"Magnets and the Magnetic Compass."
- Saturday, December 29th.—"Electricity and Electric Currents."
- Tuesday, January 1st, 1918.—"The Electric Current as a Heater and Chemist."
- Thursday, January 3rd.—"Electricity as an Illuminator and Doctor."
- Saturday, January 5th.—"Electric Dynamos, Motors, Transformers, and Railways."
- Tuesday, January 8th.—"Telegraphs and Telephones."

Royal Society of Arts.—Delivering the opening address on Wednesday, Mr. A. A. Campbell Swinton (Chairman of the Council) dealt with "Science and its Functions." He pointed out the danger that the working out of industrial processes and inventions, involving the risk of vast sums of money, might be checked through the fashion of regarding the making of large profits as a crime. He also urged the necessity of having science as a compulsory part of the curriculum of training for the Civil Service, so as to get the Departments filled by men who realised how science lay at the root of all material progress.—*Morning Post*.

Liverpool Engineering Society.—The opening meeting of the session was held on November 7th, when Mr. H. Dickinson delivered his presidential address. On Wednesday last, Mr. J. B. C. Kershaw read a paper on "The Conservation of Our Fuel Reserves by the Use of Low-Grade Fuels for Power Generation." On December 5th Mr. E. Jones will read one on "High Efficiency Air Pumps for High Vacua."

Birmingham Electric Club.—Mr. Howard Foulds, secretary of the City Electric Supply Department, read a paper, on Saturday last, before the Birmingham Electric Club, on the subject of "Publicity." Notwithstanding the pressure of Government work, he insisted that it was necessary to be prepared for the time when conditions became normal. Then a publicity campaign might be undertaken individually or collectively. Sound publicity could be obtained by careful and wise expenditure in the ordinary course of business. Persistency was one of the fundamentals of success.

Chadwick Public Lectures (Leicester).—On November 17th the first of a series of three Chadwick Lectures on "Electricity and National Welfare" was given at the Museum, Leicester, by Prof. H. T. Davidge, of the Ordnance College, Woolwich. The lecture dealt with "Electricity and the Improvement of Town Atmospheres." Mr. Davidge stated that the special aim of the lectures was to urge the pressing necessity for applying the latest developments of electrical science as an aid to:—

- (a) Making the best of our homes.
- (b) Making the best use of our soil.
- (c) Making the best of our bodies.

Recognising that a large part of mankind tends to congregate into towns, the drawbacks of town atmosphere were pointed out, and the use of electricity was described, when used as a palliative, in removing smoke and fumes after formation. The wider problem of smoke and fume prevention was then discussed, and after sketching the delights of a district completely supplied electrically with heat, light and power, the lecturer showed that the need was urgent for a system of power stations on a large scale, using very efficient, and, therefore, large generators, the cheapest fuel, the highest possible load factor, high voltage to obtain efficient distribution, and interlinking between the stations to economise in spare machinery. Broad-minded and highly instructed legislation was indicated as a necessity.

The second lecture of this series, on "Electricity and Increased Food Production," will be given to-morrow at 7.30 p.m.

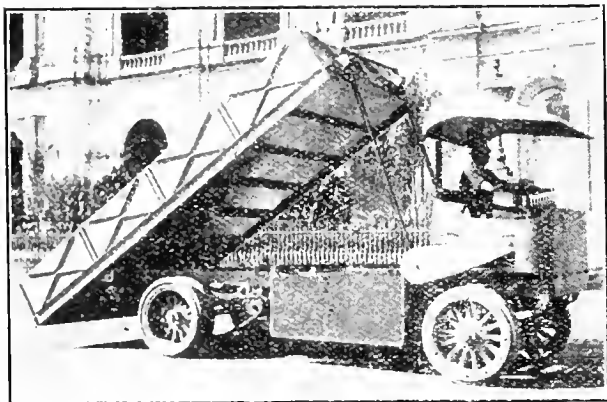
Australian Copper.—Reuter's Melbourne correspondent says that the Australian Copper Producers' Association has been formed entirely to control the shipping and selling of copper on a co-operative basis. Before the war copper was sold almost entirely through the German metal ring.

National Reconstruction.—The Education Committee of the British Science Guild, on the 5th inst., passed a resolution to the effect that national reconstruction, in order to be efficient, urgently demanded as a primary condition that the Education Bill introduced on August 10th should be proceeded with in the House without delay, and should be passed into law during the present session. The Executive Committee of the Guild, last week, approved the resolution, copies of which were sent to the Prime Minister and to Mr. Fisher.

Electric Vehicle Notes. The Detroit Taxicab and Transfer Co. (U.S.A.), which operate nearly a hundred electric taxis, has decided to obtain women to operate them between the hours of 7 a.m. and 6 p.m.; over 500 women have applied for positions. Chicago and St. Louis also have growing fleets of electric taxicabs.

The Wellington (New Zealand) Harbour Board has carried out a series of tests with a 1,000-lb. battery truck of the warehouse type. This is equipped with Edison batteries capable of running the truck for a full working day, and is the first "electric" of this type seen in New Zealand. *Board of Trade Journal.*

The City Electric Light Co., Ltd., Brisbane, Australia, has put into service a 5-ton electric self-tipping lorry for the purpose of carting coal from the Roma Street Railway coal shutes to the

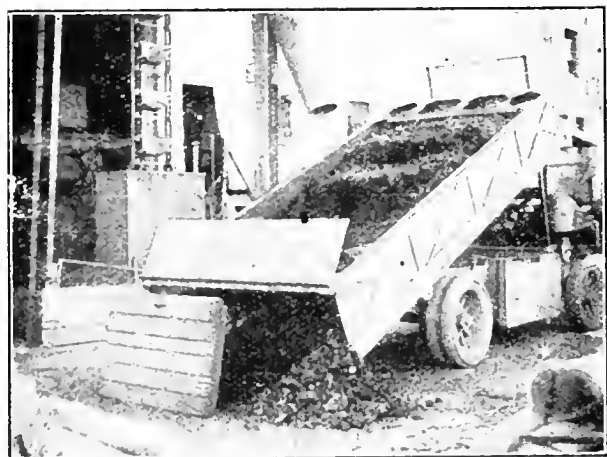


ELECTRIC COAL TRUCK AT BRISBANE, AUSTRALIA.

power station in William Street, a distance of, approximately, 1½ miles. The following particulars were supplied by Mr. John D. Just, the manager of the company:

The lorry, which weighs approximately 10 tons when loaded, is operated from a 44-cell Chloride ironclad Exide battery, and has a range, when loaded, of 45 miles on one charge, with a speed of 7 miles per hour. The body of the lorry can be elevated to an angle of 45°, and is, therefore, self-emptying, whilst it is filled by gravity at the coal shutes. The elevating of the lorry body is done by a 3-h.p. electric motor driving through gearing two vertical screws; this operation takes less than one minute.

The chassis was supplied by the G.V. Co. (U.S.A.) through its Australian agents, but the body and elevating gear were designed



ELECTRIC TRUCK TIPPING COAL AT POWER STATION.

and built in Brisbane. The lorry and its driver are now handling 50 tons of coal daily, and have replaced eight tip drays; the average consumption of electricity by this lorry, taken over one month, was 243 units per route-mile. The electrically-operated lorry has a great future before it, and the large capacity motor lorry can more than hold its own against the antiquated horse drays.

In this connection, it is interesting to notice that, in his recent annual report Mr. A. C. Cramb, the Croydon borough electrical engineer, mentions that a 1-ton electric lorry has been in commission from the beginning of the year, and during the first six months handled 3,110 tons of coal at a cost for wages and electricity of £107, or taking a vehicle life of eight years, and setting aside £78 for depreciation and £46 for repair fund a total cost of £231, which shows a saving of £46 on contract haulage for the six months. The battery is guaranteed for eight years, and although £46 has been credited to repairs the actual cost has been nominal. During the last three months a bonus system was in use, and 2,215 tons were carted a 12½ per cent. weekly increase. The cost was £132 against £203 by horse haulage, showing a saving at the rate of £250 per annum.

Volunteer Notes.—COUNTY OF LONDON VOLUNTEER ENGINEERS (FIELD COMPANIES).—Headquarters, Balderton Street, Oxford Street, W. 1.

Orders for the week, by Lieut.-Colonel C.B. Clay, V.D., commanding:—

Officer for the Week.—Lieut. W. J. A. Watkins.

Next for Duty.—Second Lieut. H. G. Golding.

Drills.—Week ending Saturday, December 1st, 1917:—

Monday.—No. 3 Company, Left Half. Recruits, signalling, 6.30.

Tuesday.—Physical drill and bayonet exercise, 7.30.

Wednesday.—No. 1 Company, 6.30.

Thursday.—No. 2 Company, 6; signalling, ambulance, 6.30.

Friday.—No. 3 Company, Right Half. Recruits, 6.30.

Saturday.—Commandant's Parade, 2.45, at Headquarters. Uniform. For route march and drill. Compulsory for A, B, and C men, unless special leave is obtained.

Musketry.—Belvedere Road, Tuesday, Wednesday, and Thursday, 5.30 to 7. Note.—The Medical Officer will attend for examination of recruits, &c., on Thursday, at 6.

Unless otherwise indicated, all drills will take place at Headquarters.

(By order) MACLEOD YEARSLEY, Capt. and Adjutant.

Electrical Ship Propulsion.—The new U.S. battleship *New Mexico*, now being built at the New York Navy Yard, the first warship in the world to be electrically driven, is approaching completion. An official statement was prepared not long ago in Washington, which gave some of the advantages of the electric drive on the larger ships, and was published in the *Electrical World*; this was the statement:—

"Electrical propulsion virtually gives duplicate means of propulsion. With two turbines and two motors, one or either of them could break down and still leave a means of propulsion; this is, of course, true in the case of direct-connected machinery, but in the case of the electric drive, if it is a turbine that is broken down, the propulsion would still be twin-screw. The two turbines would be so designed that either would be capable of giving about 17 or 18 knots, and the normal method of running would be with one turbine and two motors. This makes it possible to overhaul the other turbine, whether it is at sea or not. The turbines are always operated under fairly good load conditions, and, hence, always give good economy. Since only one turbine is used at the lower speeds, the load on it will always be twice as much as for direct-connected machinery. The turbines are always operated under fairly good speed conditions, and this ensures good economy of the turbines. This is due to the fact that the speed reduction ratio is variable. This is accomplished by winding the stators of the motors for two different numbers of poles, either of which can be put into operation by simply throwing a switch. For example, if the generator has two poles, and the motors are arranged to have either 30 poles or 50 poles, the reduction in the first case would be 15 to 1, and in the second case 35 to 1. This combination of good load conditions and high speed is really the vital point, so far as economy at cruising speeds on a battleship is concerned; and it is an advantage that any other form of propulsion will find it difficult to overcome. The governor absolutely eliminates all racing in a seaway, with the attendant strains on shafting and danger of throwing propeller blades. Speed can be maintained with much greater accuracy than with any other form of propulsion. This is of little importance to a merchantman; but it is not necessary to emphasise the importance of this in a battleship to anyone who has been in the Fleet. The space taken up is less than required for other forms of propulsion. The arrangement of the machinery is much more flexible than any other form of propulsion, as the position of turbines and motors is not fixed. The readiness with which repairs can be effected is an argument. Owing to the small size of the turbines, the upkeep will be very materially reduced. The rapidity of operation is much greater than with other forms of propulsion.

Electric propulsion does not require a separate turbine for backing. Electric propulsion has been adopted for seven battleships and five battle cruisers now being built for the U.S. Navy.

Thermo-Electric Effect by Throttling.—In a communication made to the Paris Academy of Sciences Mr. Karl Benediks mentions the following fact contrary to Magnus's law. In a homogeneous metallic circuit, a dissymmetric distribution of temperature gives rise to a thermo-E.M.F. He has sketched out a device which permits of increasing these forces somewhat in order to render them measurable with high-resistance low-sensitivity galvanometers. It was found, for example, that a cross of tungsten wires 0.22 mm. in diameter, heated with a micro-flame 5 mm. in height to a temperature estimated at 900° C., gave an E.M.F. of 19 millivolts, or about double that given by a platinum-rhodium thermo-couple (10 per cent.) for a temperature of 1,000° C. at the hot junction. Similarly by the contact of angular fragments of a ferro-silicon (50 per cent. silicon), considerable deviations took place—an important point for the theory of contact rectifiers used in wireless telegraphy.

In a later communication Mr. Benediks further dealt with this new thermo-electric effect, which may be considered as a reversal of the Thomson effect. He showed its extension to the liquid metals, like mercury, in which its sign conforms to that which is shown by theory. The direction of deviation changes with the sign of the magnetic field, in accordance with theory.

Appointments Vacant.—Sub-station attendant (49s.), for the Borough of West Hartlepool Electricity Department; mains assistant, for the Dover Corporation Electricity Works; senior and junior shift engineers, for Rotherham Corporation Electricity Department; shift engineers (50s. +), for the Borough of Oldham Electricity Department; switchboard attendant (35s. +) for the Bolton Corporation Electricity Department; switchboard attendant for the Gravesend Corporation Electricity Works; mains superintendent (63s. +) for the Bedford Corporation Electricity Department; switchboard attendant (48s.) for the Battersea B.C. Electricity Works. See advertisement pages to-day.

Lamp with Renewable Filament.—An incandescent lamp which can be readily re-charged with gas and fitted with a new filament is disclosed in U.S. Patent No. 1,232,741, issued to A. J. West, of Winnipeg, Manitoba. In this lamp, which is of the gas-filled type, there is no need for a vacuum, as it is only necessary to retain the gas in the globe under its own pressure. Accordingly, the lamp is so made that the globe can be removed to permit the renewal of the filament, and when the globe is attached to the head the joint is tight enough to retain the gas admitted. Further, in the head is provided an easy means for re-filling the lamp with gas, and retaining the gas. Upon the filament being rendered useless, the globe can readily be unscrewed from the head, and the filament withdrawn through the neck of the globe. After a new filament has been substituted, the globe can be replaced. At this time, however, it is necessary to re-charge the globe with gas. This is done by removing a screw plug and re-charging the globe with gas through a provided opening. Upon the globe being filled with the gas, it is screwed tightly in and the plug is inserted.—*Electrical World.*

Educational.—**MIDDLESEX.**—The Education Committee has approved a scheme for the extension of day continuation classes in Edmonton and Tottenham for boys engaged in large engineering works. The classes will be held at Edmonton Technical Institute and the Tottenham Polytechnic. The manufacturers concerned are willing to liberate the boys for six hours a week during working hours, but suggested one evening session, to make a total of eight hours a week, for the session ending in May.

SPAIN.—An Institute of Electrical Industries has been established in Barcelona to impart instruction in the various branches of the electrical industry. The promoters have in view the great development which the electrical industries must take on in the near future.

The Nobel Prizes.—It has been decided by the Swedish Academy of Science not to award the Nobel Prize for physics and chemistry for the years 1916 and 1917. The prize for 1917 will be reserved until next year.—*The Times.*

Fatality.—Last week an employé of the Grove Dyeing Co., at Littleborough, died from the effect of an electric shock, apparently obtained on touching a machine; two other employés who went to his assistance also received shocks.

The Zurich Bank and the Depreciation of Foreign Investments.—As was recently mentioned in this journal, the prominent investment and underwriting company known as the Zurich Bank for Electrical Undertakings has only been able to declare a dividend at the rate of 5 per cent. for the year ended with June 30th, 1917, as compared with 8 per cent. each in 1915-16 and 1914-15, on ordinary share capital of £3,000,000, whereas in each of the two preceding years the rate was 10 per cent. on the same amount of capital, apart from meeting the interest on the loans which, in each of the years cited, were higher than the ordinary capital. Many of the bank's interests are situated in Italy, Germany, France, and other countries, and the depreciation of the currency in these countries under the influence of the war has, naturally, been felt by the bank. On this point the directors state that, owing to the unexpectedly large fall in the currency of all belligerent countries in relation to that of Switzerland, a considerable depreciation has taken place in the bank's credit and investments in foreign currency. The bank has, therefore, taken this into account by entering at the rates of exchange which prevailed on June 30th, 1917, all its current banking credit abroad of which the bank will be able to dispose at some future period. In the case, however, of the considerable amount of long-term advances made to the foreign undertakings closely associated with the bank, as well as the latter's investments in these undertakings, the directors announce that they have concluded agreements with friendly banking syndicates according to which, on a possible realisation of these holdings later on, a fixed rate of exchange has been guaranteed to the bank, which forms the basis upon which these assets have been entered in the books. These rates of exchange, it is stated, are certainly higher than those which prevailed in October of the present year, but they are still considerably below the normal rates founded upon the gold parity. Naturally, the guarantee operation has imposed a certain sacrifice on the bank through the general provision of the necessary equalising fund which is associated with it, but the directors state, on the other hand, that it has permitted the bank so to deal with its foreign assets that the proceeds could be fully placed in the year's accounts.

The Use of Formed Solder.—In manufacturing articles having many soldered joints difficult to reach, it is good practice to furnish the solder punched or formed to fit the seam, as the time, labour and solder saved are important considerations; moreover, the formed solder is more likely to reach every part of the seam and ensure a tight joint. An important manufacturer of automobiles makes use of a solder link stamped from a thin sheet of solder, in making radiators of the tubular type. The radiator element is built up of vertical rows of tubes pressed through thin copper plates.

The ends of the tubes must be soldered tightly into the water chambers. The solder links are dropped over the ends of the rows of tubes and are melted with a blow-torch. The solder, being applied all around the tube in link form, runs down the tube to the tube sheet and makes a practically perfect soldered joint on five tubes simultaneously. It is obvious that much time is saved by the use of formed solder links in confined places like this; in fact, it would be practically impossible for the workman to apply solder to all the tubes in a reasonable length of time unless it were furnished him in the stamped shape.—*Machinery.*

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station and Tramway Officials. On November 10th the staffs of the Lincoln electricity and tramways department presented a watch to the chief clerk, Mr. STANLEY SAUNDERS, who, after 20 years' service, is resigning to take up the position of senior clerk in the Salford Corporation electricity department. Mr. Stanley Clegg, the city electrical engineer, made the presentation.

Burton T.C. has accepted the resignation of Mr. JAMES J. CAMERON, chief assistant engineer at the electricity works.

Wimbledon T.C. has increased the salary of the borough electrical engineer from £500 to £600 a year.

Mr. PHILLIPS, electrical engineer to the Bedford T.C., has joined the R.F.C., at the request of the Military authorities.

Mr. J. B. HAMILTON, general manager of the Leeds Corporation tramways, who has for some months been Director of Trades Regulation under the Admiralty, has been invited by the Board of Trade to join the new Control Committee in connection with the tramway services of the country. The invitation to Mr. Hamilton was discussed at a meeting of the Leeds Tramways Committee on Monday, and it was decided to give him a free hand in regard to its acceptance. His new position will entail the resignation of the Admiralty appointment. Mr. Hamilton is at present Chairman of the Executive of the Municipal Tramways Association, three of whose members have been invited to membership of the new Control Committee.

Mr. H. F. C. MITCHELL, who has been for 18 years mains inspector to the Derby Corporation, has been presented with a case of pipes and pouch on his leaving to take up the position of superintendent of mains and sub-stations for the British Cellulose Chemical Manufacturing Co., Ltd., Spondon, near Derby.

General.—Mr. G. C. HAMILTON, M.P. for Altrincham, who will be remembered by electrical men as being formerly connected with Messrs. Drake & Gorham, Ltd., informs his constituents that he is unable to deal with any division matters, as he is taking up the organisation of the work of the R.F.C. in France, and will be away for some time.

Mr. W. GIBSON has relinquished the post of manager of the Grand Theatre, Falkirk, to take up an appointment in the electrical department of Falkirk Iron Co.

Ald. A. R. JERHCOTT has been re-elected, for the fourth time, chairman of the Birmingham Corporation Electric Supply Committee.

Ald. ENOCH PRIESTLEY and Coun. I. F. ACKROYD have been re-appointed chairman and vice-chairman of the Bradford Tramways Committee. Ald. G. H. ROBINSON has been appointed chairman of the Electricity Committee for the fifteenth time.

Ald. MARSLAND and Coun. SHIRES have been appointed chairman and deputy chairman of the Huddersfield Electricity Committee. The Tramways Committee has appointed Councilors SELLERS and CANBY.

Prof. C. G. BARKLA, of Edinburgh, has been awarded the Hughes Medal of the Royal Society for his researches in connection with X-ray radiations.

On Wednesday, November 14th, at Ecclesall, Lieutenant WALTER J. CRIDGE, 15th Sherwood Foresters, who is now attached to the Central Clearing House, Ministry of Munitions, was married to Honor Isabel (Belle), second daughter of Dr. W. Collier, of Ecclesall, Sheffield.

Coun. A. A. THOMSON and Ald. G. J. ALLEN have been elected chairman and vice-chairman of the Croydon Corporation Tramways Committee respectively for the ensuing year.

Mr. WALTER ALLNUTT, F.S.A.A., who has for many years held the post of secretary of Callender's Cable & Construction Co., Ltd., and the Anchor Cable Co., Ltd., has, in consequence of his advanced age and the necessity for obtaining greater leisure, requested the directors of those companies to release him from his engagement with them. The directors have acceded to his request, and have appointed Mr. HOWARD FIELDS, who is at present secretary of the Electric Supply Committee of the Birmingham City Council, to fill the vacancy thus occasioned. Mr. Foulds will commence his duties as secretary of the above companies on January 1st next.

Roll of Honour.—Sec.-Lieut. L. P. SIDNEY, K.R.R.C., attached R.F.C., reported killed, aged 24, according to the *Times* studied in the National Physical Laboratory Testing Laboratories under Dr. Stanton, and in the Metallurgical Laboratories under Dr. Rosenhain. Subsequently he spent a year in iron and steel analysis with Mr. F. W. Harbord.

Private D. MORRIS, Manchester Regiment, killed in action, was employed by the Lancashire Dynamo & Motor Co., Ltd., Trafford Park.

Private W. YOUNG, Manchester Regiment, who has died of wounds, was an apprentice with Messrs. Lightfoot Bros., electrical engineers, Manchester.

Lance-Corporal H. COOPER, formerly a motorman on the Ashton-under-Lyne Corporation tramways, has been awarded

the Croix de Guerre, and also a bar to it, together with the Medal Militaire, for conspicuous bravery at the front.

Private G. R. PEMBERTON, Royal Warwickshire Regiment, of Aston, and A.B.S. GREGORY, Royal Naval Detachment, Handsworth, former employes of the Electric & Ordnance Accessories Co., Birmingham, have fallen in action.

Lieutenant R. O. GLADSTONE, R.E., formerly on the outside-construction staff at the B.T.H., Rugby, has been killed in action.

Private A. JONES, of the K.O. Royal Lancaster Regiment, killed in action, was formerly employed by Messrs. Lightfoot Bros., electrical engineers, Manchester.

Gunner F. BOOTH, R.F.A., killed in action, aged 25, was a former employe of the Chloride Electrical Storage Co., Ltd., Clifton Junction.

Privates J. WALKER, wounded, J. BARKER, wounded, H. WEST, wounded, and J. E. ALLEN, missing, were all former employes of the St. Helens Cable & Rubber Co., Warrington.

Private J. KENWORTHY, Loyal North Lancashire Regiment, news of whose death in Mesopotamia has been received, was in the employ of Mr. E. Dewhurst, electrical engineer, Preston.

Bombardier G. PRESTON, R.F.A., who was employed as an electrician by Mr. G. Newby, Harrogate, has died of wounds.

Private T. WALTON, N.F., who has been killed in action, was apprenticed as an electrical engineer with Mr. Pearson Rukin, Bradford.

A.B. W. A. TAYLOR, Nelson Division, who is suffering from gas poisoning, was employed by Mr. Fisher, electrician, Doncaster.

Corporal C. E. HART, West Yorkshire Regiment, who has been missing since October 9th, was employed in the Leeds Corporation electricity department.

Lance-Corporal J. D. R. HEXES, of the King's (Liverpool) Regiment, killed in action, aged 22, was apprenticed with Mr. Fred Garnett, electrical engineer, Blackpool.

Lance-Corporal G. W. S. WHITEFIELD, Manchester Regiment, killed in action, was in the employ of the Manchester Corporation electricity department.

Private J. SHAW, King's (Liverpool) Regiment, aged 23, killed in action, was employed by Messrs. Dick, Kerr & Co., Ltd., Preston.

The Military Medal for good work as a linesman under exceptionally hard conditions from time to time has been awarded to Sapper C. J. EDDY, R.E., who enlisted from the staff of the Kent Power Co., at Chatham.

Private F. H. MARTYR, Queen's Royal West Surrey Regiment, killed in action, was on the staff of the British Westinghouse Co., Ltd.

Sapper S. A. TYLER, R.E., who has died in hospital at Chatham, was on the staff of Messrs. Belliss & Morcom, Ltd., Birmingham.

Sapper H. CHIVERS, R.E., who has died from wounds at Ronen, was a wireman with Mr. T. C. Bush, electrical engineer, of Bath.

Sergeant J. ELLIS, R.A.M.C., killed in action, was for some years with the Potteries Electric Traction Co., Ltd., of Stoke-on-Trent. He had by gallantry gained the D.C.M. and a bar.

Corporal J. L. CARSTAIRS, who has gained the Military Medal for bravery, was engaged in the East Greenwich generating station of the L.C.C.

NEW COMPANIES REGISTERED.

Staveley Electric Supply Co., Ltd. (148,900).—Private company. Registered November 16th. Capital, £5,000 in £1 shares. To carry on at Staveley and elsewhere in Derbyshire the business of an electric lighting and supply company, to provide electrical energy for any private or public purpose as defined by the Electric Lighting Act, 1882, &c. The subscribers (each with one share) are:—C. P. Markham, Ringwood, Chesterfield, nominator; J. Court, Staveley, Chesterfield, surgeon; C. W. Kendall, Staveley, Chesterfield, mineral water manufacturer. The first directors are:—C. P. Markham, J. Court, and C. W. Kendall. Solicitors: Stanton & Walker, Chesterfield.

W. & D. Conveyor Engineering Co., Ltd. (148,893).—Private company. Registered November 14th. Capital, £10,000 in £1 shares. Manufacturers of and dealers in labour-saving machinery in connection with the transport of goods, runways of all kinds, elevating machinery, humpers, stackers, and conveyors; electrical and general engineers, &c. The subscribers (each with one share) are:—H. O. King, Redlands, Badyr, near Carlisle, shipowner; M. Fletcher, 31, Great St. Helens, E.C., Lloyds' broker; W. H. Weguelin, Balholm, Chorley Wood, Herts., engineer; W. E. P. Doudney, 33, Plainfield Crescent, East Dulwich, S.E., engineer. The first directors are:—H. O. King, T. Fletcher, W. H. Weguelin, W. E. P. Doudney, and C. H. Bennett. Solicitors: Downings, Crosby Buildings, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

General Cable Manufacturing Co., Ltd.—Debenture for £1,500, dated November 6th, 1917, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: T. Cohen and Co., Ltd., Spencer House, E.C.

CITY NOTES.

Monte Video Telephone Co., Ltd.

Mr. CHAS. LOCK presided at the annual meeting on November 19th. He said that the year's results were quite satisfactory, considering the difficult times. The subscriptions, rentals, &c., amounted to £78,402, against £72,000. The larger gross receipts were the result of an increase of 614 subscribers. Taxation showed a very substantial increase. There had been an increase in the actual amount of working expenses, but the actual percentage per subscriber showed a slight diminution, which was to the credit of the Monte Video management. With regard to the application for a concession for underground plant, last year he pointed out that, in view of the heavy cost of materials, the directors hoped that any grant of a concession would be delayed for some little time, and that the periods provided for in the concession for obtaining approval of the plans and raising the capital should be extended. Since then prices of materials had still further increased to an enormous extent, while it would be practically impossible for some time to come to place orders. Under these circumstances the only practical course was to suspend all idea for the present of undertaking an underground system. The cost at the present time, even if the materials were procurable—which was quite impossible—would be nearly three times as much as before the war, so that the net revenue of the company under present conditions would in no way suffice to provide an adequate return on the capital involved. It would also be quite impossible to obtain the sanction of the British Treasury for new capital for such an enterprise, so that their only reasonable course was to suspend this matter until times became more favourable. With regard to supplies, the Board had felt the necessity of looking ahead in these times, and they had managed, to place orders which would give them supplies of the principal parts of their materials for at least 12 months to come.

Swiss Companies.

The report of the *Watt A.G. für Elektrische Unternehmungen, of Glarus*, which is associated with the Zurich Bank for Electrical Undertakings, states that the company's activity in 1916-17 was limited to hitherto existing investments. These experienced a decline in the results, whilst at the same time large losses on the rate of exchange were incurred in the interest receipts in foreign currency. The accounts indicate net profits of £1,400, as compared with £9,800 in 1915-16, when a dividend of 3 per cent. was paid on the ordinary share capital of £300,000, but no distribution is possible for 1916-17.

The directors of the *Maschinen-Fabrik Oerlikon, of Oerlikon*, reporting on the year ended on June 30th, 1917, state that the scarcity of fuel resulted in the receipt by the department for machinery and transformers of considerable orders from industrial establishments, and the demand and turnover in special drives for the textile industry were very active. The great activity in the department for lighting apparatus and electro-mechanical applications continued, and sales were on the level of those in the preceding year, whilst the turbine branch was also well occupied. In the electric railway department the company had set in operation the equipment for the Biel-Tauffelen railway, and the delivery of the equipment for the London & North-Western Railway Co. was being carried out gradually. During the whole of the year the foundry for grey castings was fully occupied, and an increase took place in the orders received for forgings. The manufacture of fuses and shell cases was undertaken for the Swiss military authorities, but the company continued to refuse to supply war material to all belligerent countries. The accounts, after allocating £44,000 to depreciation, as contrasted with £43,000 in 1915-16, show net profits and balance forward of £43,000, as against £39,000 in the previous year. It is proposed to pay a dividend of 7 per cent. on the ordinary share capital of £320,000, being the same rate as in 1915-16. The directors now recommend an increase in the share capital to £640,000 by the issue of new shares, which will be offered to existing proprietors, the object being to provide additional capital for the further extension of the works in expectation of the development of business after the war.

German Companies.

The report of the *Elektro Werke A.G., of Berlin*, the financial ownership of which has now passed into the possession of the Government, states that the power station was fully completed in 1916-17, and the deliveries to the State nitrate works at Piesteritz amounted to 307,380,000 kw.-hours, and to 53,382,700 kw.-hours in the case of the Electro Nitrate works. At the end of the financial year the fuel requirements were being entirely satisfied by the output of the company's lignite mines, the average daily production being about 8,000 tons. The accounts show a loss of £1,700 for the year.

The *A.E.G. Unternehmungen A.G., of Frankfurt-on-Main*, which originated from the A.E.G.-Lahmeyer Works, reports having disposed of shares in the Bergen (Norway) tramway at a large profit on the rate of exchange in 1916-17, and of £50,000 in shares in the Meissen tramway. On the other hand, a block of shares in the Linz-Urfahr (Austria) tramway was purchased. The accounts exhibit net profits of £31,000, as against £33,000 in 1915-16, the rate of dividend

being 6 per cent. on share capital of £500,000, as in the previous year.

The Suddutsche Telephon Apparatus, Kabel und Drahtwerke A.G., of Nuremberg, whose share capital of £50,000 is mostly held by the Felten & Guilleaume Co., report that a loan of £338,000 was raised in 1916-17 to defray the cost of extensions of the works and provide capital for the increased turnover. After making provision for depreciation to the extent of £19,000, as against £11,000 in 1915-16, the accounts indicate net profits of £27,000, as compared with £11,000. It is proposed to pay a dividend and bonus of 45 per cent., this contrasting with 20 per cent. and 10 per cent. in the two preceding years respectively.

The Rhein-Westfälisches Elektrizitäts Werk A.G., of Essen, whose undertaking is one of the largest in the country, reports an increase in the connections and turnover in 1916-17 as a consequence of the great expansion in the war industries. Although the total number of glow-lump connections was not very materially augmented, the number of motors rose from 38,000 in 1915-16 to 40,500 last year. The total value of the connections, including those of the company's associated undertakings, advanced from 400,000 kw. to 432,000 kw., and the deliveries expanded from 388,118,000 kw.-hours to 555,063,000 kw.-hours in the two years respectively. As a result of the growth in the working expenses various supply companies had raised their charges by up to 30 per cent., and the company would have to follow this example. The gross profits are returned at £606,000, as compared with £531,000 in 1915-16, and after apportioning £204,000 to depreciation, as against £186,000, the accounts exhibit net profits of £213,000, as contrasted with £222,000. It is intended to pay a dividend of 8 per cent. on the ordinary share capital of £2,500,000, being the same rate as in each of the five preceding years. The loan capital amounts to £1,760,000.

Cape Electric Tramways, Ltd.—For the year ended June 30th, 1917, the profit and loss account shows a profit of £79,893, and after providing for debenture interest and redemption, and including the balance brought forward, the net credit balance is £39,152, out of which £12,000 has been credited to reserve fund, and 5 per cent. is to be paid on the ordinary shares, leaving £2,591 to be carried forward. The passengers carried numbered 23,752,016, producing £231,106, against 22,477,366, producing £212,792 in the previous year. A satisfactory increase is shown both as regards the Cape Town and Port Elizabeth systems, attributable to the passing through of Australian and New Zealand troops and to the general prosperity throughout South Africa. The difficulties of obtaining supplies, and the high prices of all materials, as well as increased war bonuses to employees, keep the cost of operation at a high level. The expenditure is further increased by the additional taxation recently imposed by the Union Government, from which provision has had to be made. In spite of these difficulties the profit showed an increase of £6,225.

United Electric Tramways Co. of Caracas, Ltd.—As the local company has again declared a dividend absorbing its net profits for the year, the directors continue their policy, during the period of the war, of fully distributing amongst the shareholders the whole of the available net revenue. Out of the disposable balance of £13,799 a dividend is recommended at the same rate as last year (7 per cent., less income-tax), carrying forward £1,899.

Amazon Telegraph Co., Ltd.—The gross revenue for the year ended June 30th, 1917, was £72,114, and the working expenses were £31,539. After providing for income-tax and depreciation of investments, also £12,812 for debenture interest and £10,113 for sinking fund, £8,000 is placed to general reserve, 4 per cent. dividend, less tax, is paid, and £7,187 is to be carried forward.

Coalite, Ltd.—The "Morning Post" states that negotiations have for some time past been in progress for the exploitation of the company's patents. An agreement has now been concluded with Low Temperature Carbonisation, Ltd., under which that company is appointed manager of the business of Coalite, Ltd., for a term of 10 years from October 1st, 1917.

Callender's Share & Investment Trust, Ltd.—Dividend of $2\frac{1}{2}$ per cent., less income-tax, for the half-year, making 5 per cent. for the year. After putting £500 to reserve, and £741 to writing off preliminary and debenture stock expenses, £5,279 is to be carried forward.

Calcutta Electric Supply Corporation, Ltd.—The number of units sold to consumers during the four weeks ended September 28th, 1917, has amounted to 2,354,138, compared with 2,156,682 units in the corresponding four weeks of 1916.

Stock Exchange Notice.—The undermentioned securities have been ordered to be quoted in the Official List:—

Melbourne Electric Supply Co., Ltd.—Further issue of £150,000 5 per cent. consolidated debenture stock

France.—The Société des Ateliers Mécaniques et Electriques de Gennevilliers has just increased its capital to 3,500,000 francs.

Chloride Electrical Storage Co., Ltd.—Interim dividend on the ordinary shares, 5 per cent., free of tax.

British Ever-Ready Co., Ltd.—Dividend, 10 per cent. per annum on the ordinary shares for the half-year ended September.

Electric Construction Co., Ltd.—Dividend at the rate of 6 per cent. per annum on the ordinary shares, less income-tax, in respect of the year ending at March next.

Castner-Kellner Alkali Co., Ltd.—Dividend, 11 per cent. for the half-year ended September, making 20 per cent. for the year.

STOCKS AND SHARES.

TUESDAY EVENING.

The Stock Exchange continues to move along cautious lines. Petrograd and Moscow are not providing light literature at present. The Italian rally, at the time of writing, is welcome, but interest awaits keenly the next developments. At home, the campaign which has begun in earnest in connection with the War Bonds is straitening purely investment business, though the War Loan and Consols keep good. Amongst the electricity markets, the feature is a continuance of activity, accompanied by rising prices, in shares of the manufacturing companies.

No further rumours have come to the ears of this individual column of the ELECTRICAL REVIEW, but hopes are more than keeping pace with the advance in prices that there is something in the air with reference to a combination of interests. Apart from this, however, it is declared by people who profess to know, that the electrical manufacturing companies are enjoying a good share of the prosperity attendant upon many other industries, upon which point the expert reader is likely to have better information than a mere financial echo. At all events, General Electric ordinary are 10s. better at 19— a splitting scheme would be highly acceptable to those who like to see a free market in any shares—while Electric Constructions are better at 23s. 9d. India-Rubbers rose 5s. to 11 $\frac{1}{2}$. Edison Swan 7 per cent. first preference have been wanted at 21s. 3d., and the partly-paid at 16s. Cromptons moved back a little to 12s. 9d., and the preference are steady at 15s. 6d.

Lighting shares keep firm. There is still a demand for those of the principal London companies, but would-be buyers get tired of waiting after a time, and seek other investments if they cannot get those which they want at first. Charing Cross Ordinary have put on 5s., Kensingtons are $\frac{1}{2}$ up, and so are City of London preference.

In the telegraph market, Globe Ordinary are $\frac{1}{2}$ better at 13 $\frac{1}{2}$, but the Preference have lost a similar fraction at 10 $\frac{1}{2}$. Great Northern recovered to 39. Western Telegraphs went back a little to 15. The Eastern group is steady. "China" shares changed hands the other day at 14 $\frac{1}{2}$, and Eastern Telegraph Ordinary at 149; Eastern 3 $\frac{1}{2}$ per cent. Preference at 61 and the 4 per cent. Mortgage Debenture stock at 73 have both been dealt in at these prices. The former stock at the present price returns 5 $\frac{1}{2}$ per cent. on the money. A good deal of business is being done in Oriental Telephones between 59s. 6d. and 62s. 6d., the middle price being advanced to £3 16s. United River Plate Telephones have been in some little request at 6 11/16. West India & Panama Preference are £8 for the Firsts and £7 for the Seconds, while the ordinary, ex the sixpenny dividend, are left at 1 7/16. Direct United States shares have lately changed hands at 6 $\frac{1}{2}$. Anglo-American Telegraph Preferred has attracted investment buying on the basis of 97. Marconi shares weakened to 3 3/16, the Preference also easing off to 2 9/16, with Americans lower at a guinea and Canadians at 10s. The recent severe slump in American rails in New York has, no doubt, something to do with the drop from 23s. in American Marconis, and this is affecting the parent shares. Another Stock Exchange case of the tail wagging the dog.

The railway market is uninteresting. No changes occurred in the electric stocks, though Districts are actually lower than they look from the nominal price of 16. British Electric Traction are steady. London United Tramways Debenture stock gained attention at the end of last week, a fair number of bargains being done at about 35. London & Suburban Ordinary were bought at 2s. 9d. on Monday; the last recorded bargain in the 5 per cent. Preference was about a week ago at 7s. 4 $\frac{1}{2}$ d. The company's "A" Debenture stock is a little better at 80 $\frac{1}{2}$.

Foreign issues are mainly dull, more particularly Mexicans. Mexican Light & Power Common remains at 22 $\frac{1}{2}$, but the Preferred shed 4 points to 31, and the First Mortgage Bonds fell 2 to 40 $\frac{1}{2}$. Brazil Traction and British Columbia Electric are fairly steady, and a conspicuous feature of strength is the 5 per cent. Debenture stock of the Anglo-Argentine Tramways, which has risen 3 to 71, in spite of circumstantial reports as to the outbreak of fresh labour trouble due to begin on one of the railways this week.

Castner-Kellner shares are $\frac{1}{2}$ up at 3 9/16, and other chemical shares are also strong. Babcock & Wilcox gained 5s. at 3 5/16, in a boomlet which has broken out amongst iron and steel shares generally, in which those of engineering companies have joined. Several companies have just lately pro-

posed the organisation of their capital accounts in such a manner as to afford shareholders a substantial bonus, and the boomlet referred to is based on the expectation that other concerns will follow suit by way of admitting their proprietors to a larger slice of profits than the former could receive in the shape of dividends, having regard to the excess profits duty. The rubber market is sticky, with the price of rubber showing a dullish tendency at half-a-crown per lb. Armaments hardened in sympathy with the iron and steel group.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.						
	Dividend		Price Nov. 20, 1917.	Rise or fall this week.	Yield p.c.	
	1915.	1916.				
Brompton Ordinary	10	9	6½	—	£6 18 6	6
Charing Cross Ordinary ..	5	5	4½	+ ½	5 17 8	8
do. do. 4½ Pref.	4½	4½	8½	—	6 13 4	4
Chelsea	4	3	2½	—	5 9 1	1
City of London	8	8	19½	—	6 2 0	0
do. do. 6 per cent. Pref.	8	6	10½	—	5 18 6	6
County of London	7	7	11	—	6 7 3	3
do. 6 per cent. Pref.	8	6	10½	+ ½	5 18 5	5
Kensington Ordinary	7	6	5½	+ ½	5 11 7	7
London Electric	8	8	1	—	Nil	
do. do. 6 per cent. Pref.	8	4	8½	—	6 6 8	8
Metropolitan	8	8	3½	—	4 12 4	4
do. 4½ per cent. Pref.	4½	4½	3½	—	7 4 0	0
St. James' and Pall Mall ..	8	8	7	—	6 14 6	6
South London	5	6	3	—	6 13 4	4
South Metropolitan Pref.	7	7	21/6	—	6 10 6	6
Westminster Ordinary	7	7	6½	—	5 3 3	3
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	6	8	97	—	8 8 9	9
do. Del.	83/6	1½	28½	—	6 9 0	0
Chile Telephone	8	8	7½	—	5 11 4	4
Cuba Sub. Ord.	5	7	8½	—	8 0 0	0
Eastern Extension	8	8	14½	—	6 7 9	9
Eastern Tel. Ord.	8	8	149½	—	5 7 0	0
Globe Tel. and T. Ord.	7	7	18½	+ ½	6 4 8	8
do. Pref.	6	6	10½	+ ½	6 17 1	1
Great Northern Tel.	22	24	89	+ ½	6 1 6	6
Iodo-European	18	18	52½	—	6 3 10	10
Marconi	10	15	3½	+ ½	4 14 1	1
Oriental Telephone Ord.	10	10	3½	+ ½	3 5 4	4
United R. Plate Tel.	8	8	6½	—	6 18 6	6
West India and Pac.	6d.	6d.	1½xd	+ 6d.	3 9 6	6
Western Telegraph	7	8	15	— ½	6 6 8	8
HOME RAILS.						
Central London, Ord. Assented	4	4	60½	—	6 12 8	8
Metropolitan	1	1	2½	—	4 7 0	0
do. Districts	Nil	Nil	16	—	Nil	
Underground Electric Ordinary	Nil	Nil	1½	—	Nil	
do. do. "A"	Nil	Nil	8½	—	Nil	
do. do. Income	6	4	82	—	4 17 5	5

* Dividends paid free of income-tax.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	Inc.
		£	£		£	£		
Bristol	Oct. 26	21,650	+1,531	43	233,041	+20,935	80½	..
Cork .. ..	.. 25	2,217	+ 196	48	23,703	+ 1,574	9·89	..
Dublin .. ..	.. 26	27,985	+1,691	43	288,710	+27,968	54·25	..
Hastings .. ..	.. 24	1,741	+ 9·3	43	54,485	+ 8,363	19·8	..
Lancashire United .. ..	.. 31	9,559	+2,175	41	109,198	+22,531	42	..
Llandudno-Col. Bay .. ..	.. 26	1,252	+ 69	47½	16,855	— 962	6·6	..
Anglo-Argentine .. ..	.. 31	45,591	+2,955	11	2,218,241	+27,703	..	..
Ankara .. ..	.. 36	22,394	+ 850	17	92,113	+ 7,932	26·59	..
Calcutta .. ..	.. 27	14,193	+ 296	..	..	+ 1,920	..	..
Kaigoorlie, W.A.	July ..	2,719	..	31	18,151	..	20·5	..
Madras	Sept. 30	4,635	..	31	41,629	+ 3,691	..	..
Montevideo	Oct. ..	30,153	+1,424	53	859,832	+12,669	..	..

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, November 21st.

CHEMICALS, &c.			Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/6	..	..
a Ammoniac Sal	per ton	£76	..	..
a Ammonia, Murate (large crystal)	..	£58	..	..
a Bisulphide of Carbon .. ..	..	£23	..	..
a Borax .. ..	..	£28	..	..
a Copper Sulphate .. ..	..	£66	..	..
a Potash, Chlorate	per lb.	2/6	..	..
a " Perchlorate .. ..	..	2/1	..	..
a Shellac	per cwt.	£13 10	..	..
a Sulphate of Magnesia	per ton	£16	..	..
a Sulphur, Sublimed Flowers ..	..	£25	..	..
a " Lump .. ..	..	£25	..	..
a Soda, Chlorate	per lb.	10½d.	..	..
a " Crystals	per ton	120/-	..	..
a Sodium Bichromate, casks ..	per lb.	..	..	..
METALS, &c.				
c Brass (rolled metal 2" to 12" basis)	per lb.	..	..	..
c " Tubes (solid drawn) .. ..	..	..	..	..
c " Wire, basis .. ..	..	..	..	..
c Copper Tubes (solid drawn) ..	..	1/5½ to 1/7	..	..
g " Bars (best selected)	per ton	£150	..	..
g " Sheet .. ..	..	£150	..	..
g " Rod .. ..	..	£150	..	..
d " (Electrolytic) Bars .. ..	..	£125	..	..
d " " Sheets .. ..	..	£152	..	..
d " " Wire Rods .. ..	..	£133	..	..
d " " H.C. Wire	per lb.	1/3½	..	..
f Ebonite Rod .. ..	..	3/-	..	..
f " Sheet .. ..	..	2/6	..	..
n German Silver Wire .. ..	..	2/8	..	..
h Gutta-percha, fine .. ..	..	6/10	..	..
h India-rubber, Para fine .. ..	..	8/5½	..	..
i Iron Pig (Cleveland warrants) ..	per ton	Nom.	..	..
l " Wire, galv. No. 8, P.O. qual.	..	£42	..	..
g Lead, English Pig .. ..	..	..	..	..
g Mercury	per het.	Nom.	..	..
e Mica (in original cases) small ..	per lb.	6d. to 8/-	..	..
e " " " medium .. ..	..	3/6 to 6/-	..	..
e " " " large .. ..	..	7/6 to 14/- & up.	..	..
d Silicon Bronze Wire	per lb.	1/8½	..	..
r Steel, Magnet, in bars	per ton	..	..	..
g Tin, Block (English) .. ..	..	..	..	..
n " Wire, Nos. 1 to 16	per lb.	8/9	..	3d. inc.

Quotations supplied by—

a G. Boor & Co.	g James & Shakespeare.
c Thos. Bolton & Sons, Ltd.	h Edward Till & Co.
d Frederick Smith & Co.	i Bolling & Lowe.
e P. Wiggins & Sons.	l Richard Johnson & Nephew, Ltd.
f India-Rubber, Gutta-Percha and	n P. Ormiston & Sons.
Telegraph Works Co., Ltd.	r W. F. Dennis & Co.

German Central-Station Tariffs.—A recent communication from the Elektrizitätswirtschaftsstelle (Electricity Administration) to the E.T.Z., discusses the grounds upon which central stations are entitled to increase their charges for electrical energy. The price of coal has risen by 100 per cent. or more, that of other working materials has risen by several hundreds per cent., and wages have risen to an extraordinary level since the beginning of the war. Voluntary allowances to dependents of workmen called to the colours represent a further heavy burden on practically every electricity undertaking. Bulk consumers are therefore urged to pay a higher price for energy, in proportion to the increased cost of production, even where long-term contracts give them a legal right to a supply at pre-war prices. Another respect in which central stations are hard hit is in loss of revenue owing to:—(1) The introduction of "summer-time." (2) Restricted use of light and power on grounds of economy or due to small works being closed. (3) Absence on active service of innumerable small consumers. It is pointed out that the effective maintenance (financial and material) of electricity and gas works is a matter of national importance, also that these concerns are at present subject to abnormal depreciation as well as increased working costs. For some time after the war, renewals will be very costly, and allowing for all these factors, a 25 per cent. increase in the selling price of energy is none too much.

Cracking Hydrocarbon Vapours by Electricity.—A process that aims to obtain by means of an electric discharge a greater yield of fixed gases from hydrocarbon vapours, is the development of J. G. Davidson and R. W. Ford, of Vancouver, B.C., Canada. Patent No. 1,229,012 has been granted covering the discovery that by passing such vapours through an electric brush discharge field, the amount of non-condensable gases is increased. In actual tests it is claimed that by this process the amount of C_2H_4 in the gas has been increased from about 25 per cent. to approximately 40 per cent., while the amounts of C_2H_2 were increased from between 7 per cent. and 10 per cent. to between 20 per cent. and 23 per cent. Ordinarily the gas is conducted through a plurality of conduits formed as vertical pipes connected at their lower ends to a supply header and at their upper ends to an outlet header, the discharge electrodes being formed of wires hung axially in the pipes from an insulated support. The pipes are grounded and the electrodes are connected by a wire to a mechanical rectifier of the usual rotary type included in the high-tension circuit of a step-up transformer, the other pole of the rectifier being connected to ground. —*Electrical World.*

THE INSTITUTION OF ELECTRICAL ENGINEERS.

Abstract of the Inaugural Address delivered by
MR. C. H. WORDINGHAM, President, November 8th, 1917.

(Continued from page 480.)

RESEARCH.

With a strong Institution such as I have depicted, the field of usefulness would be enormous, and the potentialities almost beyond calculation. One of the most important matters demanding attention is research. Scientific research on purely academic lines should be closely pursued, for it is from such work, having apparently no commercial application, that the industry itself and many of its most lucrative developments have sprung. Equally important is industrial research, by which I understand the development of scientific discoveries and new methods of manufacture.

The point I wish to make is that the workers at both kinds of research should be welded together so as to assist one another, and so that the manufacturers may have a call on the highest talent in the country, while the scientific seeker after discoveries may avail himself of the resources of the manufacturers to test any promising inventions he may make. Such co-operation must tend to give far better results than any independent efforts of one class of worker without the other.

In the National Physical Laboratory we have magnificent facilities for scientific investigation of the highest class, and now that it has been taken over by the Advisory Council for Scientific and Industrial Research it may be hoped that it will in future be supplied with adequate funds by the Government.

Industrial research stands on a very different footing in every way. If industrial research is to be of real value to the nation it is essential that much of the work done shall be kept secret, and only imparted to those who will directly utilise the information obtained for the benefit of British trade. Fortunately, this has been recognised from the first by the Advisory Council of Research, and much valuable work has been, and is being, done to enable British manufacturers to produce articles formerly obtained from abroad, such articles in many cases being of superior quality to the foreign ones.

If new discoveries or processes are obtained by the employment of public funds, it may be argued that they should be the property of the nation; on the other hand, the funds would have been of no avail without the genius of the discoverer, and he is obviously entitled to a substantial share of whatever profit is made.

Industrial differs from purely scientific research also in the scale and, in consequence, the cost of experiment. The concentration of the manufacturing interests in the hands of one or two gigantic companies in America and Germany has enabled those companies to develop their facilities for research to an extent that is clearly impossible in this country, where a much smaller volume of manufacture is conducted by a multiplicity of firms. In consequence, what facilities exist for industrial research are partial, unco-ordinated, duplicated, and incomplete. There is, therefore, a crying need for the establishment of one or more fully equipped laboratories on a large scale for the investigation of industrial problems. Such laboratories will need the generous support of the Government and the manufacturers.

Much research and many discoveries have taken place here in spite of the unfavourable conditions. The cleverness of the Germans, of which we have heard *ad nauseam*, has lain not in their originality or inventiveness, but in their quickness in appropriating other people's inventions; they have provided the money to tempt away to Germany the English inventor whose work was received with coldness and suspicion by those of his fellow countrymen possessing the capital necessary to secure the fruits of his labour, and who would not provide the funds. Hundreds of cases could be cited in illustration. I may mention one that came under my notice quite recently. A material widely used in electrical apparatus could before the war only be obtained from Germany. A firm of manufacturers in this country discovered that the whole of the plant and process for producing this material was the invention of an Englishman; they were fortunate enough to get into touch with him, with the result that they are now putting down plant which is a duplicate of that which he had designed for his German employers, and the material will now be made in this country of exactly the same quality as, or probably better than, that formerly only obtainable from Germany. We have the discoverers and inventors in this country, and always have had them; if we given them facilities as good as those possessed by our rivals, and back them up with financial support, the possibilities before us are unlimited—but we must do both.

A consideration of laboratories leads me to another matter to which I have already very briefly alluded, namely, the establishment of an institution which shall be in a position to say authoritatively whether certain standards have been complied with, and to give a hall-mark to British manufactures. It has long been a cherished ambition of mine to see established such an institution, for which I have suggested the name of National Electrical Proving House. In 1899 I read a paper before the Institution in the course of which I

described a local attempt which I had made, with a considerable measure of success, to test samples of fuses, switches, and similar fittings with a view to certifying that they reached a certain standard of excellence, and I strongly advocated that the Institution should take the matter up and carry out the idea on national instead of local lines. My proposals, however, met with considerable opposition, and nothing was done. Previous to 1913 a serious situation had arisen in connection with British trade in Canada on account of the non-existence of such an authority as I have indicated, British manufacturers having to send their goods to Chicago to be tested and passed before they could be sold in British Canada! In view of this, the Council referred the matter to a special committee, but owing to the outbreak of war the question had to stand over. After waiting for about a year and a half I sent to the technical Press, with the sanction of the then President, the proposals which I had wished to make to the Committee. I had outlined a definite scheme, and my proposals met with considerable support, and were favourably received by the I.M.E.A. and the B.E.A.M.A., but nothing happened. Since the war, the reality of the need which I first pointed out 18 years ago has been appreciated, and there is clear indication that the proposal commends itself to manufacturers and, with a courtesy and consideration which I highly appreciate, members of the B.E.A.M.A. have asked me to bring the matter forward at the Institution during my year of office. A Committee of the Council has already been instructed to report on the matter, and has recommended the setting up of a committee representing the interests concerned. When this committee has drafted outline proposals an opportunity will be given for the matter to be fully discussed by the general body of members, after which I hope that definite and adequate steps may be taken before the close of the session to set up an authority which shall be able to certify whether an article is or is not in conformity with a given standard of excellence, and shall give it a hall-mark which shall be recognised throughout the world as a guarantee of British origin and British excellence and reliability.

INFLUENCE OF THE WAR.

The political measures for the furtherance of trade can find no place in an address such as this. I will only remark that while the potentialities for good immanent in the Government are enormous, they should be directed towards assisting industries, and not be employed in interfering with them. Each industry knows best its own business and requirements, and how its interests can be furthered.

Nationalisation of certain industries is not infrequently mooted, but I venture to think that in no case should the Government undertake any business of a commercial nature. It starts with the handicap of being regarded by most as the legitimate prey of all who can get the better of it, and it is further handicapped by the impossibility of employing those methods which make for success in obtaining business and executing it satisfactorily. I refer more especially to individual effort and initiative, untrammelled power for those engaged in the work to decide and act quickly, freedom and secrecy in negotiations, and finally the important and perfectly proper incentive of personal profit.

The chief ways in which Government can assist industry are the safeguarding of British interests abroad, so that the British trader may be at least on an equal footing with those of other nationalities in foreign markets; the shielding of young industries in this country from foreign competition during the period of their infancy, and from unfair and State-aided competition when adolescent; the conservation of natural products of the Empire for the exclusive use of British manufacturers up to the maximum quantities required by them, due regard being paid also to a reasonable extent to deferring ultimate exhaustion; the removal of all obstructive and injurious legislation; and, finally, the collection of really useful information as to foreign markets not available to traders by their own unaided efforts, and its dissemination without delay among those concerned. I have already indicated the good that I think might be done by the Government in connection with engineering by conferring wider powers on the existing engineering institutions.

The problem of the promotion of British trade after the war is one which has come in for an immense amount of consideration and a much greater amount of talk. There is a strong tendency to co-operation and federation, with a unification of organisation that must bring about a powerful body representing British trade.

In deliberating upon the action to be taken, every effort must be made to give due weight to each consideration, and to avoid turning a principle eminently true and valuable into a shibboleth and pushing it to such an extent that, in place of being beneficial, it becomes mischievous. I believe the keynote of our success in the future to be co-operation and federation. The same principle is capable of application on a still grander scale, and having already federation among our own Dominions, may we not hope that our alliance with the other great branch of the Anglo-Saxon race may not be for the time of the war only, but that some way may be found, if not of actual federation, at all events of working together in harmony for the good of our branch of the human race, and opposing those nations who have shown their whole nature, ideals, and methods to be antagonistic to our own.

and of combating dangers of which the embryo is only faintly discerned at present, but which in the fullness of time may threaten our very existence.

While it is imperative that combination should be effected among manufacturers for the promotion of the Empire's world trade, in combining let us not forget it is the individualism of the Briton which has brought him into the position that he occupies in the world. Combination should be effected on lines which will recognise the British characteristic of individuality. The autocratic and machine-like methods of training suitable for the German cannot be successfully applied to the British manufacturer, who does best when he retains his own initiative and individuality. There is every indication that combination will be effected on lines which will not crush out the small manufacturer, and which will enable combinations of firms to be made in such a manner that the orders are obtained by a common organisation while the work is carried out in individual factories, each factory taking that portion for which it is best suited.

There is one danger to our trade which I greatly fear, and which will be realised unless we as individuals can rise above our own selfish immediate apparent interests, and can consider the good of the nation as a whole. The outbreak of war probably took all of us by surprise, but not the subsequent demonstration of the depths of degradation of the German mind and soul. To many of us the whole tendency of modern German thought and aspiration, and the German methods of commerce were wholly and utterly repulsive, and many of us were fully alive to the danger to which this country was exposed by the insane encouragement given to the import of German manufactures and the fatuous belief in German superiority. The eyes of many have been opened, but whether the awakening is permanent time alone can show. Never was the warning "Lest we forget" more necessary than now. Let us remember that the leopard does not change his spots, and, once the sheep's clothing has been stripped off, let us never again be deceived by the artificial exterior, however woolly and lamblike it may appear; the spots are still there. Let us not be deceived. The German has been our deadly enemy for many years past, he has been our open enemy during the last three years, and nothing has occurred which can render it in the least degree probable that he will become anything less of an enemy in the future. Let every man who is tempted, as he will be tempted, and tempted very strongly, in the near future to fall back into his old reliance on German produce, remember that in yielding on account of what appears to him to be his immediate commercial advantage he is showing himself to be a traitor to his country, and is ultimately assisting in his own downfall. If this nation is to survive in the industrial war on which we must shortly enter, it can only do so by recognising its enemies, and by its individuals holding together and supporting each other's efforts for the common welfare. Let the first question asked when dealing with a firm be, "Is it British?" and if it be not, then let one be sought that is. It may be contended that in many branches of the industry the British-produced article is inferior to, as well as dearer than, the German. If we assume this to be true, the obvious line of action is to take steps to improve the manufacture of that article, and to give those who make it a market to supply; the British manufacturer will very soon rise to the occasion, and rapidly pass his German competitor if only he be given the chance.

The war has powerfully affected Capital and Labour individually and their mutual relations. The expenditure on war-like material, coupled with a great reduction in the ratio of exports to imports, has impoverished the nation, and driven large amounts of capital into other hands than ours. The result will be that many of the profitable enterprises presenting themselves after the war will have to be financed in large measure by foreign capital. This is a danger that must be watched closely, for it will greatly mar the value of the expansion of our trade if the profits go out of the country, and it will obviously retard progress seriously if they are not available for the nourishment of our own business.

There is, however, an encouraging feature in connection with the effect of the war on capital, namely, the bringing home to most what was already known to many, that our industry was strangled for want of financial support, more especially in connection with new inventions which, while involving risk, contain also vast possibilities. We may hope that broader and wiser views will prevail in future, and that British capital will to a much larger extent be applied to the development of British trade, instead of being sent abroad to provide the sinews of war for the foreigner to attack our trade.

It is in Labour probably that the most tremendous problem of the immediate future resides. The power and influence in the hands of the workman have been demonstrated in an unmistakable manner. The stress of war, and the necessity for increased production have cast a lurid light on the methods adopted by the workmen in their supposed interests in times before the war. Neither masters nor men are likely to put up with their relations with one another being interfered with by outside authorities even so exalted as the Government, when once the war is over, and the fate of industry will depend upon how the acutely difficult problems are freed and dealt with by the two parties concerned.

The extraordinary development of women's labour raises

issues that are intricate and new. Having tasted independence and high wages, a number of those now working will desire to continue their present activities, and probably this will be bitterly opposed by the men, but I do not believe that there will be any great access of women permanently to the ranks of engineering workers. Women are physically unfit to endure the heavy work inseparable from most engineering operations; they may support it for a time, but, if persevered in, the results can hardly fail to be disastrous.

The upheaval that has taken place has probably so affected men's minds that they will be able to approach the matter with far more hope of success than if their ideas had remained stereotyped. Unquestionably mistakes have been made, and the rank and file have often been misguided, but there have been many reprehensible actions on the part of the employers, and the men's attitude has not always been without strong provocation. No one can listen to the speeches of some of the Labour leaders and be acquainted with their personalities without recognising the marked ability and honesty of purpose of many of them. Certainly, all those who have had direct dealings with workmen themselves must acknowledge that as individuals many command respect for their general character as men and their ability as workmen. That there is serious unrest at present is certain, and much of it has been traced to causes that give reasonable grounds for its existence.

It is quite certain that the men will have to be given a much greater share in the management and profits of the undertakings they are engaged on. It is equally certain that they are not at present fit to occupy the position that the importance of their contribution to the country's wealth justifies. They must be taught that they have duties as well as rights; they must be educated to take an intelligent interest in their work and in its development; their prejudices, ignorance, and suspicion must be broken down, and many serious misconceptions cleared away. Masters must learn that they themselves must do what they enjoin on their men; they must remove their own ignorance of the conditions of life and of the viewpoint of their men, and they must get rid of the suspicion that they entertain of the men, which is just as great, and perhaps as ill-founded, as the men's suspicion of them. While asking the men to deal fairly with them they must see to it that they set the example of fairness.

Unless masters and men can succeed in understanding and trusting one another, and in working together for the common good, this nation must go under in the industrial strife before us.

I believe success is to be attained by giving each man in some way or another a direct interest in the financial results of the concern employing him; by letting him have some say in its management; by treating him as a man, and not as a machine; by letting individuality have play; by ensuring that every man, even though not brilliant, shall if he works steadily be decently housed, clothed, and fed; by shielding men from coercion by their fellows, tending to reduce their efficiency; and by promoting in every way mutual regard and trust between employers and employed.

(To be concluded.)

Newcastle-upon-Tyne Local Section.

The first meeting of the current session of the NEWCASTLE LOCAL SECTION was held on November 12th, at the Mining Institute, Newcastle. Mr. H. W. Clothier, the retiring chairman, made reference to the death of Mr. Duddell, whom he characterised, as one of the most brilliant men in the electrical industry, who took so great a part in the electrical problems connected with the war that he absolutely wore himself out. He also made an urgent appeal on behalf of the Volunteers for the signalling corps of which men were wanted, and announced that one of their members, Acting-Major Geo. Stamp Taylor, R.E., had been decorated with the Military Cross. He was formerly connected with the electrical service of the North-Eastern Railway Co.

Mr. A. H. MARSHALL (Middlesbrough), the new chairman, said that recently nothing had stood out so prominently as the necessity of a better utilisation of our coal supplies and the giving of a cheap supply of power to the industries of the country, and he purposed to discuss the use of electricity and its bearing on fuel-saving in the iron and steel trades; it seemed to him that it was with those trades that the electrical industry would be associated for its greatest development in the immediate future. There was every indication that the next few years would see a greater combination of interests, better application of capital, and the utilisation of every means to economy. This must result in the extended employment of electricity. With efficient plant and means for the recovery of surplus heat, it was commercially possible to supply all the heat and power requirements of a works that was laid out complete with coke-ovens, blast furnaces, steel furnaces, and mills, from the combustion of the coal fed into the coke-ovens. This was an ideal arrangement which had been aimed at, but not attained, because even the largest undertakings had not been able either to dispense with their coal-fired heating plant or to justify the capital expenditure necessary to make full use of their waste energy. But such an economical arrangement could be obtained if one applied the advantages of linking-up to the electrical end. The idea that there were enormous quantities of gas and waste heat which could be converted into electrical energy and used for outside purposes, was a misunderstanding. It was only by taking full advantage of every means available for heat

recovery that there was any margin of power to spare in a properly co-ordinated undertaking. He submitted the following figures showing how the energy of the coal as fed to the coke ovens was distributed in the process of coking, smelting, and steel making. The energy values were expressed in Kelvins (K.W.-hours), and he was dealing with the conditions of iron and steel manufacture on the North-East Coast, taking as a basis 1 ton of ordinary Durham coking coal, having a value of 12,500 B.T.H.U.

TABLE I.

DISTRIBUTION OF ENERGY IN 1 TON COAL, 12,500 B.T.H.U. CONTAINING 8,200 KELVINS.

Quantity of product.	Carbonising 1 ton of coal.	Kelvins applicable for conversion to power.
5,500 cb. ft.	Gas used on ovens ...	690
5,000 cb. ft.	Gas surplus ...	630
7 ton	Coke ...	6,000
65 ton	Coke breeze ...	300
100 lb.	Tar ...	470
2½ gallons	Benzol ...	110
		8,200
	Smelting 64 ton pig-iron.	
31,700 cb. ft.	Gas used on stoves ...	930
73,800 cb. ft.	Gas surplus ...	2,160
1 ton	Slag (sensible heat)...	650
64 ton	Pig-iron (sensible heat)	250
	Furnace react'ns & loss	2,010
		6,000

UTILISATION OF SURPLUS GAS FROM COKE OVENS AND BLAST FURNACES.

Making steel (68 ton)	1,200	300
Reheating ingots (do.)	390	—
Balance ...	1,200	1,200
	2,790	2,500

CONVERSION TO ELECTRICAL OR MECHANICAL POWER.

Total available energy ...	2,500
Less slag value ...	650
	1,850
Thermal efficiency ...	15 %
1,850 × 15 = 280 K.W.-hours per ton of coal.	

In order to fix the idea, he took the case of a group of works equipped with four 70-oven batteries, consuming 8,700 tons per week, five blast furnaces each making 1,100 tons of pig per week, and sufficient open-hearth steel furnace capacity and rolling mill plant to convert the whole of the pig-iron make into finished steel sections; 8,700 tons of coal per week was, at a steady rate of consumption, approximately 50 tons per hour.

TABLE II.

KW. OUTPUT.

Coal consumed per hour...	50 tons.
Electrical energy per ton of coal	280 Kelvins.
Nominal output, 280 × 50	= 14,000 KW.
Minimum output, 14,000 × 76	= 8,400 KW.
Average output, 14,000 × 785	= 11,900 KW.

KW. LOAD.

Units required per ton of coal.	Mean kw.	Load factor.	Max. kw.
Coke oven auxiliaries }			
Blast furnace do. }	40 × 50	2,000 at	76
Steel furnace do. }			3,300
Blowing plant (120 × 64)	77 × 50	3,800 at	79
Rolling mills (110 × 68)	75 × 50	3,700 at	76
		9,500	14,000

Average output units per week, 11,900 × 168	= 2,000,000
Consumption do. 9,500 × 168	= 1,600,000

Surplus ...	400,000
-------------	---------

This table shows the power consumed at the works.

The coke-oven results were those obtained with any well-known make of by-product regenerative oven, operated under ordinary commercial conditions. Mr. Marshall referred to the present state of things to show what scope there was for an improvement from the point of view of fuel economy. In old-established Cleveland practice the surplus heat from the blast furnaces was converted into power by means of shell-type boilers in open settings and non-condensing steam engines at a thermal efficiency of about 5 per cent., and as a consequence there was generally little gas to spare. The exhaust steam turbine, in a good many cases, had improved the thermal economy by another 5 per cent. It was here that the power companies had been able to effect a very considerable saving of coal, while the advantages to the ironmasters had been great, not alone from the payment they received for what otherwise would be a waste product, but by getting the steam returned to them in the form of water. The advantages claimed for the electrical reversing mill had been well substantiated in practice, as was borne out by the fact that there were at present under construction at least seven reversing mill equipments, ranging from 10,000 to 20,000 H.P. in size, capable of doing the heaviest class of work, both roughing and finishing, with outputs of over 50 tons per hour. These new mills would altogether have a capacity of well over 1,000,000 tons of steel per annum. In addition, there

were numerous A.C. motor continuous mill drives being installed, in sizes of from 2,000 to 10,000 H.P. An application of electricity which had not received the attention it deserved was that of locomotive haulage for shunting purposes in such cases as they were considering, where probably there would be 12 locomotives in commission consuming 1,800 tons of coal per annum. On a very close estimate of work done, the thermal efficiency came out well below 1 per cent. The total consumption by steel works in the country for this purpose alone, on the same basis, was 160,000 tons per annum; taking for electrical driving a thermal efficiency to the motors of 10 per cent., there would be a saving of over 140,000 tons per annum. The most recent electrical development in steelworks practice, and one which had received a great impetus from the war, was the electric furnace, which was working very successfully.

What he had tried to show was that there was, on a commercial basis, sufficient energy in the coal required for the blast-furnace coke to perform all the various operations, thermal and mechanical, in and about an iron and steel works, but that owing to the large and sudden fuel variations, there must be a standing plant capacity at hand for immediate use, and also a means for consuming what surplus energy there was available. Only in this way was it possible to obtain the full and safe use of all the heat energy of the coal at low capital cost. Until such time as there was sufficient co-ordination of coke ovens, blast furnaces, and steel works to avoid the destructive burning of coal, it was evident that a linked-up electrical system was still more necessary for picking up the waste heat wherever it might be found, and passing it on to where it might be used. That was what, to a great extent, had already been done by the power companies. As an illustration of the scope of future electrical development, the total electrical energy to be dealt with, on the figures he had put before them, assuming them to apply to a make of steel of 14,000,000 tons, which, according to Dr. Addison, was what next year's output would amount to, and not counting the power taken by the blowing plant, worked out at 3,300,000,000 units per annum, with a maximum load of over 600,000 kw. In conclusion, he said it was somewhat surprising, considering the dependence of any fuel economy scheme upon electrical means for its realisation, how little that Institution had been identified with the enormous possibilities of electrical expansion, which had stood ready to hand at any time for the past 20 years. It was to be hoped that in future a great technical institution like theirs would have more influence on capital enterprise, and would carry more weight with the men responsible for the government of the country.

THE STATE OF TRADE.

By "COMMERCIAL."

THE prospect of the war continuing for an indefinite period to come has naturally prompted the commercial leaders of the staple pre-war industries of the country to seriously review the present situation of trade and its future outlook. In the opinion of a great many of those who are in the best position to judge, the situation, to say the least of it, is far from reassuring.

During the past 12 months the conditions under which trade has laboured have been beset with so many unforeseen difficulties, and the essential basic principles upon which a business is governed have become so perverted, that to obtain a correct view of the state of trade throughout the country has proved almost a hopeless task. Yet we are strongly of the opinion of these commercial leaders themselves, that to carry on indefinitely under a false sense of prosperity created by new and passing conditions, while the old and proven sources of industry are allowed to pass out of control, as a result of outside interference, incompetence, and neglect, is to subscribe to a system that is as ruinous in effect as it is short-sighted in policy.

After making the fullest allowances for the abnormal conditions brought about by the exigencies of war, the conviction continually thrusts itself forward that too often the interests of trade are being sacrificed to the dictates and mandates of an inexperienced body of newly-arisen officials, whose encroachments upon the recognised privileges of trade have been allowed, under the plea of war necessity, to be carried to a length that is wholly unwarrantable.

Perhaps one of the best examples of the disorganised state of affairs at present ruling throughout the country may be found in the essential war industries themselves, which have a controlling interest in almost every other subsidiary trade of any importance. It is not unreasonable to expect that, after the valuable experience acquired in the three years that have elapsed, and the absorption and control of the best brains and equipment the country possesses, the war industries themselves would, at least, be conducted on sound business-like lines; yet, to judge from the complaints that are continually being made from various sources, this is, perhaps, far from being the case.

The source of the disorganisation proceeds very largely from the Government offices themselves. Whereas, until 12 months ago, they could be relied upon to pay their accounts in reasonable time and in good order, the complaint is being heard all round of the confusion and delay of the Government offices in not only failing to remit accounts long after they are due, thereby involving considerable financial inconvenience among traders, but in even failing to keep in proper order elementary records of consignments of

goods of which, long after they have been consumed, they have to admit "no trace."

As regards the railways, which are under Government control, the conditions are no better. It is almost a regular daily occurrence for one Government Department to insist upon every other interest being put aside until an urgent demand is executed, only to afterwards learn that the goods have been held up in the warehouse or at the station for intervals of a week or a fortnight while the railway companies among themselves decide when to carry them.

That the railways, which are one of the vital arteries of trade, and especially of war organisation, are hopelessly understaffed, and that the purely military demands upon them have been far too liberally responded to, there can now be very little doubt whatever. The Government was long ago warned of this impending danger by responsible business men, but once again the military influence overruled the commercial. It is, perhaps, a somewhat significant fact that whenever complaints are made as to the shortcomings of British trade organisations, as compared with those of other countries, either in peace or war times, the British railways are almost invariably found to rank among the chief offenders.

The continued increase in the wages bill presents, perhaps, one of the most perplexing problems a business management has ever had to contend with. Whatever doubts the employer may entertain as to the Government's wisdom in keeping down discontent in other directions by imposing these additional burdens upon trade, he has practically no voice whatever in the matter while the Government has the power to dictate what he must do.

We have no desire to criticise the Government upon what it considers the best policy under the existing difficult and unprecedented conditions, but we should feel more reassured, as regards the future, if the Government openly declared its intention, as we have before suggested in these columns, it ought, in common fairness, to offer to do, not to abandon the employers after the war to settle as best they can this chaotic problem of wages readjustment, in connection with which so much bitter controversy and discontent are likely to be associated.

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, 11th Holborn, London, W.C., and at Liverpool and Bradford.

- 16,103. "Insulator and binder for telegraph, telephone, electric, &c., wires." A. SPENCER. November 5th.
- 16,116. "Magneto-electric machines." G. BOWRON. November 5th.
- 16,120. "Maintaining constant voltage in lighting circuits." AKT. GES. BROWN, BOVERI ET CIE. November 5th. (Germany, November 11th, 1916.)
- 16,122. "Constitution of the magnetic circuit in electric ignition apparatus for internal-combustion engines." AKT. GES. BROWN, BOVERI ET CIE. November 5th. (Germany, January 12th.)
- 16,136. "Electric accumulator boxes." C. R. D. PRITCHETT, & PRITCHETT AND GOLD & ELECTRICAL POWER STORAGE CO. November 5th.
- 16,145. "Electric furnaces." N. PRENTICE. November 5th.
- 16,154. "Vats for accumulators, batteries, etc." ETABLISSEMENTS DE DION BOUTON SOC. ANON. November 5th. (France, January 11th.)
- 16,179. "Incandescent lamps." W. D. HAMILTON. November 6th.
- 16,194. "Starting devices for internal-combustion engines." A. L. M. VRIES & J. GRAY (Reynolds & Ayres). November 6th.
- 16,201. "Engine-starting apparatus." G. GREEN & F. MAY. November 6th.
- 16,202. "Electric switches." A. HOLT. November 6th.
- 16,223 & 16,224. "Electric heating and cooking apparatus." W. P. BENNETT. November 7th.
- 16,231. "Telephone receivers." A. MARR. November 7th.
- 16,244. "Electric signalling system." F. G. BELL, W. C. DAVEY AND STERLING TELEPHONE & ELECTRIC CO. November 7th.
- 16,248. "Electrically-heated gauntlet gloves." C. G. NORRIS. November 7th.
- 16,261. "Electric accumulators." W. H. EXLEY & H. LEITNER. November 7th.
- 16,263. "Railway signalling." MCKENZIE, HOLLAND & WESTINGHOUSE POWER SIGNAL CO. & UNION SWITCH & SIGNAL CO. November 7th.
- 16,264. "Railway signalling systems and relays for use therein." MCKENZIE, HOLLAND & WESTINGHOUSE POWER SIGNAL CO. & UNION SWITCH & SIGNAL CO. November 7th.
- 16,265. "Magneto-electric machines." BRITISH THOMSON-HOUSTON CO., H. W. H. WARREN & A. P. YOUNG. November 7th.
- 16,266. "Magneto-electric machines." BRITISH THOMSON-HOUSTON CO., A. G. SUMMERY & A. P. YOUNG. November 7th.
- 16,267. "Magneto-electric machines." BRITISH THOMSON-HOUSTON CO. AND A. P. YOUNG. November 7th.
- 16,276. "Rheostats." SIR W. G. ARMSTRONG, WHITWORTH & CO. & W. E. DARR. November 7th.
- 16,279. "Regulating shunt dynamos." AKT. GES. BROWN, BOVERI ET CIE. November 7th. (Germany, November 11th, 1916.)
- 16,286. "Terminal connectors for electrical conductors." O. ZIMMERMAN. November 7th.
- 16,317. "Means for controlling electric lighting of motor vehicles." W. CURTIS. November 8th.
- 16,320. "Conduit fittings for electrical wiring installations." W. F. BOYD. November 8th.
- 16,321. "Device for closing orifices in roof and walls of electric furnace through which electrodes pass." W. TRAVIS & T. H. WATSON & CO. November 8th.
- 16,339. "Disposition of metals by electrolysis." M. A. BOLTON & A. WICKER. November 8th.
- 16,354. "Magneto-electric machines." BRITISH THOMSON-HOUSTON CO. AND A. P. YOUNG. November 8th.
- 16,371. "Spark plug for explosion motors." G. DE BRANDNER. November 8th.
- 16,394. "Galvanic batteries." G. ODDHAM & J. ODDHAM. November 8th.
- 16,398. "Spark plugs." J. GERKEN. November 8th.
- 16,426. "Railway signalling and high-frequency selective devices for use therein." MCKENZIE, HOLLAND & WESTINGHOUSE POWER SIGNAL CO., AND UNION SWITCH & SIGNAL CO. November 9th.
- 16,434. "Dynamo-electric machinery." E. GREENHILL, B. LONGBOTTOM AND LECTHERMO PATENTS, LTD. November 9th.
- 16,439. "Aerodrome lighting for landing of aircraft." CALLENDER'S CABLE AND CONSTRUCTION CO. November 9th.

- 16,448. "Microphones." H. S. ALLEN. November 9th.
- 16,449. "Electro-magnetic heating apparatus and elements." SOC. DES MOTEURS SALMON (System Canton-Unne). November 9th. (France, November 20th, 1916.)
- 16,465. "Spark plug." E. A. BARON, G. BARON & J. J. BARON. November 9th.
- 16,475. "Electrical heating apparatus for application to clothing and fabrics." A. H. CURTIS, IGRANIC ELECTRIC CO. & S. R. WRIGHT. November 9th.
- 16,477. "Electrically-heated gloves." C. N. HOLMQUIST. November 9th.
- 16,499. "Starters for electric motors." ELECTRIC & ORDNANCE ACCESSORIES CO. & N. G. LANGRISH. November 10th.
- 16,507. "Electric furnace." C. H. VOM BAUR. November 10th.
- 16,516. "Jointed arms or brackets for carrying incandescent electric or gas lamps." H. C. TOFIELD. November 10th.
- 16,517. "Electrical alternating current relays." ELECTRIC CONTROL, LTD., AND O. EISEN. November 10th.
- 16,532. "Electric vehicle, &c., lamps." W. H. EGGINTON & H. LUCAS. November 10th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

- 10,576. HIGH-FREQUENCY GENERATORS FOR WIRELESS TELEGRAPHY AND TELEPHONY. J. Bethend & E. Girardeau. August 10th, 1915. (101,148.)
- 12,559. AUTOMOBILE SIGNALS AND THE LIKE. E. T. Gray & A. T. Hoevet. September 5th, 1916. (110,373.)
- 13,080. TELEGRAPHY. J. S. Withers (K. C. Cox). September 14th, 1916. (110,374.)
- 13,671. DYNAMO-ELECTRIC MACHINES. British Thomson-Houston Co. & A. P. Young. September 26th, 1916. (110,376.)
- 14,812. ELECTRODES FOR SECONDARY BATTERIES. S. F. Tyler & E. H. Naylor. October 18th, 1916. (110,396.)
- 14,853. ELECTRICITY MULTICORE CABLE DIVIDING BOXES OR APPARATUS. British Insulated & Helsby Cables, Ltd., & R. W. Blades. October 19th, 1916. (110,399.)
- 15,242. ELECTRIC HEATING AND MELTING FURNACES. V. Stobie. October 26th, 1916. (110,409.)
- 15,742. DYNAMO-ELECTRIC MACHINES. A. H. Midgley & C. A. Vandervell and Co. November 3rd, 1916. (110,421.)
- 16,041. ELECTRIC SIGNALLING. H. Green. November 9th, 1916. (110,424.)
- 17,048. ELECTRIC HEATING APPARATUS. M. J. Railing, J. H. Farthing & F. Winstanley. November 28th, 1916. (110,438.)
- 17,158. APPARATUS FOR DETECTING FIRE-DAMP IN MINES. T. J. Thomas. November 29th, 1916. (Addition to 15,094/15.) (110,439.)
- 18,054. RAILWAY SIGNALLING SYSTEM. E. Paganini. December 23rd, 1915. (102,953.)

1917.

- 1,453. MEANS FOR LOCKING ELECTRIC LAMPS IN THEIR SOCKETS. G. R. Beith and British Agencies, Ltd. January 29th, 1917. (110,462.)
- 2,494. MANUFACTURE OF ARMATURE DRIVING SPINDLES FOR MAGNETO-ELECTRIC MACHINES. F. R. Simms & Simms Motor Units, Ltd. February 20th, 1917. (110,466.)
- 3,125. APPARATUS FOR THE ELECTROLYTIC PRODUCTION OF COPPER AND OTHER METALS. March 2nd, 1917. M. V. Garin. (110,474.)
- 4,237. ELECTRICAL CONDENSERS AND PROCESS OF MAKING SAME. Philips, Brinton Co. March 23rd, 1916. (105,333.)
- 4,860. SPARKING PLUG. F. A. Saxelby, F. H. Bluemel & Bluemel Bros. April 4th, 1917. (110,492.)
- 4,865. PLUG CONNECTIONS FOR ELECTRIC CIRCUITS. H. Lucas & W. H. Edwards. April 4th, 1917. (110,493.)
- 5,267. IGNITION DYNAMO-ELECTRIC GENERATORS. L. J. le Pontois. April 13th, 1917. (110,496.)
- 7,004. ELECTRIC LAMP HOLDERS. Cable Accessories Co. & F. H. Reeves. May 16th, 1917. (110,509.)
- 7,150. WIRELESS TELEGRAPHY AERIALS. S. Hall. May 18th, 1917. (110,513.)
- 9,801. ELECTRIC SWITCHES. H. H. Berry & W. J. Markham. July 6th, 1917. (110,523.)
- 10,113. ELECTRODES FOR USE IN ELECTROLYTIC GAS GENERATORS. I. H. Levin. December 20th, 1915. (Divided application on 15,357/16.) (108,477.)
- 11,867. HEATING CONDUCTORS OF THERMIC TELEPHONES. Naamloze Venootschap de Nederlandsche Thermo-Telefoon Maatschappij. September 15th, 1916. (109,797.)

Electric Lighting and the Value of House Property.—

In the Bow County Court, last week, Judge Graham, K.C., decided that to have a house fitted out with electricity enhanced its value. Messrs. E. J. Rose & Co., Ltd., sued Wm. Geo. Shinn, of Chiswick, to recover £23. Defendant decided to move out of London in a hurry, and saw Messrs. Trimming, the agents for the plaintiffs, about a house at Teddington, and it was alleged that he agreed to take it on a three years' lease. Fitting it out with electricity was spoken about, and the plaintiffs agreed to pay half. Top speed was the only question, and the work was proceeded with at once, the completion being promised in eight days. The house had to be papered as well, and he chose the paper. The electric lighting actually cost £26 10s., of which they were asking £13 5s. When they sent the agreement to him to sign, however, he refused, saying his wife was too ill to be moved. They had done the work, and wanted the payment. Mr. Singleton, of Messrs. J. Singleton and Sons, electric light fitters, Hampton Hill, said they fitted the electric light. He did not think it enhanced the value of a house much, as some people wanted gas, and were quite content with it for light as well as for cooking. The plaintiffs said that electric light would not benefit at all, as people did not specify for it. He did not consider electric light was a factor in the matter at all. The defendant said they promised to send the agreement along for signature in two days, but it did not arrive for four, by which time he thought it was off, and had taken another house. Counsel for the defence said it was a preposterous claim that this house should be fitted with electric light and he should not be allowed a penny for it. Anybody knew that fitting a house with electric light increased its value. Judge Graham decided that the value was increased, and gave a verdict for the plaintiff for £21 only, and costs.

THE
ELECTRICAL REVIEW.

VOL. LXXXI.

NOVEMBER 30, 1917.

No. 2,088.

ELECTRICAL REVIEW.

THE I.E.E. AND CURRENT TOPICS.

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We have recently been overwhelmed with a torrent of addresses of Chairmen of Local Sections of the Institution of Electrical Engineers, all, as well as the address of the President, delivered within a period of eight days, and have found it a difficult matter to digest so generous a feast of reason, contrasting so sharply with the straitened regimen imposed upon our alimentary organs. The Presidential Address alone would have sufficed to provide a fruitful source of topics for discussion; we have already touched upon some few of its prominent features, and must content ourselves with a brief reference to others.

In common with several of the Chairmen, Mr. Wordingham laid stress upon the immense importance of research in connection with our industries not only in the development of new methods and discoveries, but also in the field of pure science, in which the seed is sown that forms the indispensable origin of such—and added his quota to the universal appeal for co-operation between all classes of workers. He also drew attention to the discouragement usually met with by inventors in this country, and this is a point which for generations has acted as a brake on the wheels of progress; apparently we are, as a nation, inherently sceptical as to the value of new ideas, of which, nevertheless, we have always been prolific. It would be easy to cite scores of instances in which British inventions, turned down with contempt at home, have been eagerly taken up and developed by foreigners, to their great profit; the striking example adduced by the President will, however, suffice, and it is only to be regretted that we are not always so fortunate as in this instance. In the aggregate an immense amount of invention and discovery of British origin must thus have been driven abroad, with the result that, besides losing the opportunity to establish new industries, we have later had to pay heavily for the products of the foreign manufacturers. Not only should our industrial leaders do more individually to encourage and develop the spirit of invention by more liberally—or, rather, more equitably—rewarding inventors, basing their assessment on the true value of the new ideas instead of the usual plan of paying as little as they can in decency offer, but also our patent laws should be radically revised in favour of the inventor. The principle at the basis of "letters patent" is to obtain full publication (as the name implies) of new discoveries, for the benefit of the nation, whilst rewarding the inventor by securing to him a monopoly of the profits for a term of years; it is needless to point out how far our patent laws fall short of attaining either of these ends, and the utter misconception of the situation which is cherished by the authorities is blatantly exemplified by the fact that the Patent Office is conducted on the lines of a revenue-earning department! Who would dream of running the National

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The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 8d.; Canada, £1 3s. 10d. (\$5.80). To all other countries, £1 10s.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.

AUCKLAND N.Z.: Gordon & Gotch, Albert Street; The Mining and Engineering Review, 31a, Strand Arcade, Queen Street.

BRISBANE: Gordon & Gotch, Queen St.

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DUNEDIN, N.Z.: Gordon & Gotch, Princes Street.

JOHANNESBURG, CAPETOWN, BLOEMFONTEIN, DURBAN, PORT ELIZABETH, &c.: Central News Agency, Ltd.

LAUNCESTON: Gordon & Gotch, Cemetery Street.

MELBOURNE: The Mining & Engineering Review, 90, William Street; Gordon & Gotch, Queen Street.

MILAN: Fratelli Treves.
NEW YORK: D. Van Nostrand, 25, Park Place.

PARIS: Boyvean & Chevillet, 22, Rue de la Banque.

PERTH, W.A.: Gordon & Gotch, William Street.

ROME: Loescher & Co., Corso Umberto I° 307.

SYDNEY: The Mining & Engineering Review, 273, George Street; Gordon and Gotch, Pitt Street.

TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.

WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

THE "ELECTRICAL REVIEW'S"

ELECTRICAL & ALLIED TRADES DIRECTORY

(THE RED BOOK),

1917 EDITION.

H. ALABASTER, GATEHOUSE & KEMPE,
4, Ludgate Hill, London, E.C. 4.

Physical Laboratory as a trading concern, in order to assist the national revenue? Yet to do so would be exactly analogous to the practice pursued in the case of the Patent Office, which should spend every penny of its revenue on the improvement of the facilities offered to inventors, and might justly claim a national subvention in addition. We are glad to observe that there is a strong movement in progress with a view to bringing about drastic reforms in this backward department.

The National Electric Proving House, advocated by the President, is an institution for which we also have repeatedly pressed: such a scheme was actually in course of germination just before the outbreak of war. The benefits that it would confer upon the electrical industry would be almost incalculable, and we most sincerely hope that Mr. Wordingham's powerful advocacy, backed as he is by the B.E.A.M.A., will bring it into existence at the earliest possible date, as a matter of urgency.

For the President's views on the future policy of the Government for the furthering of British trade we have nothing but praise: the same applies to his weighty warning with regard to the denial of trading relations with the German after the war. Let the German salesman learn that his wares, like his deeds, stink in our nostrils, and that no Briton who values his self-respect can enter into any sort of intercourse with members of a nation that bedded our wounded men, prisoners in their hands, on horse-dung, and kicked and spat upon them as they lay in silent agony.

On behalf of science we must enter a gentle protest against the conclusions at which the President has, to our mind, too hastily arrived. He refers to the effect upon the German nation of "the cultivation of science to the exclusion of other human activities," and infers that science is to be held accountable for the barbarities of which they have been guilty. Surely this is a mistaken view. In the first place, the Germans, above all other nations, have made a speciality of those studies collectively known as the humanities, to such an extent, indeed, that our classical teachers are constantly referring their students to German authorities upon the classics and upon other branches of literary erudition, including—oh, shameful confession!—the study of the English language and history. In recent years, comparatively speaking, they have studied science also, but their vile prostitution of the teachings of science to the ends of military aggression no more reflects upon the virtues of a scientific training than upon the value of classical studies. It is their inherently brutal temperament, their intense egoism and vainglory, that is at the root of their misdeeds. Those of us who are crying out for reform in our educational methods demand not, as Mr. Wordingham suggests, the elevation of science to the position of "the be-all and end-all of education and existence" by no means: what we call for is a scientific education, a very different thing, in place of the lop-sided and myopic system that at present dominates our public schools and older universities, and we most heartily endorse the President's support of "those moral and religious principles which alone can afford adequate or worthy motives for human action." As he says himself, engineering as a profession, "rightly apprehended, is one of the most ennobling," bringing a man "into intimate contact with the laws and processes of Nature, and their everlasting truths," a sentiment directly opposed to the view that the study of science can debase the mind.

In conclusion, while we have had occasion to differ in some respects from the President, we are inclined to the belief that our differences are matters of expression rather than of opinion, for we have shown that on those very points his words can be quoted in support of our contentions: and we have

to thank him for an address which contains abundant food for thought, and should be read by every member of the electrical industry.

The One-man Light-weight Safety Car.

THE technical equipment of the average British tramway undertaking has shown comparatively little progress for a good many years; and in many cases the original type of equipment is still used. At the same time, operating conditions have undergone a complete change, especially during the period of the war, and no doubt many tramway managers have given serious thought to the future of their undertakings under the conditions which may possibly exist for some years to come. We refer more especially to the smaller systems, which may be faced not only with abnormal operating costs, but also with a falling-off in the travelling habit if more stringent economic conditions prevail. If with such undertakings the problem of making ends meet has always been a pressing one, what will it be in the years to come?

Consideration of this matter leads to the reflection that British tramway authorities are, perhaps, rather too prone to follow in each other's footsteps, irrespective of conditions. It would, for instance, be surprising if the identical type of car which is a satisfactory street transport unit in, say, a city of 300,000 people, were also the best transport unit in a provincial town of, say, 30,000 inhabitants. In this connection, we cannot help feeling that the increasing use of the light-weight one-man car by the smaller American tramway systems carries with it a valuable hint to our own tramway authorities. The American problem was one of "more service at less cost," which, although arising from a dissimilar cause, *i.e.*, jitney bus competition, has many points of similarity to our own. At the present time about 150 undertakings operate cars of this type, so that their success in the States as a means to an end cannot be doubted.

The American one-man car is the result of specialised design, with a view to reducing weight and attendance, or, in other words, power, maintenance, and wages costs. The cars are single-truck single deckers, built low with 24-in. diameter wheels, and equipped with two 25-H.P. high-speed motors, which weigh about 36 lb. per H.P., as against the 58 lb. of the old standard 35-H.P. motor, and a corresponding reduction is made in controller weight. Air brakes, automatically interlocked with step and door mechanism, and, in emergency, with the power circuit and sanding arrangements, are provided, and the design obviously lends itself to high rates of acceleration and retardation, to time saving in service stops, and to safety conditions. While it is true that the pay-as-you-enter idea has not caught on in this country, it must be remembered that the system has had no fair trial here, and that the passenger has not been confronted with the alternatives of paying a higher fare or giving himself a little extra trouble.

The small tramway system has need of a more flexible car unit than the standard four-wheel double-decker commonly in use; congested traffic plays no part in its problem—rather the reverse, and this is another reason why the more nimble light-weight car, if we may judge by American enthusiasm as to its traffic-building propensities, should receive consideration here. We hesitate to accuse our tramway authorities of lack of originality, especially in view of Mr. Baker's advocacy of single-deck cars under special conditions at Birmingham (see *ELEC. REV.*, page 373), yet the fact remains that, for some reason or other, British tramway practice, with minor exceptions, remains stationary.

THE EDUCATION AND TRAINING OF ENGINEERS.

By "RADIX."

THE subject dealt with at the meeting held on October 25th at the Institution of Civil Engineers, namely, the education and training of engineers, is one of vast and far-reaching importance to the welfare of the nation, and the country owes Mr. A. E. Berriman and Mr. A. P. Fleming a deep debt of gratitude for the initiative they have taken in this matter. A pioneer's lines do not lie in pleasant places as a rule, and until the value of his work comes to be realised—more often than not years after his death—he is apt to be looked upon as a "crank," and to become an object of scorn to those who are not far-sighted, or of open hostility to those with whose interests his ideals threaten to conflict.

In the course of a lecture delivered before the Liverpool Philomathic Society in April, 1869, Huxley said: "I ask anyone who has adopted the calling of an engineer, how much time he has lost when he left school, because he had to devote himself to pursuits which were absolutely novel and strange, and of which he had not obtained the remotest conception from his instructors? He had to familiarise himself with ideas of the course and powers of Nature, to which his attention had never been directed during the whole of his school-life, and to learn, for the first time, that a world of facts lies outside and beyond the world of words. I appeal to those who know what engineering is, to say how far I am right in respect to that profession."

These words are as true to-day as they were 48 years ago.

Our whole system of education needs reform, not only with a view to afford native talent greater scope and facilities for development, but also to provide better means for ascertaining the existence of latent ability. The etymology of the word "educate" suggests the very antithesis of our present methods. Under our existing system it is largely a matter of chance whether that which lies dormant in the child's mind is "led out" or is stifled by what it is sought to "cram in." It is absurd and illogical to subject the mind of each youngster to an identical course of training. A system of education should be an intelligent, not a mechanical, one. It should stimulate and develop individuality and elasticity of thought, and not formulate a standard of knowledge of facts which merely calls for a certain degree of retentiveness in the memory.

One speaker referred adversely to the value of a college education. Another defended it, and stated that "there is nothing wrong with a college education." That is technically true. There is nothing *wrong* with it, but in most cases it results in a greater or less degree of agility in mental gymnastics which one finds wholly out of place in the storm and stress of after-life. I will give an instance, for the facts of which I can vouch:—

A man attended the three years' engineering course at one of our best-known colleges during the 'eighties. Each year he took first or second place in the class examination in heaven knows how many subjects. He was awarded two scholarships. He then spent about two years in the shops. He had previously studied for upwards of four years in France and Germany, and spoke both languages. After his shop experience he was offered the magnificent salary of £50 a year as assistant to his quondam professor of engineering. Now the really sad part of this story is that experience in after-life proved to this man that his professor was perfectly

right. He was certainly not worth more it is doubtful if he was worth even as much.*

This man has commanded four-figure retainers for many years, but he attributes this to the education he gave himself in the school of experience of the world, and of men and things.† The best men he has had as assistants have been those who did not write letters of the alphabet after their names, but who as Mr. Hadow would say were *good* men as well as skilled men; they were men of sound, healthy moral principle.

This experience, though by no means singular, should not lead to an under-estimation of the value of knowledge of theory in engineering. Without the science of engineering little progress would be made. I am contending against the inharmonious mental development which results from the kind of engineering training one receives at college. The scientific part is excellent, but the practical part is almost worse than useless. One of the speakers, in referring to a machine which had been made in the laboratory of a certain college, said that it was admirable in every respect, but there were two questions which no one was allowed to ask about it: how long it had taken to make, and what it had cost.

In view of the vast and ever-increasing accumulation of knowledge, scientific and practical, I feel very strongly that we have already entered upon an era in which any attempt on the part of one man to keep pace both with scientific research and with its application in practice, is foredoomed to failure. The specialist in practical engineering must not specialise also in science, and, per contra, the scientific engineer must not pose as a practical man. They should hunt in couples, and each should know enough about the other's field of activity to ensure intelligent co-operation.

There are two important points to which the Committee should give their attention. They should endeavour to secure State aid for carrying on experimental research on a much larger scale than has hitherto been possible with the resources at the command of individuals and firms. Secondly, we must cease from blinding ourselves to the progress made by other nations. We have been prosperous in the past in spite of, rather than because of, our methods. Those whose business it should have been to read the handwriting on the wall have wrapped themselves up in the cloak of insular prejudice, and have even refused to listen to the warnings of those who travelled beyond the confines of this island. "Blinkers off" should be one of the watchwords of the Committee.

The reference, on the part of five speakers, to the moral element in the education and training of engineers is exceedingly significant, for it shows that we are awakening to the fact that "the tree of knowledge is not the tree of life"; but the diffident and almost apologetic tone of those allusions is sadly suggestive of the growing realisation that the moral law is becoming honoured more in the breach than the observance—a fact which is at the root of most of the social evils of the day.

Take the present-day relations between Capital and Labour. Can one say, with justice, that either side is wholly in the right? Unfortunately, those

* "When a man's knowledge is not in order, the more of it he has the greater will be his confusion of thought. When facts are not organised into faculty, the greater the mass of them the more will the mind stagger along under its burden, hampered instead of helped by its acquisitions. A student may become a very Daniel Lambert of learning, and remain utterly useless to himself and all others." (Herbert Spencer, "Study of Sociology," Chap. XI, p. 267.)

† "Strictly speaking, every one must educate himself." (Hamilton, "Metaphysics," Lecture I.) The objective truth of this, as a fact of experience, and its bearing upon the vital importance of the development of Will and the formation of proper habits of mind in the young, needs no demonstration.

who have championed the cause of Labour have for the most part been recruited from the ranks of those whose minds are inharmoniously developed. It is not difficult to see clearly if one does not see far, and the fatal error underlying the well-meant efforts of these would-be reformers was to attempt to accomplish in shirt-sleeves that which a diplomat would have approached in evening dress. They sought to fight Capital instead of co-operating with it, with the very natural consequence that the party attacked adopted the same tactics. Production has thereby suffered enormously, and, what is worse, the *moral* of both men and masters has tended to degenerate.

Incidentally, both sides seem to have ignored the fundamental principle that Capital and Labour, though necessary factors in the production of wealth, are in themselves powerless to accomplish anything useful without the exercise of directive ability, just as the conception of "force" necessarily involves somebody or something that gives it direction.

(To be continued.)

THE ROMANCE OF ELECTRICAL WORK.

By A. ARNOLD.

IN the early days of electric lighting, the glamour of novelty spread itself over all dealings with the little-known science, and the pioneers of progress were afire with enthusiastic fervour, alike in their serious work and in their imaginative ideas of the future field of their activities. Romance was writ large upon the earlier applications of electrical transmission of energy and its utilisation as a lighting agency. Men dabbling with it were regarded as being of necessity a separate species of the *genus homo*, and were looked up to almost as supermen. The idea that without fire, and by nothing more than the touch of a button, light could be mysteriously tapped, appealed very strongly to the imaginations of a generation accustomed to messy oil lamps and an indifferent gas supply. The vast majority of the populace had not come into more intimate contact with electric lighting than by seeing a few meagre examples at exhibitions, or perhaps noticing a little converted public lighting. The possibilities of power transmission, electric cooking and heating, wireless telegraphy, and the many other applications of electrical utilisation of energy were not only unknown, but unsuspected, at any rate by the non-technical public. Technical men, to some slight degree, realised a part of these possibilities, but certainly never dreamt to what enormous proportions and importance the electrical supply of energy would grow. A fine spirit of almost altruistic enthusiasm was in their ranks, and their ardent zeal for the best that they knew in electrical matters and the conscientious energy with which they tackled their everyday work and the new problems that were continually arising began to infect even the phlegmatic public. The progress that was made in the popularising of electric lighting among the ultra-conservative people of this island was due not only to the intrinsic merits of the commodity, but to an even larger extent to the enthusiasm and zeal of those pioneers who undertook its development.

To-day nearly all the ardour of that glorious time has vanished. Familiarity has indeed blunted our appreciation of the romance electrical. Every man is for himself—out to make the most money out of the job, and caring nought for anything else. The altruistic ideas and ideals have all frankly disappeared, and electrical work has lost all its romantic glamour, and has become merely a method whereby Capital and Labour exploit the public purse for their own advantage. Even among municipal concerns the electricity department has begun to be considered a necessary evil, rather than the glorious opportunity it may have been perceived to be for providing one and all with a plentiful supply of energy at cost price, to the end that the locality may prosper and the community at large benefit thereby.

Companies are usually candid about their aims, which are first and last financial, and to the attainment of their ends they will even in some cases sweat their employees and grudge their plant the expansion and attention it should rightly receive. The attitude of the individual engineer, too, has become less noble, almost ignoble. Men in this kind of work, no less than in almost every other path of life, become so sophisticated that they find it practically impossible to enthuse upon any subject, and particularly so upon the work which occupies a very large portion of their lives. Where is the enthusiasm of the old society meetings? They have degenerated into solemn advanced lectures, with but very few exceptions. And the personnel of the industry in general has become infected with the 20th century "fed-up-ism," and does as little as possible consistent with keeping the despised job.

The fruits of these things are becoming daily more apparent. There is a complete lack of understanding between the men and the managements, between the staffs and the managements, and between the managements and the public. The threatened railway strike in the middle of the greatest war ever undertaken was symptomatic of the general unrest prevailing; none the less dangerous, because it is usually less vocal than in this case. The men suspect the managements of making large profits and withholding more than a fair share, the managements consider that the men are taking advantage of the lack of labour to put forward unreasonable demands. Staff men are only waiting for the proclamation of peace to change their venue; they hope to obtain improved conditions and pay, considering that their extra work and worry has not been sufficiently recognised by their present employers. The employers apparently imagine that as they have been legally able to control their staffs during the war to a large extent, such conditions will last indefinitely; and hence if the staff men do not like their present status and pay, they can do the other thing. In many cases, too (with some shining exceptions), the management's attitude to the public has been equivocal. They have not seriously attempted to keep a reasonably competent staff, nor have they sufficiently impressed the authorities with the necessity, in the national interest, for permits to obtain new plant. The first item was doubtless due to patriotic but mistaken zeal; the second has limited the output of munitions, coal, &c., and has been as bad for the shareholders as for the country at large. The public would have benefited here again had the powers that be in the electrical world been gifted with a little more enthusiasm, imagination, and common sense. All these troubles are, to a great extent, due to lack of confidence between master and man, and to the want of co-operation between administrative bodies. Industry is at civil war; peace can come by the ruin of one of the combatants (in this case ruin of one entails collapse of the other) or by wise negotiation. Could confidence be restored, negotiations could take place; but the sincerity of the delegates must be beyond reproach. While suspicion is in the air peace is impossible, for the alternative red ruin of reaction or mob rule is unthinkable.

Cannot the old hearty relations between master and man (and assistants and man) be resurrected? Is industry too far riven to rise again to nobler things? Could the old enthusiasm and pride of each individual in his own life work be rediscovered, there would be fewer mean advantages taken, suspicion would give place to a hearty confidence that each man was working for the common good, and internecine strife would cease with a mutual redistribution of opportunities and privileges. The ancient age of romance and chivalry would return, and, coupled with modern civilisation's advantages, would make this world a very pleasant place. But probably this is too Utopian to be practical.

The moral, however, is obvious. Without being pessimistic, the present labour situation—giving that term the broadest significance—cannot be described as other than serious, and it is admitted to be so by many writers, even by those of anti-Socialistic tendencies. At the conclusion of the world-war the situation will be aggravated by the demobilisation of many thousands of workers newly released from discipline, and unless some alteration takes place before then the results will probably be disastrous. The attitude of the educated classes influences the workers very extensively,

and the present staleness in the former is a root cause of the disaffection of the masses. A return to the former ideals, to keenness and enthusiasm on the part of all in authority, would be an example which would exert a very steadying influence, and which, coupled with a sympathetic handling of the grievances which may be shown to be well grounded, would probably allay the prevailing discontent. And such a revivification of enthusiasm should not be difficult to electrical men, for, after all, romance is not dead. Too close application to detail makes it difficult to take the long view, it is true, but a few moments' reflection will show that even within the last few months there have been developments in electromechanical circles which would have appeared but the wildest of dreams to the preceding generation, and a closer following of the technical periodicals is a capital remedy for those who tend to become *blasé*. The realm of wireless telegraphy has a peculiar glamour for the heavy electrical engineering devotee, and *vice versa*, and even in these days of stress and hurry, a hobby of this sort is a valuable aid to sanity and enthusiasm. The participation in technical debates of the more informal sort (of which the Friday evening discussions of the Junior Institution of Engineers are about the best example) and the cultivation of the spirit of camaraderie among members of such Associations are other methods of combating incipient staleness, while keeping within strictly professional interests. In addition, some concern of a totally different and more personal nature may be indulged in with profit, and, indeed, the man is fatally prosaic who can only derive inspiration from contemplation of his own department of life. These many suggestions are not exhaustive, of course, but may serve to show that not only the pioneers, but their humbler followers may, if they will, retain their pristine zeal, and even be able to find some *joie-de-vivre*.

GAS FIRING BOILERS.

By T. M. HUNTER, M.A., B.Sc.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS.)

GAS as a boiler fuel was first used in connection with blast furnaces somewhere about the middle of last century. Huge quantities of dust were deposited in the boiler flues, resulting in a constant decrease of the evaporation, and requiring to be cleaned out every few weeks. Under these circumstances the possibilities of the fuel were not realised. About 25 years ago, gas-cleaning plants were introduced, which did away with this disadvantage.

The introduction of regenerative coke-oven plants next provided quantities of gas, which was also used for boiler firing. It was, however, found that even with this richer gas the efficiency of gas-fired boilers was still very low.

The theory gained ground that gaseous fuel was unsuitable for boiler firing, and that it was impossible with it to obtain anything like the efficiency or the evaporation obtainable in the same boiler by coal firing.

About 20 years ago the Mond by-product producer, followed by other producers, provided another source of gas in large quantities, and in some cases this gas was used for boiler firing. The author thinks that in no case yet has gas firing of boilers with by-product producer gas been made a commercial success, but he firmly believes that there are modern producer and boiler plants even now on the market which can make the gasification and gas-firing proposition a commercial success under suitable conditions.

Gas-cleaning plants made the use of producer and blast furnace gas possible in gas engines, but the adoption of steam turbines reduced the steam per horse-power-hour from 20 to about 10 lb., and it became evident that if gas-fired boilers could raise the steam at 75 per cent. efficiency the results from a modern turbine set would be as good as those from a gas-engine set, while as regards reliability and the skilled attendance required, the steam turbine was unquestionably first.

There is no doubt that gas-fired boilers have now a greater future than ever. Probably the time is not so far distant when our present method of burning coal together with its valuable by-products will be considered obsolete, and possibly even illegal. It will then be replaced by some type of by-product producer or coal distillation plant yielding gas, and this gas will without doubt be largely used for boiler-firing purposes.

Calorific Value of Gas.—The calorific value of a gas is expressed in this country as the number of therms (B.T.U.) in 1

cu. ft. at 60 deg. F. and 30 in. mercury column. On the Continent, normal conditions are 0 deg. C. and 760 mm. mercury.

The calorific value of a gas is found by burning the gas in a calorimeter, and measuring directly the heat produced. This method reduces all the products of combustion to the temperature of the atmosphere, and thus condenses the water vapour arising from the combustion of H₂ and hydrogen compounds. The value thus obtained is called the "gross calorific value" of the gas.

In almost every case where gas is burned for practical purposes, the water vapour arising from the combustion escapes to the chimney as a vapour, and is not condensed. It has, therefore, become the custom to treat the latent heat lost through the non-condensation of this water vapour, not as a charge against the boiler, but as a charge against the gas itself. The "net calorific value" of a gas—which is the value generally quoted—is the gross calorific value less the latent heat of the water vapour of combustion.

If in any special case the products of combustion are cooled down so far that some of this water vapour does condense, a calorific value more nearly approaching the gross calorific value would have to be used, otherwise the results shown would be quite deceptive.

To calculate the calorific value from the analysis of a gas, we multiply the volume of each constituent by the calorific value of that constituent, and add together the results. The following table shows the calorific values of the common constituents of gas; and an example is added to show the method of using the table.

Gas.	Gross calorific values.		Net calorific values.	
	Therms per cu. ft.	Calories per cu. metre.	Therms per cu. ft.	Calories per cu. metre.
Carbon monoxide, CO ...	314	3,062	311	3,062
Hydrogen, H ₂ ...	342	3,012	293.5	2,613
Methane, CH ₄ ...	1,063	9,460	966	8,598
Ethylene, C ₂ H ₄ ...	1,721	15,300	1,627	14,480
Hydrogen Sulphide, H ₂ S...	659	5,860	619	5,513

CALORIFIC VALUE OF A COKE-OVEN GAS.

Analysis, per cent.	Net calorific value.	
H ₂ 49.1	0.491 × 2,613 =	1,282
CH ₄ 32.6	0.326 × 8,598 =	2,800
C ₂ H ₄ 3.1	0.031 × 14,480 =	449
CO 8.1	0.081 × 3,062 =	248
N ₂ 6.6		
O ₂ 0.5		
100.0		1,779 calories per cu. metre.
		= 537 therms per cu. ft.

The question of gross or net calorific value of the gas often leads to misunderstandings. It is advisable in all contracts that it should be clearly specified which value of the gas is to be used, so as to avoid any possibility of friction. In all the calculations given in this paper the net calorific value of the gas is used.

Value of Gas.—Let us assume a coke-oven plant of 50 by-product ovens which deals on an average with 100,000 tons of coal per year, and yields 6,000 cu. ft. of surplus gas of 450 therms per cu. ft. per ton of coal. If this gas were burned with an efficiency of 80 per cent. it would be possible to generate 220,000,000 lb. of steam from and at 212 deg. F., which corresponds to 96,500 tons of steam per year.

If the value of a ton of steam to a colliery is taken at 1s. 3d., the value of the surplus gas will be just over £6,000, and each 1 per cent. efficiency lost or gained will make a difference of £60. If the 100,000 tons of coal should produce 70,000 tons of coke, the total value of the gas will be nearly 1s. 9d. per ton of coke.

Of the heat generated in a blast furnace 50 per cent. is consumed by the process of making iron, and the other 50 per cent. is recovered in the blast-furnace gas. If we assume one ton of coke to be used per ton of iron, and the value of blast furnace coke to be 18s. per ton, 9s. per ton of iron is represented by the calorific value of the gas. If the stoves consume 30 per cent. of the surplus gas, and if 10 per cent. be allowed for losses through bell lowering, 60 per cent. is available for boiler firing, representing a value of nearly 5s. 6d. per ton of coke.

Let us assume that a ton of coke is equivalent to 27,800,000 therms; then 13,900,000 therms per ton of coke will be available in the gas, and if 60 per cent. of that is surplus for boilers and gas engines, 8,340,000 therms can be burned under boilers.

If we again assume a boiler efficiency of 80 per cent., 8,340,000 therms would give 3.13 tons of steam from and at 100 deg. C. per ton of coke. If the value of steam at ironworks is 2s. per ton, which corresponds to a coal price of 12s., and an evaporation of 6 lb. of steam per lb. of coal, we obtain 6s. 3d. worth of steam per ton of coke.

In order to realise the economical importance of the whole question, let us assume the case of an ironworks with four furnaces using on an average 3,000 tons of coke per week. The value of the coke for boiler-firing purposes is in their

case £48,750 per year, and each 1 per cent. difference in efficiency means a difference of no less than £487. It is hardly credible, yet true, that scarcely any ironworks obtains a boiler efficiency of more than 50 per cent., and that many get an efficiency much lower than this, so we see that small ironworks as described above are losing 30 per cent. of £48,750, or £14,610 worth of steam a year, which could easily be recovered. The question of gas economy is thus seen to play a most important part in the financial prospects of ironworks.

Returning to the case of the ironworks described above, the loss per ton of coke is at least 1s. 11d. when assuming an efficiency of 50 per cent. As efficiencies are frequently as low as 40 per cent., the actual losses sustained are often over 2s. 7d. per ton of coke.

The manufacture of pig-iron in Great Britain was some 10,000,000 tons a year before the war, so that if the average loss is only 2s. per ton, the formidable sum of £1,000,000 a year is sent up the stacks of the ironworks of Great Britain.

Very few people at present use producer gas for boiler firing. On the other hand, at many works there are considerable amounts of waste products, like belt pickings, coke breeze, shale, &c., which are very rich in combustible matters, and yet unsuitable for boiler-firing purposes. Any proposition would be welcome which would render it possible to turn these waste products to profitable account without endangering the stability of the steam supply.

The fallacy of a producer gas proposal for boiler firing without absolute security of the results obtained in the boilers is evident if the following figures are taken into consideration. A modern producer will yield nearly 75 per cent. of the heat contained in the fuel as heat in the gas, and with the old combustion arrangements hitherto in vogue no higher efficiency than 50 per cent. can be counted on, so that only 37½ per cent. of the heat in the fuel appears as heat in the steam.

If we take a fuel containing 12,000 therms per lb., the total steam raised in a gas-fired boiler per lb. of fuel in the producer would not exceed 4½ lb. from and at 212 deg. F. Then, again, 1½ lb. of this had to be returned to the producer in the blast, so that the net evaporation for outside purposes was only 3 lb. per lb. of fuel. Under ordinary circumstances the same fuels fired into boilers would have given 7 or 8 lb. of steam per lb. of fuel. With modern combustion arrangements an efficiency of 50 per cent. with producer gas can be raised to 75 per cent., so that fuel of 12,000 therms will give 7 lb. of steam per lb. of fuel; and as with the latest by-product recovery producers the steam necessary for producing by-products has been reduced to the amount necessary to drive the blowers, &c., the actual yield would be over 6½ lb. of steam per lb. of fuel. The result in steam for outside purposes is not materially worse than if the fuel had been burnt in the boilers, and the by-products are available to provide for depreciation, interest, and profit.

Suitability of Gas for Boiler Firing.—Coke-oven gas gives comparatively higher efficiencies than the two other kinds of gas in gas-fired boilers owing to the greater ease with which it can be burned. The nature of the gas, however, renders it difficult to make burners which will deal with large quantities of gas. The comparatively narrow flues of Lancashire boilers offer so much resistance to a speedy expansion of the burning gas that unless we use forced draught the evaporation from coke-oven gas in Lancashire boilers is confined to 5,000 to 6,000 lb. per hour. If, therefore, new boilers are contemplated it will always be advisable, provided that the quality of the water permits it, to choose water-tube boilers. Coke-oven gas is particularly suitable for firing water-tube boilers, and with suitable combustion arrangements evaporations of 5½ lb. per sq. ft. of heating surface can easily be obtained at the highest efficiency.

Blast-furnace and producer gas though of comparatively low calorific value, provided that they are clean and supplied under suitable pressure, will give good results, both in Lancashire boilers and in water-tube boilers. With Lancashire boilers evaporations of over 8,000 lb. per hour can be obtained, and with water-tube boilers 5 to 5½ lb. per sq. ft. of heating surface.

Blast-furnace gas we have to accept as it comes from the furnaces. It is so important that the iron made should be exactly what is required, that the kind of gas produced is never likely to be a matter of much concern to the blast-furnace manager. We must accept the fact that occasionally the gas is hardly combustible at all, and we must devise means to deal even with this condition.

The matter is different in dealing with producer gas. Gas is here a valuable product, though only the second product in point of value. The manager of the producer has it in his power to give us a gas which is much more or much less suitable for boiler firing. We naturally wish the richest possible gas, as it is the easiest gas to burn. At one large Mond plant the gas was found to be just under 100 therms per cu. ft., while at many plants the gas is over 150 therms per cu. ft.

Apart from the question of calorific value, there is the question of the constituents of the gas. Two gases of similar calorific value can be shown which would give very different results on combustion. By-product producer gas is made by blowing steam and air into the producer fire, and the resulting gas contains hydrogen and CH₄. These gases, on burning, form respectively 1 and 2 cu. ft. of water vapour per cu. ft.

of H₂ and CH₄, and the latent heat absorbed in forming this vapour, viz., 966 therms per lb. of vapour, is at present one of the inevitable losses in the use of the gas. The only way in which this heat could be recovered would be by cooling the chimney gases sufficiently to condense the water vapour, and this is impossible with our present economisers. To show the losses which are inevitable from this cause, the author gives the analyses of several gases, the net calorific value, and the number of therms lost by latent heat in the water vapour caused by combustion.

	Coke-oven gas.	Blast-furnace coke-gas.	Moore producer gas.	Mond producer gas.
	Per cent.	Per cent.	Per cent.	Per cent.
CO ₂	—	12	12·7	16
CO	8·1	29	15·5	8
H	49·1	1·5	20·2	23·4
CH ₄	32·6	0·7	2·2	3·2
C ₂ H ₄	3·1	—	—	—
N ₂	6·6	56·8	49·4	49·4
O ₂	0·5	—	0·2	—
Calorific value (cold gas)	Therms. 540	Therms. 112	Therms. 132	Therms. 130
Loss by latent heat in vapour of combustion	58½	1½	12½	17

This table shows the great value of the losses from this cause. A gas is more valuable for boiler firing which has a greater proportion of CO to H₂, other things being equal. Producer buyers should look carefully into this point when specifying new plant. A certain amount of steam must be blown into the producer in order to recover the ammonia, but at present far more is used than the amount necessary for this purpose in order to cool the fire. The author believes that some other method should be adopted for this cooling. The Moore producer, mentioned above, does part of this cooling by means of a water jacket. It has been suggested that much of this cooling could be done by some method such as by blowing in boiler flue gases carrying, say, 15 per cent. of CO₂, and taking advantage of the absorption of heat which occurs when CO₂ is reduced to CO in the presence of heated carbon. This is known in America as the Eldred process. In this way the gas should be improved and much steam saved. The question, however, is still in the region of experiment.

(To be continued.)

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The I.E.E. Discussion on the Metric System.

In the note published in your current issue under the above heading, reference is made to the lecture I had the honour of delivering before the members of the Institution of Civil Engineers and Kindred Institutions in March last.

My lecture was subsequently reproduced in pamphlet form, of which I enclose a copy, and, in the event of any of your readers being particularly interested in the approaching I.E.E. discussion, I should be glad to supply copies, as far as my stock permits, on hearing from them.

The inclusion of this subject in the I.E.E. syllabus for December 13th is welcome, as affording a further opportunity for its complete ventilation at a time when it is receiving considerable attention. I venture to hope those participating in the debate will devote their attention to the suggestion of ways and means of overcoming such difficulties as are incidental to any change, rather than to criticisms of the destructive order which would merely postpone, and therefore render still more difficult, our inevitable adoption of this overdue reform.

Harry Allcock, M.I.E.E.

Hale, Cheshire, November 21th, 1917.

Training Chinese Engineering Representatives for Chinese Trade.

Some time back a point was raised in the local Press comparing the output of engineers from the Eastern universities with the opportunities for employment in any of the engineering branches. More men are being turned out than employment can be found for, with the result that a large number of them have to accept posts other than those for which their training primarily fitted them.

It is obvious that the future commercial war and struggle for new markets will result in the opening up of China, and

that the struggle will involve great efforts on the part of the competing nations. Up to the present, trading in this country has been carried out through the agency of native intermediaries, and in view of the great extent of the country, the difference in tongues, &c., it is difficult to see how these agents can be dispensed with. There can be no doubt that the nation that can get at the natives by Chinese intermediaries possessing a good commercial and engineering training stands the best chance of getting the market, and for this reason I think that British manufacturers should take advantage of this surplus of raw material, who depart from Eastern universities, and make them offers of training in their works, &c., in commercial and engineering practice. In return for these facilities the native engineers should act as representatives for the firm by whom they were trained for a specified term. The offer, I believe, would be eagerly accepted, and the monetary outlay would be small in comparison with the benefits that would accrue later. The Western nations who will compete in this field will need every ounce of their energy to stem the rising tide of Japanese trade with China. The Japanese have a college at Shanghai for specially training their own countrymen for work in China, and over 900 students have been passed through who are now working in various parts of the country. This scheme has proved so successful that the erection of larger colleges is under consideration. Seeing that such a step is impossible in our case, I think an experiment on the lines I suggest above would be justified by the result.

Celestial.

Hong-Kong, September 30th, 1917.

Portable Electric Lamp Cooking Box.

I have read with interest the description in your issue of November 9th of Mr. Edwards's cooking box. I am fully convinced that this is the system by which cooking will be carried out in the future: the present wasteful and haphazard methods of cooking are a disgrace to a civilised race, and the need for economy in coal is making people wake up to the fact.

I have been working on the same lines as Mr. Edwards for the last 18 months, and have arrived at the same general arrangement, but have adopted two distinct additional features, viz., an automatic temperature control and an automatic starting arrangement.

In my automatic cooker I use only a 16 c.p. lamp in a completely insulated box, in which the cooking utensils are very nearly a fit, the air space being small. In a pocket in the heat-insulating material there is a thermal strip which, when the temperature reaches a predetermined figure, cuts off the lamp on the thermo-blink principle, maintaining the temperature a little below boiling point. This prevents anything in the cooker from boiling over. If Mr. Edwards tried to cook porridge with his arrangement I am afraid he would find that it had boiled over when he opened it.

In addition to this, I have an alarm clock arranged with a contact which is closed by the alarm. The arrangement makes an excellent breakfast cooker, and to anyone without a servant, or with one that won't get up in time in the morning, this automatic should be a boon.

At night the oatmeal or Quaker Oats is put in the bottom container with the necessary quantity of cold water and salt, and in the top the rashers of bacon or fish, &c.; the plates are put on top, and the whole closed down. The alarm is then set for, say, 6 o'clock, and at 8 o'clock you can come down to find your breakfast ready, perfectly cooked, and piping hot. One would be inclined to think that the oatmeal would be lumpy, but this is not so, and bacon cooked in this way is not distinguishable from that fried in the ordinary way. The cost of current for cooking breakfasts for two is less than 3d. a week, with current at 1½d. per unit. To anyone tasting a steak or chop, for the first time, that has been cooked by this slow method it comes as a revelation.

This automatic cooker will be especially useful to anyone who is uncertain as to meal hours; food can be left in four or five hours after it is ready, and come out exactly the same as if just ready. To be able to come home at any time of the day or night to a hot meal without any preparation, cooked at the cost of a fraction of a farthing, should put electricity for cooking in a position from which it will be difficult for the gas engineer to oust it.

Patent has been applied for, and this automatic cooker will shortly be placed on the market.

Percy Watson, A.M.I.E.E.

(NORTHERN ELECTRICAL CO.)

Grimsby, November 12th, 1917.

German Cables Specified in War-time.

I see it constantly stated that the people of the country are determined to have no further trade with Germans, but I am afraid that unless this is made in some way compulsory, we shall find ourselves in a short time doing as much trade with them as ever.

I received a specification for certain new work in a private house, from a leading Leeds architect, and to my great astonishment the cable is specified to be manufactured by

the Lahmeyer Electrical Co., which I think I am correct in assuming is, or was, an enemy concern, and, as far as I am aware, has been wound up as such.

It is, of course, quite reasonable to suppose that this architect has never taken the trouble to read his specifications, but it is rather an unfortunate commentary on our past methods of trading when anyone reflects that it was possible at any time to insert a clause in a specification compelling the tenderers to purchase German goods.

This is more apparent when one considers the large number of high-class cable makers there are in this country.

R. Falshaw.

Harrogate, November 20th, 1917.

[It is difficult indeed to understand how any British architect could be induced to specify that German cables must be used, in peace time; but how such a clause could be allowed to stand in war time passes comprehension. We fully agree with Mr. Falshaw that, in face of such a clause, the necessity of compulsory measures for the protection of British manufacturers is manifest.—EDS. ELEC. REV.]

The E.T.U. or the A.E.S.E.?

Your article is most opportune, and most people will welcome it as a basis from which to attack the problems of the central-station engineers. I was also interested to read that, as regards the workmen in central stations, there was not the same trouble, as they favoured trade union methods; also that there were several unions who catered for them.

In passing, I should like to say that I fail to find any real difference between a trade union and an association, both primarily being formed to safeguard collectively the individual worker. I will admit that trade union methods of the past (and the present, in some cases) leave much to be desired, but there are signs and portents that the future will find better methods in vogue, in which the employer and arbitration will take more prominent parts.

But I certainly think that the central-station workmen should also start to organise themselves, as the wages question, for instance, is just as bewildering between the various stations as is the case of the technical staffs. At present, when a central-station worker joins a trade union he immediately finds himself alone, paying for a programme which is often quite outside his compass, having no voting power to forward his own particular ideals, and generally having to accept a condition of affairs which is lower than is now his, and with no one to really trouble about his troubles and grumbles in the future.

I would be greatly obliged if you would find a place in your valuable journal to put this letter (I sincerely apologise for its length), in the hope that it might produce evidence of members of the engine and boiler-plant departments of central stations who have similar ideas, in which case, should they desire, we might arrange a meeting to discuss a means of uniting ourselves in one union, or to a union who would form a branch for central station employees only, on similar lines to the Electrical Section of the National Union of Railwaymen.

Progress.

Resistances in Parallel.

In your issue of the 9th inst. there is a letter, accompanied by a calculating chart, from Mr. L. O. Meyer. In the letter he speaks only of two resistances in parallel, but his chart can be used for any number of resistances in parallel. Take five resistances of 2, 4, 5, 8, and 10 ohms respectively: the first pair taken off the chart give 1.33 ohms, the next pair 5.08 ohms. The joint resistance of these two gives 0.93 ohm. Taking the last figure and the remaining resistance, viz., 10 ohms, gives us 0.85 ohm, which is the resistance of all five in parallel.

A. G. Hilling.

Stanford Hill, November 26th, 1917.

The Sensibility of the Eye.—A recent publication of the Bureau of Standards (Scientific Paper No. 303), entitled "Relative Sensibility of the Average Eye to Light of Different Colours, and Some Practical Applications to Radiation Problems" gives data on the spectral sensibility to radiation of the average eye, as based upon a group of 130 observers. The relative visibility curves were determined with a flicker photometer and an equality-of-brightness photometer. The data indicate that 60 per cent. of the cases examined fall into three quite evenly divided groups, which are either (1) red-sensitive, (2) blue-sensitive, or (3) average; while 30 per cent. of the cases examined are quite evenly divided into three groups which fall below the average sensibility in either (1) the red, (2) in the blue, or (3) in both the red and the blue, thus giving rise to an apparently high sensibility in the green. A mathematical equation is given of the average visibility curve, which is applied in a separate paper in calculating the luminous energy emitted by a black body at various temperatures; also the luminous efficiency, the Grova wave-length, and the mechanical equivalent of light. The value of the latter is about 50 candles per watt of luminous energy of maximum visibility.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Sampson Acid and Water-Proof Lampholder.

MESSRS. WARD & GOLDSTONE, of Salford, Manchester, have recently introduced the patent acid and water-proof lampholder shown in fig. 1. It includes a vitreous porcelain shell, the upper part or chamber of which, enclosing the top of the ordinary lampholder, is filled with a sealing compound, while an acid-proof rubber shield hermetically seals the lower portion of the lampholder, fitting between the porcelain shell and lamp bulb. The interior lamp

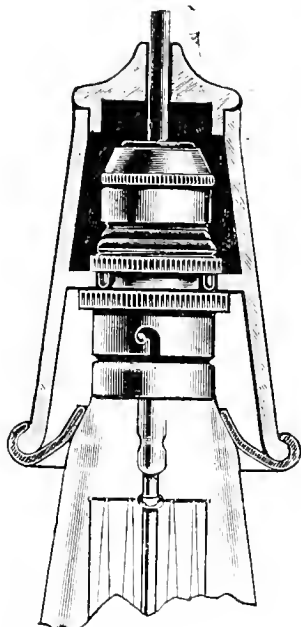


FIG. 1.—ACID AND WATER-PROOF LAMPHOLDER.

holder is locked in position in the shell by means of two shade rings, the upper one having projecting claws which fit into a slot in the porcelain, preventing the lampholder from turning round in the shell when screwed into position.

The holder is easy to wire and takes standard tough rubber jacketed flexible cord; it is suitable for use in chemical works or exposed positions.

Bennis Portable Elevators.

Many industrial processes involving the handling or transport of materials could be performed with greater speed and efficiency, and with a large saving in labour, but in many of these cases the installation of a fixed or elaborate conveying system would not be practicable or justifiable, owing to the changing venue of operation, or the irregular, possibly infrequent, and not always calculable, periods when its use would be required. Such conditions are admirably met by the use of portable elevators or conveyors. They can be brought into use, as, and when required; they can be moved

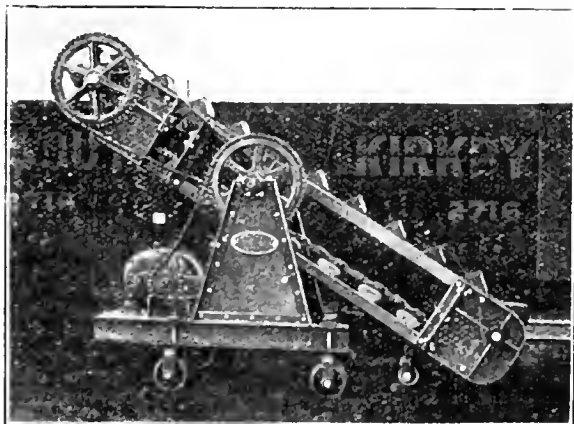


FIG. 2.—PORTABLE ELECTRIC ELEVATOR.

from place to place with the greatest ease, and they can be arranged so that the work of loading and unloading can be carried out by merely reversing the running.

A small portable coal elevator of this type made by MESSRS. F. BENNIS & CO., LTD., of 28, Victoria Street, S.W. 1, is shown in fig. 2. It is 10 ft. long between the centres of the drums, and has buckets 8 in. wide.

The framework of the elevator consists of rolled steel channels and angles braced together. The top and bottom of the elevator is formed out of cast-iron plates.

The bearings for the shafts are cast on the plates, and the whole is bolted together to form a self-contained structure.

The elevator is mounted on a portable truck in such a manner that the angle of the elevator can be altered if desired.

The truck is built out of mild steel sections and is carried on four rollers attached to pivoted axles. The top of the axle is made with a square so that it can be turned round with a spanner, and provision is made for locking the wheels in four positions. The axles work independently of each other.

The elevator is driven by two chain drives. Two sprocket wheels are placed on the pivot shaft. One of these sprockets is driven direct from the motor, and the other sprocket drives the elevator shaft, so that the relative centres of the shafts are maintained irrespective of the angle of the elevator.

When in operation the elevator is pushed up to the coal heap, and the coal trimmed forward to the buckets.

LEGAL.

BIRMINGHAM RAILWAY CARRIAGE AND WAGON CO., LTD., *v.* ROUND.

In the Court of Appeal, before Lords Justices Swinfen Eady, Warrington, and Scrutton, on November 21st, there was heard the appeal of the respondent in this case from the award of Judge Howard Smith, sitting at the West Bromwich County Court as the Arbitrator under the provisions of the Workmen's Compensation Act.

The appellant, Round, who was in the employment of the applicants as an electrician's assistant, on October 29th, 1916, met with an admitted accident which resulted in his right hand being crushed, the little finger being rendered permanently useless and the ring finger being also somewhat seriously damaged. Round at the time of the accident was 22 years of age. The employers paid him half wages of 16s. 7d. per week down to May 23rd, 1917, when they filed an application to redeem the weekly payments by a lump sum payment. The County Court Judge, after hearing the medical evidence, found there was some partial earning incapacity of Round as a result of the accident, but that it was not permanent, and he assessed the compensation payable by the employers to him at the sum of £80, for which amount he made his award, without making any order as to costs. From this decision Round now appealed, upon the ground that in the circumstances the County Court Judge should have assessed the compensation payable by the applicants to him upon the basis that, as a result of the accident and the injuries he had sustained to his hand, he was partially permanently incapacitated from earning the wages in the future which he would in the ordinary course expect to earn as a skilled man in his trade.

At the conclusion of the arguments of counsel, their Lordships held there was evidence upon which the learned County Court Judge could justify his award, and dismissed the appeal, with costs.

METROPOLITAN WATER BOARD *v.* DICK, KERR & CO., LTD.

JUDGMENT was given in the House of Lords, on Monday, in an appeal by the Metropolitan Water Board from an order of the Court of Appeal.

Mr. P. O. Lawrence, K.C., Mr. Holman Gregory, K.C., and Mr. Joshua Goodland appeared for the appellants; Mr. Upjohn, K.C., Hon. F. Russell, K.C., Sir Ernest Pollock, K.C., and Mr. Douglas Hogg, K.C., for the respondents. The facts of the case have already been reported.

The LORD CHANCELLOR, in moving that the appeal should be dismissed, said the question in this case was whether a contract for the construction of reservoirs and waterworks between the Metropolitan Water Board, the appellants, and Messrs. Dick, Kerr and Co., Ltd., the respondents, could be treated by the respondents as at an end, in consequence of an order of the Minister of Munitions that work under the contract should cease. The action was begun by the Metropolitan Water Board by writ dated May 19th, 1916, against the contractors, and the statement of claim asked for a declaration that the contract was still in existence as a binding contract, and had not been determined. The defence alleged that notice from the Ministry of Munitions, dated February 21st, 1916, was given in exercise of the powers conferred by the Defence of the Realm Acts and the regulations and orders made thereunder, and that the notice required the contractors to cease work on their contract, and that they ceased work accordingly. The defence went on to allege that thereby the contract ceased to be binding. The case was tried by Mr. Justice Bray, who gave judgment for the Metropolitan Water Board, holding that the notice should have been dealt with under the terms of the contract by an extension of time for the completion of the contract, and that the contract was still in existence. On appeal this decision was reversed by the Court of Appeal, consisting of the Master of the Rolls, Lord Justice Warrington, and Lord Justice Scrutton. The appellants by the present appeal asked that the decision of Mr. Justice Bray should be restored.

HIS LORDSHIP having dealt with the contract and with the authorities, said that the principle had been well established. The contract in the present case was for the completion and handing over of these works within six years from August 16th, 1911. The effect of the prohibition might be that the works could not be resumed until, at all events, the greater part of the six years had expired, and by that time all conditions as regards labour and material might be absolutely different. This, in the words of Mr. Justice Rowlett, would be "not to maintain the original contract, but to substitute a different contract for it."

In his opinion, this appeal should be dismissed, with costs.

The other noble and learned Lords gave judgment to the same effect.

Order accordingly, with costs.

ELECTROLYTIC CORROSION OF TELEPHONE CABLE.

AT Preston County Court, last week, his Honour Judge Hugh Sturges gave his reserved judgment in the case heard by him a fortnight ago at Blackpool, when the Postmaster-General sought to recover £16 18s. from the Blackpool and Fleetwood Tramroad Co., Ltd., for the cost of repair of telephonic lines alleged to be necessary through a leakage of electric current from the defendants' lines. (ELEC. REV., May 16th, page 165.)

HIS HONOUR observed that the tramroad was constructed in 1896. In 1914 the Postmaster-General caused to be laid within 7 ft. of the defendants' electric tramroad a lead piping containing telephonic cables. No notice was given to the defendant company before the cable was laid as to its position, or method of insulation. Two years after the cable was laid a breakdown occurred through the lead piping having corroded, due to a leakage of electricity from the defendants' lines, and the action was to recover the costs of repairing the injury. His Honour found that there was no evidence that the defendants had not complied with the provision in their Act that they should construct and run their undertaking with due regard to telegraphic lines, and it was shown that monthly tests were made and submitted to the Board of Trade to show there was no excessive leakage of current. The plaintiff's alternative claim upon that provision failed. The other alternative claim, founded upon Sec. 8 of the Telegraph Act, 1878, also failed, as he found that the section, which related to the liability for the cost of repair of injured telegraph lines, could not over-ride the provisions of Sec. 65 of the Tramroad Co.'s Bill, in which Sec. 8 of the Telegraph Act was deemed to be incorporated. Sec. 8 was only applicable for contingencies arising that were not provided for in the section of the company's Bill.

HIS HONOUR accordingly gave judgment for the defendant company, with costs, and also granted leave to appeal, if desired.

A MARCONI APPEAL.

IN the Court of Appeal, before Lords Justices Pickford and Bankes, on Monday, the matter of a petition of right of Marconi's Wireless Telegraph Co., Ltd., was heard upon the appeal of the company from an interlocutory order of Mr. Justice Atkin, dated December 7th last year, directing that the petition should be tried before a Judge sitting without a jury. The suppliant company contended that the question of fact in the petition should be decided by a jury.

MR. LESLIE SCOTT, K.C., in support of the appeal, said the subject of the dispute arose out of an agreement made on July 30th, 1913, between the suppliants and the Postmaster-General. The issues involved were considerable. If the agreement was treated as one that would run for 18 years, upon the conservative estimate made on behalf of the company, it resulted in something like £1,500,000 in the way of damages; and if the view was taken that the company was entitled to royalties for 28 years, the damages might be over £2,000,000. Important points were involved in the case. He contended that the company had the absolute right to a jury, and that the learned Judge had, in refusing to allow the case to go before a jury, exercised his discretion wrongly, and alternatively if it was a matter of discretion, on the facts of the case, it was plainly a case for a jury. The agreement was for the company to erect six stations in the great wireless chain—England, Egypt, the East African Protectorate, the Union of South Africa, India, and Singapore, or some neighbouring point of the Malay Peninsula—and there was a proviso that the Postmaster-General might cancel the contract in respect of three stations, and it was as though the action was an ordinary one for damages for breach of contract. The pleadings set out the agreement, and that the suppliants had placed large orders for the contract, and instead of the Postmaster-General cancelling the three supernumerary stations, he decided that the one in India should be proceeded with. England, Egypt, and the East African Protectorate, he suggested, were definite orders. By saying India should be proceeded with, the Postmaster-General, he submitted, had waived his right to repudiate. In preparation for the installations the company did a great deal of work, and supplied large quantities of materials. When the Postmaster-General repudiated the agreement the company had spent £140,000, of which they received from the Government about £62,000, and the company claimed a declaration, leaving the damages to be arranged or assessed in such way as might be thought fit or expedient. The Postmaster-General repudiated the whole agreement in a letter dated December 30th, 1914, after the outbreak of the war. The suppliants were told not to proceed with the wireless stations. The letter said:—"I am directed to inform you the Government has decided not to proceed with the Imperial Wireless Chain." If any question was raised as to what precisely

was repudiated, and what the company was not to proceed with, that sentence, said counsel, obviously meant the whole thing.

LORD JUSTICE PICKFORD: May the letter not mean—We rely upon that as cancellation of the three, even if we cannot give up the whole six?

MR. SCOTT contended that the position was untenable. The suppliants had lost the benefit of the whole agreement. They wrote on January 11th, 1915, claiming compensation for the abandonment of the agreement, and the Postmaster-General thereupon withdrew his letter of December 30th, and offered to co-operate with the suppliants in carrying out the terms of the agreement with all promptitude. In the agreement there was a provision that as to South Africa, India, and Singapore, the Postmaster-General might, by notice in writing, before the establishment of these three long-distance installations, cancel the agreement relating to them. Here it was no work no pay, but for work already done the company was to be indemnified. Regarding the continuous-wave system this clause appeared: "The Postmaster-General, if he contemplates the use of the continuous-wave system in any of the said stations, shall not give any preference to any company over the Marconi Co. if the Marconi Co. are able and willing to show they can provide a Marconi system of continuous wave with equal efficiency and economy." At the time of the agreement there was no continuous-wave system commercially practicable.

The SOLICITOR-GENERAL contended that this was a case in which the learned Judge had exercised his discretion properly, and that the petition should be tried before a Judge alone. The Solicitor-General further submitted that Section 7 of the Petition of Rights Act gave the learned Judge the discretion which he had exercised, and, in the circumstances, he contended their Lordships should not interfere with the discretion which he had exercised.

MR. LESLIE SCOTT having replied on behalf of the suppliants,

LORD JUSTICE PICKFORD, giving judgment, said the case really resolved itself into an action by the company for damages for breach of contract. He thought himself it was eminently a case to be tried before a Judge sitting without a jury; but whether that was so or not, he did not think it was a case in which the Court should interfere with the discretion which had been exercised by Mr. Justice Atkin, and that being so, the appeal would be dismissed, with costs.

LORD JUSTICE BANKES delivered judgment to the same effect.

WAR ITEMS.

Australia and Enemy Trade.—The "Financial Times" states that the Committee of the Australian Associated Chambers of Commerce has issued a report emphasising the necessity of cutting off all trade with the enemy after the war.

Trading with the Enemy.—The "London Gazette" for November 23rd contains further names of persons and bodies in the following countries with whom trading is prohibited:—Argentina, Paraguay and Uruguay, Bolivia, Brazil, Chile, Colombia, Hayti, Morocco, Netherlands and Netherlands East Indies, Norway, and Spain.

"County" Men and the War.—We have received a copy of No. 5 of the Staff War Bulletin of the County of London Electric Supply Co., Ltd., and associated companies. The Roll of Honour now contains 467 names, 58 having joined the Forces since the issue of the Bulletin in December last. Thirty-two men have been killed in action, and 62 wounded; 26 hold commissions. The pamphlet contains portraits of some of the men and other interesting photographs.

Germany and Switzerland.—A "Times" article on "German Methods in Switzerland; Art of Peaceful Penetration," concludes as follows:—"All the best concert parties come from Germany. The finest sites round the Lake of Zurich have been bought by Germany. A hundred Germans acquire Swiss citizenship every month to 10 of all other nationalities put together. Germans all but acquired the new port of Basle, and were only thwarted at the eleventh hour by the burghers themselves, who are now to build it with their own funds. Half the power generated by Swiss stations on the Rhine drives German machinery or lights German cities, and there is one 'Swiss' electrical syndicate with seven Swiss and 16 German directors! Where will it all end? The fearless patriotism of the New Helvetic Society may postpone the threatened tragedy; can it avert it?"

Engineers' Bonus.—The Ministry of Munitions has announced that the War Cabinet has decided that the bonus of 12½ per cent. on earnings shall be paid to men aged 21 years and over who are employed on munitions work as plain time workers (and not otherwise), skilled, semi-skilled, or unskilled, in shipbuilding and ship-repairing, and that the bonus of 12½ per cent. on earnings already given to certain skilled men under the Skilled Timeworkers' Wages Order of October 13th shall be paid to men aged 21 years and over who are employed on munitions work as plain time workers (and not otherwise), skilled, semi-skilled, or unskilled, in engineering shops, boiler shops, and foundries, whose wages it has been the practice to regulate by the movements in wages in the engineering and foundry trades. The bonus will be payable as from the beginning of the first full pay following October

12th, 1917. The Order carrying out the details of the above decision will be issued as early as possible. Until it is issued no payments are to be made.

The Government have decided to appoint a committee to interpret Orders regulating the bonus, to settle to whom such Orders are to be applied, and generally to smooth over difficulties regarding their interpretation. The committee will consist of representatives of the Ministry of Munitions, the Ministry of Labour, the Admiralty, and the War Office. Any communication which it may be desired to address to the committee should be forwarded to The Chief Industrial Commissioner, Ministry of Labour, Montagu House, Whitehall, S.W.1.

After the War.—Prof. A. W. Kirkaldy, Professor of Finance at the Birmingham University, speaking to bankers in Leeds last week, on "Industrial and Commercial Reorganisation After the War, particularly as affecting Finance," said many people thought that after the war millions of men would immediately return, that the women now working would be thrown out, that the new arrangements would go, and that the old-fashioned tools and methods would come back. That was impossible. If it were possible it would be disastrous. It would take some years to get the men back. When the fighting was finished large numbers would be wanted as a police force, and when that was over we should require an army of at least a million men for this generation. Personally he had no fear whatever about unemployment, if only they could avoid what some people thought was going to be a great fight between Capital and Labour. Such a fight would spell disaster. They might win the war, and yet the enemy might get all the fruits. In Europe there would only be two countries that would be able to take part in world competition—Britain and Germany. The Germans were a resolute and disciplined people, and they would do all they could to re-create the position they had lost, and if we were foolish enough to fight among ourselves they would do it.—*Leeds Mercury.*

Dr. Addison has announced the appointment of an Advisory Committee to consider the disposal of surplus Government property and stores after the war. The Committee will consider methods not only for putting surplus war stores and property on the public market in a business-like manner, thereby avoiding loss and waste, the flooding of markets, and so on, but also for insuring that the things disposed of are allocated to the fullest and best possible use that can be made of them in view of national needs at the time. Figures have been published from time to time showing the colossal scale of the Government's war purchases. War day by day consumes great quantities of these purchases—food, munitions, stores, and the like—but when peace comes many of them, including all the reserve stocks and stocks "bought ahead" will be unconsumed. Other purchases of war, on the other hand, are not consumed from day to day, and will reach the day of peace but little impaired, for example, machinery, ships, and the Government's war properties of lands and buildings which now cover an area of approximately 170 square miles. Some of these war purchases will be needed for continued Government use; others may profitably be reserved for future use. But vast quantities will have to be disposed of. So big a liquidation of war effects should not take place without most earnest consideration and forethought. Every available brick and beam and machine will be needed by the nation, and every ounce of food; for the shortage in these things will not be made good merely by the signing of a treaty. The Committee will therefore seek to hasten the preparation of inventories by the many Government Departments having war stores and property under their control.—*Morning Post.*

Women's Work on Engineering Munitions: Permanent Memorial. It is part of the scope of the Women's Section of the National War Museum that it should contain a permanent collection of engineering exhibits, illustrating the proficiency attained by women in work of an engineering nature in connection with the manufacture of munitions of war. The range of women's work on munitions and on other engineering work necessary to the war is so vast that a special committee has been formed to undertake the work of collecting suitable specimens, and firms are invited to assist this committee by submitting particulars of such examples as they would be willing to present to the National War Museum. The collection is only intended to illustrate the nature of work which women have undertaken since, and in consequence of, the war, and it will include details of aero-engines, aeroplanes, steam and other engines, motor vehicles, machine tools, guns, small arms, projectiles, gauges, cutters and small tools, gun-sights, and other articles coming within the limitation mentioned. The name and address of the firm giving the specimens may be recorded in a manner approved by the Committee, either on the specimens or on the case containing them. It is hoped that firms employing women on engineering work in connection with the making of war material will be willing to contribute specimens which will constitute a permanent memorial and record of the work women have done in the war. Communications should be addressed to the Hon. Secretary of the Women's Work Subcommittee, National War Museum, 9, Queen Anne's Gate, London, S.W.1. It is desired that samples should not be sent in the first instance.

Financial Facilities for Trade after the War: A New Committee.—The Treasury and the Minister of Reconstruction have appointed a committee to consider and report whether the normal arrangements for the provision of financial facilities for trade by means of existing banking and other financial institutions will be adequate to meet the needs of British industry during the period immediately following the termination of the war, and, if not, by what emergency arrangement they should be supplemented, regard being had in particular to the special assistance which may be necessary:—(a) To facilitate the conversion of works and factories now engaged upon war work to normal production. (b) To meet the exceptional demands for raw materials arising from the depletion of stocks. The committee will consist of the following:—

Sir R. V. Vassar-Smith (Chairman of the Committee), Chairman, Lloyds Bank, and President of the Institute of Bankers.
Sir J. Bradbury, Joint Permanent Secretary to H.M. Treasury.
Mr. A. E. L. Chudlton, Director of Ruston, Proctor & Co., Ltd., agricultural machinery manufacturers, Lincoln.
Mr. E. B. Fielden, Deputy Chairman of the Lanes, & Yorks. Railway.
Sir Algernon Firth, Chairman of the Associated Chambers of Commerce of the United Kingdom.
Mr. R. Fleming, chairman of several well-known investment trust companies.
Mr. A. C. D. Gairdner, Managing Director of Union Bank of Scotland, Glasgow.
Mr. F. C. Gouldenough, Chairman, Barclay & Co., Ltd., Bankers.
Sir Alex. McDowell, K.B.E., member of the firm of Carson & McDowell, solicitors, and well-known in the linen trade.
Sir Alexander Roger, of the Ministry of Reconstruction.
Mr. John Sampson, representative of the Controlled Establishments Association.
Mr. A. W. Tait (G. A. Touche & Co., chartered accountants), director of a number of large commercial undertakings.

Exemption Applications.—At Camberwell, the South Metropolitan Gas Co. appeared to show cause why 34 certificates of conditional exemption granted to public street lamp-lighters should not be withdrawn. Mr. Albert Stokes, on behalf of the company, stated that the men now held certificates of protection from the Munitions Area Recruiting Officer. The company had been able to train substitutes to take the places of these men, so that, as far as the company was concerned, these men could now be released for the Army. The men were not lamplighters in the ordinary meaning of the word, for they were engaged on repairs. In a sense they were tinsmiths, and thus came under the schedule of the protected trades. If the certificates were withdrawn by the M.A.R.O. the men would have to join up, but so long as they retained them they could leave the company and get work elsewhere. The Town Clerk said the men had still the right to lodge an appeal for exemption with the Tribunal on domestic grounds, even if the certificates were withdrawn. It was not fair now, when the company were prepared to release the men, that they should be permitted to hold the certificates, and get work with another company who had not been patriotic enough to train women to do the work. Sir Evan Spicer said he agreed, but, at the same time, the thanks of the Tribunal were due to the company for their patriotic action not only in releasing these men, but for their attitude since the outbreak of war. They had done everything they could to release men for the Army by training women and other substitutes. He proposed that the Tribunal tender their thanks to the company. The Chairman (Ald. Maloney) said the company had done their duty all the way through. Mr. Stokes, in stating that he would convey the resolution to his directors, said he hoped in the not very distant future they might be able to release a few more men. The conditional exemption certificates were then withdrawn, and the National Service Representative undertook to communicate with the M.A.R.O. with a view to the certificates under the Protected Trades Schedule being withdrawn.

At Bispham, near Blackpool, the manageress of a local hydro appealed for the electrical engineer employed there, who maintained 1,200 lights. He was classified B.1. The man had been in the company's employ for 18 years, and the manageress admitted that no attempt had been made to get a substitute, as it was necessary to have an efficient man about the place for the comfort of visitors. The Military Representative said the comfort of visitors was a secondary consideration in these times. Temporary exemption to March 1st was given.

Barnstaple Borough Tribunal has granted exemption until March 31st to J. D. Bushell, assistant at the Corporation electricity works. He was called up under instructions from the Munitions Area Recruiting Office, but the call was suspended until March 31st for a substitute to be trained. The T.C. has the right to appeal again.

At Hastings, exemption was applied for by R. Merrifield (40, Class A), electrical fitter, for 15 years with Mr. Wordley, and three months were conceded.

At Hastings, the Tramway Co. appealed for a motorman (33, C.2), and by assent on the part of the Military he was exempted for three months.

At Eastbourne, appeals were made for three men engaged at the Corporation electricity works. They had been put back for substitution, and the engineer (Mr. J. K. Brydges) said that only one man had been sent as a substitute, and after looking at the work required to be done he said that

he was not able to do it. Mr. Brydges added that since the previous appeal the difficulties at the works had increased. The cases were adjourned *sine die* for substitution.

Exemption was claimed at Kirkby Lonsdale for the man in charge of the electric light plant on the Underley Estate. He is a B.I. and was discharged from the Army on medical grounds in 1915. He was exempted until February 1st, with leave to appeal again.

Wrexham Rural Tribunal has given temporary exemption until February 12th to W. Williams (28, C2), electrician, Coedpoeth, engaged in the business of his father.

Reading Tribunal has refused exemption to J. H. Grubb (C3), electrician at the Palace Theatre, but suspended the calling-up until December 12th.

The Cumberland Appeal Court heard a military appeal against R. Boyle (31), a cable jointer in the electricity department of the Carlisle Corporation. Mr. Purse stated that the man was passed in Class A when the Medical Board were, a short time ago, passing the halt, the lame, and the blind. In his department he had lost 50 per cent. of his original staff, and he had instructions from the Electricity Committee to give every facility to men to join, but, in the national interests, he did not think that this man should be taken. He was in the Volunteers, and on his first parade he fell out and had a fit. At the outbreak of war Boyle was in the Army, and was discharged three months afterwards. A fresh medical examination was ordered.

At Southwark, Mr. W. H. Donovan, director of the London Commercial Electric Stores, Ltd., 36, fit for sedentary work at home (C3), again appeared to show cause why his certificate of conditional exemption should not be withdrawn. The case was adjourned a month ago in order that he might conform with the condition laid down that he should join either the V.T.C. or the Special Police. Appellant reported that he had since joined the V.T.C. at Croydon, where two nights a week he was engaged on clerical work. He was granted six months' exemption on condition that he registered at the Labour Exchange within seven days for work of national importance.

BUSINESS NOTES.

Tungsten Importation Licences.—Answering a question in the House of Commons recently as to why licences were granted to certain British electric lamp makers for the importation of tungsten wire for electric lamps, when the import of this commodity has been nominally forbidden, and supplies can readily be obtained in this country from British manufacturers at competitive prices, the President of the Board of Trade said that licences had not been given for several months.—*The Engineer*.

Electrical Exhibition at Tokio.—An Exhibition of Electrical Machinery and Appliances will be opened at Tokio on March 20th, 1918, under the auspices of the Nippon Denki Kyokwai (Japanese Electric Association). The manufacture of electrical machinery and appliances in Japan has, as our readers are aware, undergone great development during recent years, and the object of this Exhibition is to show the progress that has taken place, and to give a stimulus to further enterprises. The *Board of Trade Journal* states that the exhibits will include motors, generators, batteries, and generating plant equipment; electric railway materials; telegraph, telephone and wireless telegraph apparatus; electric lighting apparatus and accessories; appliances for the electrochemical industry; domestic electrical appliances; industrial electrical machinery, pumps, cranes, &c.; surgical, educational and experimental electrical apparatus; and general accessories. Only Japanese manufactures will be shown.

France.—La Compagnie des Forges et Acieries Electriques Paul Girod is the name of a new company which has lately been formed in Paris, with a capital of £600,000, to acquire and carry on work at Ugine (Savoie).

British Trade with Brazil.—There has been issued by British Chamber of Commerce in Brazil (143, Rua da Quitanda, Rio de Janeiro) a booklet giving valuable hints for manufacturers and exporters concerning possible improvement of British trade with Brazil. The material has been compiled by the Secretary, Mr. Arthur Abbott, from the reports of various Sub-Committees and other reliable sources. Mr. Abbott will be pleased to answer inquiries on special points which interested parties in this country may desire to put to him. It is shown that our enemies attained a firm hold on the commerce of Brazil, in great part through their having adopted the metric system years ago in Europe, and the hope is expressed that when England has done the same British trade may be able to recover lost ground, and to hold its own after the war. It is held, however, that any proposal that it should be unlawful for a British merchant to sell goods excepting in terms of the metric system would be most prejudicial to British commerce in Brazil. A Rio representative's opinion is quoted to show that technical representation pays well.

British manufacturers are urged to remember the importance of having spare parts for all types of machines available in the country. A large Swiss manufacturing house has opened an important establishment with a large stock of plant and accessories, and with a competent technical staff. British manufacturers must do likewise or lose business. Representatives sent out must have

a good knowledge of the Portuguese language, *not* Spanish; Portuguese is being taught in the States, with a view to capturing Brazilian trade. There is an opening for British retail stores, packing must receive greater attention, and criticism is offered respecting English catalogues. In the last connection different illustrations should be given of the same machine, parts of machinery should be numbered for greater clearness, illustrations should be given of large work carried out, there should be a Portuguese-English and English-Portuguese index, and details of spare parts, also prices of machines and parts, must be given. Owing to fluctuation in exchange, prices should be quoted in sterling. Customs tariffs should be carefully studied. There should be better facilities for granting credit. Travelling representatives must be of the right type, and must be able to speak Portuguese fluently.

In a selection of notes relating to particular classes of imports, several electrical lines are referred to:—

"Electric Switches and Other Fittings.—A great deal of very cheap and inferior stuff used to come from Germany, but the business has gradually been getting into the hands of American makers. British goods are almost unknown, although there appears to be no reason why, with a careful study of market requirements, British makers should not be able to compete. It would be hopeless, however, to attempt to sell standard British goods here, as they are quite unsuitable.

"Electric Lamps.—Formerly imported from Germany, Austria, and U.S.A., now entirely in American hands. Imports from Great Britain nil. The business in this, as in all electrical material, is enormous and well worthy of attention. The German (Osram) lamp was predominant in the market.

"Electric Lighting Fittings.—The greater part of these goods used to come from Germany, and a little from England and the U.S.A. The general styles are cheap and light in weight, but gaudy in appearance.

"Electric Generators, Motors, Dynamos, &c.—Germany and the U.S.A. are able to sell at prices that practically prevent England from supplying anything but the requirements of British companies working here, or a few favoured orders. This is a most important matter, as Brazil is specially favoured, owing to its immense water power, in respect to the development of electrical energy. Germany and the United States of America have been able to do this on account of their business being handled by very large and wealthy manufacturing concerns, quite capable of undertaking themselves the largest contracts and of financing them where convenient and advisable.

"Water Turbines.—As water power exists almost everywhere throughout Brazil, there is always business in view. Swiss, German, and American turbines are chiefly imported, on the grounds that they are better designed.

"Electric Wires and Cables.—This business used to be in the hands of German, American, and Italian makers. German goods were distinctly inferior in quality, but exceedingly cheap, and the same might be said of the Italian. American manufacturers have done a large business for years in all grades of wires and cables, and at present have it all to themselves. British goods have been conspicuous by their absence, although the country offers a vast field for them. A point to note is that the thicknesses should always be given in millimetres or Browne and Sharpe Gauge."

We believe that it will shortly be possible for copies of the pamphlet to be obtainable in this country from the Association of Chambers of Commerce of the United Kingdom, Parliament Mansions, Victoria Street, S.W. British manufacturers interested in the Brazilian market would find it well worth while to secure a copy.

Diary.—MESSRS. JENSON & NICHOLSON, LTD., Goswell Works, Stratford, London, E. 15.—We have received a handy (Letts') diary and notebook for 1918. There is a great deal of useful information of a general kind, also some of a particular kind respecting the firm's special insulating varnishes, &c.

December Moonlight.—MESSRS. C. A. VANDERVELL AND CO., LTD., are issuing Moon Chart Cards for the month of December, and will be happy to send one to those who write in to Acton. The card is compiled, as before, by Mr. A. Midgley, the chief engineer to the firm.

Plant for Sale.—Bedford Corporation Electricity Department has for disposal two high-speed enclosed compound self-lubricating engines, direct-coupled to one-phase alternator, 2,100 volts, 60 cycles. For particulars, see our advertising pages to-day.

Catalogues and Lists.—ENTERPRISE MANUFACTURING CO., LTD., Gun Street Electrical Works, London, E. 1.—Leaflet illustrating their "E. M. C." ship electric fans.

DUNCAN ELECTRICAL CO., LTD., 1,665, St. James Street, Montreal.—Twenty-page illustrated price list of Edison sockets, cut-outs, tumbler switches, and other specialties; also an export price list of some of the same manufactures in foreign languages, and a number of other leaflets. The company is paying special attention to export markets.

Book Notice.—MESSRS. H. DUNOD & E. PINAT, of Paris, have sent us their catalogues of books dealing with scientific and engineering subjects, of which, as is well known, they have long made a speciality.

Dissolutions and Liquidations.—KINGSTON & CO., LTD., Margate.—A meeting of creditors is called for Monday, December 3rd. Liquidator: Mr. J. W. Scarlett.

MICA MANUFACTURING CO., London, N.—With reference to the notice published, last week, this partnership has only been dissolved so far as Mr. Whiffen is concerned. The other partners are carrying on the business as usual.

LIGHTING AND POWER NOTES.

Accrington.—REPORT OF SPECIAL COMMITTEE.—The Special Committee appointed by the T.C. to inquire into the working of the electricity department has presented its report. A tabulated statement shows that the capital expended rose from £68,858 in 1907-8 to £172,062 last year. The first seven years yielded a profit of from £604 to £2,701 (1910-11), but in 1913-14 the profit fell to £677, and subsequent losses were £3,073 in 1914-15, £2,792 in the following year, and £9,507 last year. The report deals with the disturbing elements experienced in war time, including the Government restrictions upon several large power users, the continuous serious advance in wages, increased cost of materials, higher interest, &c. Wages have increased 18 per cent. in two years, with reduced sales of 6 per cent. Charges have been increased on two occasions during the current financial year. The Committee reports that as to the future nothing can be advanced that is not of a speculative character, but the first consideration is that no additional capital expenditure must be incurred which will not, so far as the present quantum of production is concerned, effect greater economies than the added expenses.

Australia.—The Victorian Government has decided to ask Parliament for authority to supply electric power from Newport power house. Owing to the difficulty of obtaining equipment for the electrifying of the suburban railways, the power house is ahead of the rest of the scheme, and will be in a position by March or April next to supply electric power in bulk. The power available will be considerably in excess of railway requirements for some time to come, and as the other suppliers of power to the public in Melbourne are reaching the limit of the capacity of their equipment, it is proposed to sell them power from Newport. Following the Cabinet meeting, the Minister of Railways said he would introduce the necessary Bill into Parliament almost immediately.

VICTORIAN BROWN COAL.—According to the Australian papers, the Premier of Victoria (Sir Alex. Peacock) has received the report of the Committee of Experts on the proposals to develop the brown coal deposits at Morwell. The Committee reporting in its favour, recommends that an electrical generating station and transmission scheme be established, with a power house at Morwell, that the management (both technical and commercial) be in the hands of an engineer-manager, who shall devote his whole time thereto, and be responsible to a board of three salaried directors to be appointed by the Government, and that the authority board proposed should as early as possible ascertain the prospect of establishing in the States new industries that require large quantities of cheap electrical energy—such as those treating zinc concentrates and manufacturing calcium carbide, alkalies nitrates, &c. The Minister for Mines considers that authority should be given for the preliminary work suggested by the Committee.

The report considers the probable demands for power, amongst which it is believed that the zinc industry alone may absorb 100,000–150,000 H.P. ultimately. Without allowing anything for railways or new industries which may be established, it is estimated that the Melbourne requirements in 1921 will amount to 163 million units, with a maximum demand of 46,580 kW., and in 1925 to 311 million units, with a maximum demand of 97,500 kW. The City Council will require a supply in two years' time, and the Supply Co. shortly after: the situation calls for a plant of 100,000-kw. ultimate capacity, and the Morwell site provides natural condensing water for the first 50,000 kW.

The estimated total annual cost, including annual charges, of supplying to Melbourne 50,000 kW. at a 43 per cent. load factor, from Morwell, is £210,191, or 26½d. per unit, as against 339d. per unit, if the coal were transported. The former figure is less than that of any of the alternative proposals. The estimates based on an initial capacity of 50,000 kW., with a power house designed for an ultimate 100,000 kW., show an expenditure of £1,262,500, including £261,120 for the 82-mile transmission line. Additional expenditure would be incurred on the terminal station at Richmond and in connecting it to the city supply, &c., and the total expenditure would be £1,555,673. It is estimated that energy could be sold to existing undertakings at 326d. per unit, which compares with the City Council's cost per unit sent out in 1916 of 199d., excluding capital charges on its power house. The Committee recommends that whether or not the State undertakes the generation and distribution in bulk of electricity, it should control and direct the co-ordination of all the State and statutory supply undertakings in Victoria.

Batley.—PRICE INCREASE.—The Electricity Committee has decided to increase the charge for electrical energy for power and heating (not for lighting) by another 10 per cent., making a total increase over pre-war rates of 27½ per cent.

Blackburn.—PRICE INCREASE.—The Electricity Committee recommends that, as from January 1st, the charge for current shall be advanced by 10 per cent., making a total increase of 25 per cent. during the war.

Bristol.—STREET LIGHTING.—The recommendations of the Sanitary Committee re street lighting (see *ELEC. REV.*, page 444, November 9th) were not adopted by the Council: the Committee was instructed "not to alter the lighting of the incandescent street lamps in any manner that will necessitate the whole of the incandescent lighting of the city, domestic and public, being cut off on receipt of air raid warning." The resolution prevented the Committee carrying out its recommendation. On Thursday, November 22nd, the Committee reported that, at a conference with

the Chief Constable and the city electrical engineer, it was stated that there are 698 arcs and half-watt lamps, all being now in use. There are 1,573 electric incandescent lamps, and 629 have been in use throughout the war and 944 not in use. If brought into use the latter could not be extinguished instantaneously without, at the same time, cutting off all other incandescent lighting. This also applied to the 629 lamps in use. The Chief Constable and the city engineer are agreed that, in the event of a raid, these lamps were to be extinguished instantaneously, and that would involve the extinction at the same time of all incandescent electric lighting in private and public buildings. The Chief Constable recommends that all the incandescent electric lamps should be brought into use, in spite of the fact that this will necessitate the extinction of incandescent electric lighting in public and private buildings. The hospitals in Bristol had arranged for alternative lighting, and the same provision should be made in other public buildings. In houses candles should be available. It has been arranged that the power supplies will first be cut off and then the lighting. The two alternatives before the Council were (1) to exclude the whole of the incandescent electric lighting and to use the electric arc and half-watt lamps; (2) to include the whole of the incandescent as well as the half-watt lamps, accepting, at the same time, the liability for the extinction of all incandescent lighting in case of a raid. If the Committee was in favour of the second alternative it would be necessary to make a report to the Council, recommending the rescinding of the resolution of November 9th. After an animated discussion, the recommendations of the report were approved by 10 votes to 5, the Committee recommending the adoption of the second alternative stated in the report.

Clayton.—E.L. PROPOSALS.—Whilst the Electrical Distribution of Yorkshire, Ltd., has given notice of intention to renew its application for power to supply Clayton and Queensbury with electricity for power and lighting, the position at Clayton is becoming complicated. Queensbury has consented to the company's application: the Clayton District Council, last year, decided to support the company, but a ratepayers' meeting demanded that the decision be rescinded, and that Bradford Corporation be asked for terms. The Council has recently had to consider the matter again on the raising of the new application, and has approached the Bradford Corporation, who last week appointed a Sub-Committee to negotiate with Clayton Council.

Continental.—SPAIN.—La Sociedad Anonima Productora de Fuerzas Motrices is the style of a company formed at Bilbao, with a capital of 6,400,000 pesetas and the following objects:—The acquisition and utilisation of waterfalls; manufacture and sale of materials for the electrical industries; acquisition and working of coal fields, metal-bearing deposits, production of lime, cement, &c. The company already owns a fall on the Flamisell River, where the installation under construction will be completed by the end of 1919.

ITALY.—The recently amalgamated concerns, La Dinamo-Società Italiana per Imprese Elettriche and the Anza Società, Milan, have begun the construction of a new central station at Iselle, and are also improving the plant which is to serve for the piercing of the Sempione Tunnel.

An increase in plant is being carried out by the Unione Esercizi Elettrici, Milan.

As a result of the union of the Forni Elettrici and the Elettro-carbonium concerns, extensions have been taken in hand, which are expected to enable the joint companies to turn out 1,000 tons of electrodes per month, or other products of like kind.

Dublin.—An interesting display of electric lighting for country houses was a feature at a farm-tractor exhibition held recently.

Edinburgh.—At a meeting of the annual Commission of the Convention of Royal Burghs, last week, Councillor Stevenson (Edinburgh) reported on the proceedings of the B. of T. Electric Power Supply Committee. In giving evidence before the Committee, Mr. Stevenson said there would be a marked difference of opinion when it was sought to unite private and municipal enterprises, or alternatively to eliminate one at the expense of the other. He stated his strong preference for municipal control on the ground that electricity was gradually becoming more and more a public necessity, and it was not in the public interest that it should be in the hands of private companies, even if they were limited to a sliding scale of dividend. A combination of all companies and local authorities in each industrial district was quite impracticable, while any attempt to put all the electrical undertakings under a power company would create such local opposition that success along these lines could not be attained.

Ex-Provost Keith (Hamilton), the chairman, did not think any one of them would like to see the electrical power of either the country or of separate communities placed in the hands of any large company. The position taken up by Councillor Stevenson was one they cordially homologated.

Gainsborough.—E.L. PROPOSAL.—The Urban Council some years ago obtained a prov. order to supply electricity within its area, and has twice been granted an extension of time. Mr. Jas. Marshall, of Marshall, Sons & Co., engineers, now announces that he is about to apply to the B. of T. for a prov. order authorising him to supply energy to the town. Messrs. Marshall have already in course of erection on the Trent a large power station, which is rapidly approaching completion; it would be a comparatively easy matter to enlarge this station to almost any extent.—*Yorkshire Post*.

Greenock.—**LOAN SANCTION.**—The Scottish Office has sanctioned the borrowing of £53,000 for the extension of the Corporation electricity undertaking, which raises the total sum borrowed in this connection to £465,000.

India.—According to *Indian Engineering*, a licence has been granted for electric supply at Mhow cantonment; the system is to be D.C., at 230 and 460 volts, and the municipality with take energy for 312 street lamps during the period of the licence.

Kinlochleven.—Among the applications for provisional orders of which public notice is being given, is one on behalf of the British Aluminium Co., Ltd. The promoters propose to extend the operations of their factories at Kinlochleven, Lochaber, by impounding the waters of Loch Laggan and Loch Troig and of the River Spean and other lochs and streams connected with these, for the purpose of providing additional water power. The scheme entails the acquisition of land in the district and the deviation of public roads and of a portion of the West Highland Railway, as well as a great amount of constructive work.

Leicester.—**NEW POWER STATION.**—The T.C. has decided to apply for a provisional order to acquire land and erect a generating station, at an estimated cost of £285,000.

London.—**ST. PANCRAS.**—The Electricity Committee reports that great difficulty is experienced in obtaining the necessary deliveries of coal; the undertaking is consuming about 150 tons per week in excess of the contract deliveries, and, as a consequence, the reserve stocks are being seriously depleted. The 2,000-kw. turbine set at the King's Road station recently broke down. This machine had been running continuously for nearly three years, but, owing to existing conditions, it had been found impossible to overhaul it during that time. The spare parts are in hand for replacement, but, owing to existing scarcity of labour, three weeks will be required for the necessary repairs to be completed. In the meantime, arrangements have been made to obtain assistance from the L.C.C. Large consumers of current have reduced their load during the maximum load period, and these arrangements have relieved the undertaking in the serious position in which it was placed. It is proposed that the connection with the L.C.C. sub-station should, so far as practicable, be made permanent, so as to be of mutual assistance should occasion arise.

HACKNEY.—An application is to be made to the L.C.C. for sanction to borrow £28,000 for an extension of the steam-raising plant at the generating station. The estimated cost of a 66,000 lb. per hour steam-raising plant is put as follows:—Two boilers, £12,150; two economisers, £2,250; two sets flues, fans, motors, chimneys, £4,080; two brickwork settings, £2,250; one pump pit (provisional), £290; lagging, galleries, £750; Insurance Co.'s inspection (provisional), £75; travelling hopper, £495; cutting away roof (provisional), £150; two feed pumps, £985; pipework, lagging, &c., £2,450; contingencies, awards to labour, &c., £1,575; total, £27,500. The borough electrical engineer has been instructed to obtain an estimate from Messrs. Babcock & Wilcox, Ltd., for the plant required.

Morocco.—An electric station has been opened at Tangiers by the Compania Transatlantica Espanola. The scheme contemplates the installation of eight generating sets, of which one only is at present in working, of 200-H.P. capacity, driven by a Sulzer-Diesel motor fired by creosote. The firm of Bastos Bertran Hermanos y Ca. supplied the plans and plant and carried out the installation.

Mytholmroyd.—**PROV. ORDER.**—The U.D.C. has had under consideration the terms on which the Halifax Corporation was prepared to supply electricity, subject to the granting of a prov. order, and those of the Electrical Distribution of Yorkshire, Ltd. At a further meeting it was decided to seal the agreement with the Halifax Corporation.

Nelson.—**PRICE INCREASE.**—The Electricity Committee has decided to increase the price of electricity by ½d. per unit for lighting and ¼d. per unit for power.

New Zealand.—In answer to questions in the House of Representatives, relative to the proposal by Mr. Orchiston to extract nitrogen from the air by means of electric power developed at Milford Sound, for which project it was stated that a company had been formed, the Hon. W. McDonald intimated that the matter would be submitted to the Cabinet for consideration, while the Hon. W. Fraser, Minister of Public Works, said the application had been considered by him, and rejected by the Cabinet (apparently under the Dominion Act retaining water-power development, generally, for the Government). He added that the application was made with a view to acquiring and selling the rights to an American company, and that he hoped the House would not ask the Government to part with the valuable power, which might be used for other purposes (the treatment of the local refractory ores) than the extraction of nitrates. It was stated in discussion that the power available would produce £100,000 worth of nitrate products per annum.

The Wellington City Council has decided to raise the price of electricity supplied by the tramways power house by ½d. per unit for power purposes only. This is the first increase in charges for municipal service since the war began.

The Auckland City electrical engineer reports that, owing to the shortage of cable, it will be necessary to refuse future connections in the central city area.

Rawtenstall.—**PRICE INCREASE.**—The T.C. has decided to increase charges for electricity from January next as follow:—Lighting by 15 per cent., making 25 per cent. on pre-war rates; heating 15 per cent., making 30 per cent.; power 18½ per cent., making 33½ per cent. to consumers using up to 250 units per H.P. per quarter, and over 250 units the removal of the present advance of 15 per cent., and the substitution of the standard coal clause.

Rotherham.—**PRICE INCREASE.**—The Corporation has given notice that the charges for electrical energy for power and heat purposes have been increased by 20 per cent., and that such increased charges will apply to the quarter ending December, 1917, and afterwards until further notice.

Shipley.—**PRICE INCREASE.**—The District Council has decided to increase the flat rate for power from 1½d. to 2d. per unit, with an advance of 25 per cent. on the sliding scale for power users, making 50 per cent. on pre-war charges; the price for lighting purposes will be advanced from 1½d. to 5d. per unit, the increase to take effect from January 1st, 1918.

Sligo.—**WORKHOUSE LIGHTING.**—At a meeting of the Board of Guardians it was suggested that electric light should be installed in the workhouse. Ald. Jinks remarking that a similar proposal at Sligo Asylum had led to a guarantee that a saving of 50 per cent. would be effected.

South Africa.—The T.C. is faced with a shortage of electric cable and tramway cars. In December representations were made in England in regard to the need for turbine and boiler plant and various electrical machinery. Some of this plant has been obtained, but the many new local industries render the need for additional turbine plant greater than before. As regards the tramways, it was intended to purchase 11 additional cars in 1914, but the matter was deferred, and at present about 4,000,000 additional passengers per year are being carried. At present about 134 cars are in commission, while 150 could be usefully employed.

Stirling.—**PRICE INCREASE.**—The price of electricity for lighting purposes has been increased by ½d. per unit.

Swansea.—**PLANT EXTENSION.**—At the meeting of the Corporation, last week, the Electricity Committee reported on the agreement arrived at with the Swansea Harbour Trust for increased supplies of electricity, which would necessitate the extension of the Trust's power station at the docks. The agreement is to come into force not later than June 30th next, the Corporation to supply up to 500 K.V.A. and to make arrangements to increase the same to 1,000 K.V.A.; the price to be paid by the Trustees will be £2 per kw. per annum, plus 585d. per unit, subject to a coal clause, the Trustees to pay a minimum of £2,000 per annum, but until the Corporation is in a position to supply up to 1,000 K.V.A., the minimum to be £1,500 a year. The agreement is to be for seven years, with the option of an extension for another seven years. The Committee, in view of the urgency of the matter, recommended that tenders be obtained for the plant, and that application be made to the L.G.B. for sanction to the borrowing of £39,000. The chairman, in moving the adoption of the report, said he hoped that in the near future the whole of the smaller stations in the neighbourhood would be linked up with the Corporation supply. The matter was referred to a special meeting of the Council, and authority was given to invite tenders.

Tasmania.—The Public Works Committee has been hearing expert evidence on the proposal to spend £10,000 on the projected hydro-electric scheme on the King River to supply the Mount Lyell Co. with 25,000 electric H.P. The money will be devoted to driving a tunnel through which the King River will be diverted, in order to permit of the examination of the river's bottom preliminary to laying down the foundations of a permanent dam. The complete scheme will, it is estimated, absorb £840,000, and take three years to install. The dam will be a curved concrete structure with a height of about 180 ft. above the river bed. The storage area will be approximately 8 sq. miles. The catchment supplying water to the King River above the dam is about 200 sq. miles, and it is estimated that there will be a yield of 45,000 H.P. at the generators. This, it is confidently anticipated, will usher in a new industrial era on the west coast of Tasmania, making possible the commercial handling of low-grade ores which could not otherwise be looked at.

It is not intended to await the completion of the scheme before launching out in new enterprises. The Mount Lyell Co. is increasing the power plant at its own station at Lake Margaret, with a view of transmitting to Zeehan sufficient power to work the first units of the treatment plant for the electrolytic production of zinc from the Mount Read-Rosebery group of mines.—*Melbourne Age*.

The Report of the above Committee has been submitted to the Tasmanian House of Assembly. It states that the Government will be shortly in full legal ownership of the Zeehan smelters, over which it has a mortgage of £20,000, advanced some years back to keep the works going. It is probable that the residues from the electrolytic treatment works, to be erected at Zeehan, will be sufficient to keep the lead smelting furnace in operation. This should result in the reopening of low-grade ore mines which were closed owing to lack of smelting facilities. The estimated cost per horsepower for the King's River scheme compares favourably with that at Great Lake, and should be considerably less than at Lake Margaret.—*Sydney Telegraph*.

Willesden.—The Electricity Committee reports having had under consideration correspondence with reference to the supply of electrical energy in bulk by the North Metropolitan Electric Power Supply Co. after March 31st, 1918. A further report will be presented in due course. Arising out of instructions to carry out certain extensions, application is to be made to the L.G.B. for permission to raise a sum of £2,900. An offer has been received to purchase land belonging to the Council in Denzil Road originally acquired by the authority as a site for a generating station. If this land is disposed of, it will be necessary to extend a high-tension cable to a factory to be erected, and to provide a transformer, at an estimated cost of £900. Application is to be made to the L.G.B. for sanction to the borrowing of this amount.

Wimbledon.—**YEAR'S WORKING.**—The report of the year's working of the Corporation electricity undertaking to March 31st last shows a total revenue of £11,988, expenditure amounting to £27,586, and a gross profit of £14,101. Interest and sinking fund charges amounted to £18,622, leaving a deficit on the year's working of £4,221. During the year 3,712,749 units were sold, a decrease of 68,995 units; the total average price obtained per unit sold was 2'647d., and the total average all-in cost per unit sold was 2'987d.

Windsor.—**PRICE REVISION.**—The Electrical Installation Co., Ltd., has asked the T.C. to assent to the charges for current being increased by 1d. per unit, and the matter has been referred to the Lighting Committee for consideration.

TRAMWAY AND RAILWAY NOTES.

Barrow-in-Furness.—A remarkable accident occurred on the tramways last week. A ten-year-old girl was standing on the top of a car, when the trolley rope swung round and caught her in the neck, lifting her bodily off the car and dropping her in the roadway. She received cuts and bruises.

Blackpool.—The Corporation is making application for a provisional order to carry out street improvements in various parts of the borough which will allow of better tramway facilities.

TRAFFIC FIGURES.—The receipts on the Corporation tramways for the past month were £5,736, or £1,766 more than last year, the increase being largely due to the transfer of the Squire's Gate line to the Corporation. The total receipts from April 1st to November 15th were £89,761, an increase of £11,333 on last year, and the receipts per car-mile were 2s. 1½d., an increase of 2d.

Bradford.—**WAGES DISPUTE.**—Six hundred of the tramway employes met, on Saturday midnight, to consider the Corporation War Wages Committee's recommendations in regard to wages, declining to grant the employes' application for an advance of £1 per week on pre-war rates, the same to be merged into wages instead of war bonus, double time for Sundays and Bank Holidays, and equal pay for men and women on the same class of work; but recommending that a further 3s. per week bonus be given to men and 2s. to women. The meeting unanimously rejected the offer, and decided that if the City Council adopts the War Wages Committee's recommendation, 21 days' notice that a dispute is pending be given to the Committee on Production.

Burnley.—**STRIKE.**—Last week a strike of skilled engineers in the district took place regarding the interpretation of the recent award of 12½ per cent. wages advance by the Ministry of Munitions. The departments particularly affected were the gas, tramways and electricity, the men concerned being mostly engineers and fitters, who contended that they came within the scope of the award. On their behalf, it was submitted that the skilled men engaged on commercial work and priority work were on work of national importance, and that they were entitled to the advance along with those on munition work to whom it had been granted. Steps were taken to advise the public that in consequence of the strike it might be necessary to reduce the tramway service, and Mr. H. Mozley, the tramway manager, was authorised by the Tramways Committee to offer the men concerned the 12½ per cent. advance at once, on the understanding that if the Ministry of Munitions decided that they were not entitled to the advance, the extra payment should be remitted. The men accepted this offer.

Bury.—The Corporation Tramways Committee has declined the request for a suspension of traffic on Christmas Day. The Preston Corporation Tramways Committee recommends a limited service from 2.30 p.m.

Continental.—**SPAIN.**—Plans are being prepared in respect of a projected electric railway between Calahorra and Arne-lillo, a distance of about 37 km.

Application has been made for a concession for the establishment of an electric tramway in the city of Brzgos. The promoter is Don Luis Gallardo. A similar concession has been applied for by the Compañia Tranvias Electricos de Vigo, being an extension of its network from Los Canos to Fausto de Chapela.

Croydon.—The T.C. has adopted a recommendation of the Tramways Committee that the attention of the B. of T. be drawn to the inadequate representation of municipalities on the new expert Committee for dealing with tramway labour and material; also that the terms of reference should include consideration of the control of motor-omnibuses.

Leeds.—During a violent gale which swept West Yorkshire, last week-end, a car from Leeds to Bradford jumped the metals at Bramley, was caught by a strong gust of wind, and swerved across the footpath, knocking down a telegraph pole and colliding with a wall. Some little damage was done to the car, but there was no personal injury amongst the passengers.

London.—**GOVERNMENT TRAMWAY CONTROL.**—The L.C.C., in authorising Mr. A. L. C. Fell, the chief officer of the tramways, to serve on the expert Committee appointed by the B. of T., adopted the recommendation of the General Purposes Committee that the Committee should be constituted on a basis securing representation of the municipal and private interests concerned proportionate to their magnitude, and that it is important that it be entirely free from association with any traffic undertakings likely to be effected, and therefore the appointment of an interested party as chairman is unfortunate.

HAMSTEAD.—**ELECTRIC VEHICLES.**—The B.C. has recently acquired a couple of electric motor vehicles fitted with Edison batteries for the use of the Medical Officer of Health's department. The chassis are being fitted with special van bodies for the collection and delivery of infected bedding.

Manchester.—**FARE REVISION.**—The Corporation Tramways Committee, instead of increasing fares, has decided to shorten the stages by reverting to the scale in operation prior to the last revision in January, 1913. The 1d. stage will be reduced by about 629 yards, and other distances in proportion. The age for children's half-fares will be reduced from 16 years to 14 years. It is proposed that the revision shall be in force for six months. If the City Council approves, the revision will come into force immediately.

TRAMWAYS FEDERATION.—At a Conference, on Friday, of representatives of Lancashire and Cheshire tramways undertakings, it was decided to form a Lancashire and Cheshire Tramways Federation, to be composed of two representatives and the manager of each concern. A resolution was passed declaring the advisability of establishing an Industrial Committee, representative of authorities and employes, on the lines of the Whitley Report.

Notwithstanding the decision of the Tramways Committee that cars shall run as usual on Christmas Day, the ballot of the employes shows an overwhelming majority in favour of a stoppage, 1,902 voting in favour and only 23 against.

TELEGRAPH AND TELEPHONE NOTES.

A Wireless Telegraph School for Ireland.—The Technical Education Committee of Dublin, under the guidance of Mr. W. J. Lyons, a Dublin expert in wireless work, has completed arrangements for opening a School of Wireless Telegraphy for the whole of Ireland. A generous free admission scholarship scheme is offered by the Marconi Co., which has given very strong encouragement and support to the Committee in this new development of its technical schools.—*Irish Times*.

Australia.—The Postmaster-General has stated that it is intended to install automatic telephone exchanges in Sydney and Malvern, Victoria. The Sydney exchange is estimated to cost about £90,000 and the Malvern exchange about £56,000.

At a lecture in Melbourne, Commander Creswell, of the Australian Navy, stated that wireless messages sent out from Germany were being daily intercepted by the wireless stations at Perth and Sydney.—*Melbourne Age*.

Long-Distance Wireless.—The United States Government has opened a radio-telegraph station at Hawaii, Honolulu, and messages have been exchanged over 5,000 miles. For some time Hawaii has been in touch with Yokohama, Japan. The United States outpost station will now be able to send messages to the Australian station at Sydney; but, owing to its comparatively low power, the latter cannot reply to Hawaii.

New Zealand.—The annual report of the Post and Telegraph Department states that improved methods of detecting wireless signals were introduced at Awarua, Wellington, and Auckland a few months ago, and apparatus for the other stations will shortly be brought into use. The results obtained at Awarua, where the apparatus has been extensively experimented with, have been particularly gratifying. Signals of readable strength have come in from American, Asiatic, and European stations. The use of this detecting apparatus with a particular combination of receiving circuits has demonstrated that daylight signals from stations using the ordinary wave-lengths can be rendered plainly audible, which by the ordinary methods and the use of the crystal detector could not be heard. Time signals have been transmitted from the Observatory clock, Wellington, to Tahiti, the distance covered being 2,215 nautical miles. The laying of an extra cable connecting the North and South Islands has been completed by the Eastern Extension Cable Co.

Russia.—An All-Russian Radio-Telegraphic Congress is to be inaugurated at Petrograd on December 9th.

Storm Damage.—On Saturday last the metropolis was swept by a hurricane, which continued for several hours with great violence. Similar stormy weather was experienced in most parts of the country. The gale caused very little interruption to telegraphic and telephonic communication within the metro-

polis, although lines in the country were damaged. In the Rotherham district a fierce gale of wind and rain attained a velocity of 60 miles an hour. Telegraph and telephone wires were broken in all directions, causing a dislocation of business. —*Daily Telegraph*.

CONTRACTS OPEN AND CLOSED

OPEN.

Ashton-under-Lyne.—December 5th. Engine slack for Electricity Committee. Borough Electrical Engineer, Wellington Road.

Australia.—PERTH.—December 5th and 12th. Postmaster General's Department. Telegraph and telephone instruments and parts, battery material and telephone switchboards, parts, &c. See "Official Notices," November 16th.

ADELAIDE. December 12th. P.M.G.'s Department. Telephone material. Schedules 478 to 482. See "Official Notices" November 23rd.

SYDNEY.—In the near future the Deputy Postmaster-General will be inviting tenders for certain telephone and switchboard parts. Some particulars can be consulted at the Department of Commercial Intelligence, 73, Basinghall Street, London, E.C. 2.

Carlisle.—December 4th. Electricity Department. "One 1500/2000-KW. turbo-alternator and one surface condensing plant. See "Official Notices," November 16th.

Leeds.—December 4th. Electricity Department. 6,000-KW. turbo-alternator and condensing plant. See "Official Notices" to-day.

London.—H.M. Office of Works. December 6th. Twelve months' supply of electric wire and cable; three months' supply of electric bell fittings. See "Official Notices" to-day.

Manchester.—December 12th. Three fan draught cooling towers at the Stuart Street station, for the Electricity Committee. See "Official Notices," November 16th.

Rosario.—February 23rd, 1918. Municipality. Establishment of telephone service within the municipal radius. Conditions on application.

CLOSED.

Bury (Lancs.)—B.G. Electric motor for hot water supply: Veritys, Ltd.

Glasgow.—Recommended tenders:—

Electricity Department.—Bruce Peebles & Co., Ltd., two 500-KW. rotary converters for consumers' premises, at £2,200 each, plus £45 for spares. British Thomson-Houston Co., Ltd., three 1,930-KW. rotary converters for the generating stations, at £4,768 each.

Tramways.—Cable. Liverpool Electric Cable Co., Ltd.; General Electric Cable Co., Ltd.

Trolley cord.—Joseph Cookson, Ltd.

Rotary converter.—British Westinghouse & Co., Ltd.

Galvanised steel wire.—Whitcross Co., Ltd.

Cleansing Department.—Electrical material.—Woodward & Co.

Grimsby.—Town Council. Accepted tender: Crompton and Co., Ltd., at £152, motor-generator and switchgear for charging electric vehicle batteries.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, November 30th. At 8 p.m. At 31, Victoria Street, S.W. Paper on "Drawing Office in Relation to other Departments," by Mr. E. D. Roberts.

Institution of Municipal and County Engineers. Friday, November 30th. At 5 p.m. At Burlington House, Piccadilly, W. Discussion on the "Supply of Power or Fuel to Vehicles on Public Highways."

Institution of Mechanical Engineers.—Friday, November 30th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. The Thomas Hawksley "Lecture on Heat Engines," by Capt. H. Riall Sankey, C.B., R.E.

Salford Technical and Engineering Association.—Saturday, December 1st. Visit Manchester Corporation Hydraulic Pumping Station, At 7 p.m. At the Royal Institute. Annual Meeting.

London Association of Foremen Engineers.—December 1st. At 7 p.m. At Cannon Street Hotel. Annual meeting.

Royal Institution of Great Britain.—Monday, December 3rd. At 5 p.m. At Albemarle Street, Piccadilly, W. 1. General monthly meeting.

Royal Society of Arts. Monday, December 3rd. At 4.30 p.m. At John Street, Adelphi, W.C. Cantor Lecture, by Prof. H. C. H. Carpenter, on "Progress in the Metallurgy of Copper." Lecture I.

Wednesday, December 5th. At 4.30 p.m. Inaugural Trueman Wood Lecture, by Sir Dugald Clerk, F.R.S.

Society of Engineers.—Monday, December 3rd. At 5 p.m. At the Geological Institute, Burlington House, Piccadilly, W. Lecture on "High-speed Railways after the War," by Mr. Chalmers Kearney. Tickets (free) from the Secretary, 17, Victoria Street, S.W. 1.

Institution of Civil Engineers.—Tuesday, December 4th. At 5.30 p.m. At Great George Street, S.W. Paper on "Recent Developments in By-Product Coking," by Mr. G. B. Walker.

Association of Supervising Electricians.—Tuesday, December 4th. At 7.15 p.m. At St. Bride's Institute. Paper on "Transformers."

Institution of Electrical Engineers.—Thursday, December 6th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Paper on "Electrical Cooking as applied to Large Kitchens," by Mr. W. A. Gillett.

(Birmingham Local Section).—Wednesday, December 5th. At 7 p.m. At the University, Edmund Street. Paper on "Gas Firing Boilers," by Mr. T. M. Hunter.

Greenock Electrical Society.—Thursday, December 6th. At 7.45 p.m. At 22, West Stewart Street. Paper on "Wireless Installation," by Mr. G. Reid.

Chemical Society.—Thursday, December 6th. At 8 p.m. At Burlington House, Piccadilly, W. Lecture on "The Relation between Chemical Constitution and Physiological Action," by Dr. F. L. Pyman.

NOTES.

Corrections.—Owing to an obvious slip in connection with the final proofs of our leading article last week, a slight confusion occurred on page 182; lines 18 to 50 in the first column should have been deleted. In line 55 for "as" read "at."

An Institution of Electricity Supply Engineers.—We have received a copy of the following letter, which explains itself:—

H. W. Healy, Esq.,

Battersea Borough Council Electricity Works,
Battersea.

INSTITUTION OF ELECTRICITY SUPPLY ENGINEERS.

Dear Sir.—The result of the meeting held at the Hammersmith electricity works, on November 5th, proved such interesting reading and potential of such far-reaching results that a meeting of the whole of the assistant technical officers of the Sunderland Corporation electricity department was convened yesterday to discuss the report published in the current Press.

Whilst admitting that the scheme is as yet in a state of flux, nevertheless the broad ideals aimed at in the prospective institution, together with the responsible character of the Provisional Committee elected to consider the constitution of the same, received the unanimous approval of our meeting, and the undersigned were delegated to forward you this letter in sympathetic support.

The reasons animating the electricity supply engineers in the metropolis exist in equal degree throughout the provinces, and we have, therefore, forwarded a copy of this letter to the technical Press, in the hope that all the provincial undertakings, both municipal and company, will follow our example and send along to you an expression of their sympathy with, and approval of, the movement, in time to be submitted at the general meeting to be held in London in due course.

The start made in London has been so auspicious that we look to the rest of the provinces to fall in line voluntarily and without delay, as the fundamental success of the prospective institution depends entirely on its membership being of a national character.

We hope in the near future to convene a general meeting on the North-East Coast of all the senior electricity supply engineers between the Tyne and Tees, with the object of furthering the movement in this part of the country, and trust this intention will be of assistance to the Provisional Committee.

S. R. WINDLE. J. W. TOWNLEY.

WILFRED YORKE. B. J. R. BUSHNELL.

Sunderland, November 27th, 1917.

National Insurance (Part II) (Munition Workers) Act, 1916.—The following is a further decision of the Umpire:—

2,393 X. Workmen engaged wholly or mainly in the manufacture of metal signs for advertising purposes.

Notice is given that the Umpire has received application for decision as to whether contributions are payable or not in respect of the following class of persons:—

502. Workmen engaged in making gas bags for motor-cars.

The Umpire proposes to give his decision on the above application on or after December 10th, 1917, and representations should be made before the 7th.

Colliery Signalling Patents.—A decision has just been given by the Chief Examiner of Patents in connection with a patent application of the Sterling Telephone and Electric Co., Ltd., and others, for signal cancelling apparatus (No. 105,659, dated May 31st, 1916), which had been opposed by the Automatic Telephone Manufacturing Co., Ltd., on the grounds of their prior British Patent No. 18,780, of 1914, and unfairness and inadequacy of description.

At the hearing on November 7th, Mr. Courtney Terrell appeared as counsel for the opponents, and Mr. H. W. K. Jennings, of Messrs. W. P. Thompson & Co., of London, as patent agent for the applicants. In opening the case, Mr. Jennings explained clearly the distinctive features and advantages of the Sterling system, and contended that the applicants' specification fairly defined the exact scope of their invention.

Mr. Terrell maintained that the applicants' invention was claimed in the opponents' Claim 5.

The Chief Examiner decided that neither of the relays described and claimed by the applicants had functions similar to the opponents' first relay; further, that applicants' invention did not fall within the opponents' Claim 5; and, finally, that the applicants' specification was perfectly fair, and gave sufficient notice to the public as to the prior art.

The opposition was accordingly dismissed, with costs.

Australian Electric Steel.—The first plant of the Australian Electric Steel, Ltd., is situated at Alexandria, Sydney, and is equipped with a 2-ton Electro-metals two-phase furnace, supplied from the 5,000-volt three-phase circuits of the City Council through Scott-connected transformers. This plant has been in operation about eight months, and its output is principally castings low in carbon, and special alloy steel castings for mining and electrical work; the charge is common steel scrap and pig-iron. The success already achieved has been such that the company has already commenced the erection of a similar plant in Western Australia. Mr. J. M. Deschamps is the managing director, and Mr. T. D. Robertson (M.M., Sheffield) the metallurgist to the company.—*Commonwealth Engineer*, Vol. V, No. 2.

Reconstruction and Trade Policy.—In Parliament, last week, Mr. George Terrell asked the Minister of Reconstruction whether, in connection with his work of reconstruction of British trade, he was proceeding on the basis that after the war British manufacturers would be protected by a tariff against foreign imports, or on the basis of free trade. In reply, Dr. Addison intimated that the question of the fiscal policy after the war was being considered by Lord Balfour's Committee on Commercial and Industrial Policy.

A Ministry of Health.—At a conference called by the Council of the Faculty of Insurance, on Saturday, Dr. Addison said the Insurance Act had demonstrated to the public that ill-health was very expensive. As Minister of Reconstruction it fell to his lot to do what he could to try to arrive at an arrangement for dealing with health matters which would be workable, comprehensive, and practical, and to bring into it, as far as possible by agreement, the various parties concerned in the preservation of the public health. At the Ministry of Munitions he set up a Committee to investigate health matters. It made some interesting discoveries. A set of women turning aluminium fuse tops were working 66 hours a week. Take their hourly output as 100. Then these same women worked a period of weeks of 54.8 hours. The hourly output was 131. They worked a period of weeks of 45.6 hours, and the output was 158. It paid that factory to employ these women only 45 hours a week. Similarly, there was a set of boys working 72 hours a week boring topcaps. Taking their output at 100 per hour, their hourly output, when they worked 51 hours a week, was 117, and when they worked 53 hours 119. A reduction of hours from 58 to 51 of men engaged on heavy work increased their hourly output from 100 to 139. One of the vital matters after the war was to increase the productive power of the nation, and investigations of that kind were of a singularly important and fundamental character. Above all things, accurate information was needed, and he was going to try to get it. The first thing to do was to get a central health authority, but he did not anticipate that anybody nowadays with the experience of war control would want everything to be done by a Department in Whitehall. They must look forward to a great measure of decentralisation. He had been charged to get into touch with the interested people and to formulate a plan.—*Morning Post*.

Electrometallic Effects Across Very Thin Insulating Sheets.—Monsieur Brany, in continuation of his important communication to the Paris Academy of Sciences, has studied the unipolar conductivity of certain couples—e.g., galena-platinum wire or galena-copper wire. These couples, under suitably regulated contact pressure, allow the current to pass in one direction but not in the other. A similar unipolar conductivity is observed with a sheet of mica interposed between two metallic disks of different substances, specially selected. It is not, however, only in the unipolar conductivity that the nature of the metals embodied in a mica condenser plays an important rôle. This feature is also evident in simple conductivity experiments, where certain associations of metals are found to be more advantageous for ensuring the conductivity of the mica. Two metallic surfaces placed opposite each other exercise a specific external influence across the intermediate medium by the action of a low E.M.F. at distances which are sufficiently great to be measured directly.

Science and the Civil Service.—The Committee on the Neglect of Science has issued a pamphlet dealing with the Report of the Committee appointed by H.M. Treasury to consider and report upon the scheme of examination for Class I of the Civil Service. The Civil Service Committee has recommended that there should be two examinations—one a qualifying examination to be taken by all candidates, and the other a competitive examination; but no subjects are made compulsory, so that no necessity is put upon the headmasters of the great Public Schools to give any more attention to science than has hitherto been the case.

The recommendations of the Committee stop short after securing "equal opportunity" for all subjects. With regard to the Natural Sciences, the Report expressly states that the Committee declines the responsibility of making education in them a necessity. The scheme gives the equal opportunity; "the schools and Universities must do the rest." The difficulty remains as before—namely, that the schools and Universities are, to a large extent, in the hands of teachers of the Classics. In the great Public Schools the headmasters are, without exception, "Classics," the Natural Sciences are treated with neglect, and their importance as an essential and dominant part of sound education is ignored.

The object of the Committee on the Neglect of Science was, and still remains, to obtain from the Civil Service Commissioners such a scheme of examination as would compel the managers of the great Public Schools to adopt a more intelligent scheme of education. The Commissioners are the only body in existence which can put pressure on the great schools and Universities. Very naturally

but not courageously or patriotically—the Civil Service Committee refuses this responsibility. "Permissive legislation" is the limit of its courage. So it has been in former times in regard to measures for securing the public health, elementary education, and even national defence. But eventually legislation in these matters has taken a compulsory form; and so it must, without further delay, in regard to education. It is simply absurd, says Sir E. Ray Lankester, to allow the great schools and the old Universities to administer great national funds so as to maintain the vested interests of a schoolmaster-class, ignorant of, and therefore hostile to, the most important national interests—the education of our best sons in the knowledge of Nature.

The "Guarantee of Work Scheme" of the E.C.A.—By the courtesy of Mr. H. Marryat, Editor of the *Electrical Contractor*, who has kindly sent us advance proofs of the forthcoming issue of that journal, we are enabled to announce that this important scheme has now been definitely adopted by the Electrical Contractors' Association, after overcoming strenuous opposition. The scheme is set out in the Articles of N.E.C.T.A., Ltd., a company formed by the Association for the express purpose of putting the scheme into practice without infringement of the Charter of Incorporation of the E.C.A.

Our contemporary says:—The Council, confirming its adoption of the scheme, made the date of its being given effect subject to the calling of special meetings of sections and branches opposing, at which members of the Council were to be given an opportunity of speaking on the subject. A series of such meetings has been held, and unanimous votes of approval were recorded in every instance, the unanimous acceptance of the scheme by the Northern Section meeting at Leeds on Saturday, November 3rd, being the final act required to justify the Council in proceeding immediately to put the scheme in operation.

The reason that so much discussion and delay has occurred in carrying out this admirable piece of constructive policy is that the proposal is unique in character, and, like the Daylight Saving Bill, its advantages are far from obvious at the first reading. The advantages to the individual member are indirect and ultimate, whereas many seeming disadvantages are ready to be picked from the surface. Considerable discussion and explanation has been necessary before members generally could be expected to see the Guarantee of Work Scheme in its broader aspect, not as a means of immediate profit to individuals, but as an effective lever to raise the status of the whole contracting trade.

In simple terms the scheme, which is set out in detail in the Articles of N.E.C.T.A., Ltd., provides that on and after a date which will be decided during the next few weeks, the Association as a whole will guarantee that the work of each of its members shall be in accordance with the standard requirements laid down in the Wiring Rules of the Institution of Electrical Engineers, and that the Association will back its guarantee with its purse. Certain exceptions and limiting conditions are imposed, and ample powers are taken for inspection both during erection and after completion of our members' work.

The adoption of the scheme means that henceforward no man who desires to do bad work can find a place within the ranks of our Association, that the E.C.A. stands definitely and finally for good work, and that those members of the I.M.E.A., who, after subscribing to the I.E.E. Rules, persistently encourage slip-socket tubing and other infringements of the rules, will find themselves being left behind in the path of progress.

[We congratulate the Association on this highly satisfactory achievement, the result of five years' strenuous labour on the part of the Council, which will immensely strengthen the Association and increase its prestige. —Eds. ELEC. REV.]

Gas-bag Motor-cars.—Owners of motor vehicles which the Petrol Committee has refused to license have eagerly seized upon the gas-bag as an alternative, and enormous numbers of cars are being converted to gas. As this work is employing men whose services are urgently required for essential war work, says the *Times*, it is highly probable that the use of gas in such cases will be prohibited.

A Manchurian Electric Locomotive for Mines.—H.M. Consul at Dairen (Mr. H. G. Parlett) has forwarded a copy of the specification of an electric locomotive which has recently been built at the South Manchuria Railway Co.'s works at Shakako, for the use of the Fushun mines. It was proposed to build seven other locomotives of a similar character by the middle of November. It is understood that this is the first attempt to build this kind of locomotive in Manchuria, supplies having hitherto been obtained from Germany or the United States of America. British firms interested may consult the specification at the Department of Commercial Intelligence in London.

Electrical Rain-Making in Australia.—At the final meeting of the Rain Precipitation Investigation Committee, held on October 3rd, the Committee placed on record the fact that no information whatever had been submitted for the consideration of the members which justified the claim that any advance had been made in Australia in the direction of causing, or increasing, rainfall. The Committee was appointed by the Premier towards the end of the year 1915 to investigate certain claims of Mr. Balsillie in connection with rain-making by electricity.—*Sydney Daily Telegraph*.

The Minister of Works and Railways has agreed to a practical trial of the Balsillie rain-stimulating device at Hopetoun, in the Mallee. At this centre there are complete rainfall data extending over many years, enabling a reliable comparison to be made. Experiments with the device are being continued at Wynbring, on the route of the Trans-Continental Railway.—*Melbourne Age*.

Steady Arcs for Bioscopes.—In order to retain the arc in focus, the negative carbon of a bioscope arc is often made of smaller section than the positive, and to maintain its conductance it is copper plated. The copper has a tendency to collect in molten beads on the tip of the carbon, which splutter when the arc touches them, causing undesirable flickering and projecting molten metal on the lens, to which it adheres firmly. The formation of these beads can be entirely prevented by a nickel coating over the copper sheath. This device has been patented by Mr. B. Perris, of Lakewood, Ohio, U.S.A. (U.S. Patent No. 1,241,710). *Electrical World*, Vol. LXX, No. 19.

Fatalities.—On November 20th, an inquest was held at Littleborough with reference to the death of Thos. Rayner (36), a machine cutter at the Grove Wiring Co.'s works. By a short-circuiting of the motor and a connecting wire to a fixture on the machine, the cutting machine at which Rayner was working on the previous Saturday became alive. His assistant, J. T. Taylor, said that deceased, who had gone to the lever, was clinging to the guard round the main driving strap, and looked as though he were in a fit or seizure. He was gripped to the guard, and his face was discoloured and contorted. Then he was suddenly twisted off, and fell on the floor. All the place round the motor seemed charged. Medical evidence showed that deceased had died from shock.

J. E. Russell, the electrician in charge at night, described the fitting quite recently of an electric fan to carry the dust off the machine in question. It was done under the direction of the chief electrician and himself. The machine was driven by steam. The 6-h.p. motor which drove the fan was a few yards away. The dust was carried up a 12-in. pipe. From the motor to the pipe ran a piece of wire a twentieth of an inch in thickness, and the pipe was metallically connected with the machine. The wire was used to steady or stay the pipe, and did not strike him as being dangerous, though they had seen that that was the means by which the machine became electrified. He never drew the attention of a new man to it. He had changed his opinion now. It was obvious from the condition of the cover over the motor leads that electricity had been passing into the cover. This leakage had made the whole motor frame alive, and the current then passed along the small stiffening wire to the fan pipe, and so made the whole metal part of the machine alive, and anyone touching the machine and standing on the concrete floor would have the full force of the shock. There was no earth wire on this motor, though there were on all the others. After the accident the wire was red hot. One of the terminals had jumped, and the electricity had escaped into the motor frame.

The Coroner said it was a grave mistake to connect the wire with the motor when it could quite as easily have been fixed to the wall, and it was a grave error that the motor had not been properly earthed, but he thought the jury would find there was no criminal neglect. A verdict of "Accidental death" was returned.

A Goods Clearing House for Railways.—Sir Albert Stanley, President of the Board of Trade, on November 24th, received an influential deputation urging the need for reform of the railway system, particularly in the collection and distribution of merchandise. Mr. A. W. Gattie explained the system proposed for the collection and distribution of goods, and asked the President to appoint a Committee of Inquiry vested with full powers to carry out a thorough investigation of the scheme. Sir Albert Stanley gave a lengthy and sympathetic hearing to the deputation.

Wages in Metropolitan Electricity Works.—The Town Clerk of Hammersmith has sent out a circular-letter stating that from time to time the question of rates of wages paid to different grades engaged in the Council's electricity undertaking has been brought before the appropriate Committee of his Council, sometimes upon an application of the men concerned, and at other times upon a representation by one or other of the Unions claiming to represent the different sections of men. His Committee has felt a certain amount of difficulty in dealing with such applications in a proper manner, owing to the uncertainty of the effect which any action which it might take might have upon the position of other generating stations. In the cases of applications brought forward by societies claiming to represent certain classes of men, the difficulty has been complicated by the uncertainty as to how far such societies are representative of the classes of men concerned. In these circumstances, the Committee expresses a general agreement with a proposal that, if possible, there should be a Federation of Electrical Supply Authorities in London and Greater London, whose particular function it would be to consider, from a federation point of view, the rates of salary and wages paid to persons engaged in the generation and distribution of electricity. Should such an organisation be formed, it would become a natural medium for the discussion of work and rates of pay amongst the persons affected, whether such discussion was with the sanction of the men direct or with some society recognised as representing the men. Other Councils are asked if they are prepared to assent to the suggestion, or if they think the matter is one which should be discussed at a meeting of representatives of electricity undertakings.

Hackney Borough Council has also sent out a circular to the effect that its Committee has had under consideration a communication from Sir George Askwith, dated September 17th, enclosing a memorandum as to a conference, which was held on September 6th, on the question of working conditions and rates of pay in the power stations of London. The Electricity Committee is of opinion that the several authorities owning electrical undertakings in the metropolis, before binding themselves to form a body to deal with working conditions and rates of pay, should meet in conference with a view to deciding whether the principle suggested in Sir George Askwith's communication would be acceptable, or otherwise. Councils are asked to appoint delegates to the last-mentioned conference.

Hackney Electricity Committee reports that the Wages Conference of Municipal Authorities in Greater London owning electricity undertakings has held its first meeting; many of the authorities have appointed delegates, and officers have been appointed in connection with the Conference. On the Executive Committee all members have voting power, but in the Conference the vote is to be by undertakings.

On the 6th inst. the Conference passed the following resolution:

tion:—"This Conference recommends the adoption of the award of 15s. increase on the pre-war wage to all employes affected by the awards of the Committee on Production and to the technical staff, to date from September 1st, and such 15s. to be inclusive of any increase granted since August, 1914, as war bonus or war wages."

The Committee recommends that the chairman and ex-chairman for the time being of the Electricity Committee, together with the borough electrical engineer, be appointed to act as delegates on behalf of the Borough Council at the Wages Conference, with authority to treat with employes' representatives as to the question of securing uniformity of wages and working conditions of men engaged in electricity undertakings.

Jacks for Tramcar Accidents.—At an inquest at Newcastle-on-Tyne, on the 26th inst., on a child who had been killed by a tramcar, it was stated that the child was under the car when it was pulled up after the accident, and being beyond the motor-case, could not be got at through the trapdoors inside. It was about half an hour before a breakdown gang got to the scene of the accident. Coroner Appleby said that was not the first accident of the kind, and people were under the impression that if jacks were carried on the cars, they would be sufficient to lift the vehicles. A tramcar inspector said that if jacks could be carried, it would be necessary to have men who understood the work to use them, or they might tilt the car over. Mr. E. Hatton, general manager of the tramways, said the question of using jacks was not new in the city, and had been discussed in other towns. He had had inquiries from other tramway systems as to the methods adopted in cases of accidents of that kind. What they did was to communicate with the nearest depot, and the men turned out with what jacks they had. The Haymarket depot also was informed, and the wagon, which was supplied with all kinds of appliances, and was always in readiness, was sent out to the scene of the accident. In that particular case, the Byker men turned out with 5-ton jacks, which lifted the car (which weighed 11 tons) some 12 in. That was not sufficient, and from the breakdown van they obtained larger jacks, which could not be carried on a tramcar. It was not a question of money that affected the fitting of jacks on cars, but the suitability of the machinery to do the work. He could not see at the present time any better method of dealing with those accidents, but if a more expeditious method could be devised it certainly would be adopted. In cases of accidents on steep inclines, the lifting had to be carried out by persons possessing engineering knowledge. The verdict was one of "Accidental death," and no blame was attached to the driver.

Electric-Light Switching.—From Messrs. A. P. Lundberg and Sons, 477-489, Liverpool Road, London, N. 7, we have received a copy of a new preliminary-grade examination paper on this subject. We are informed that anyone can obtain a copy on application, together with other particulars regarding these free home examinations. The paper itself includes a set of rules for the guidance of examinees, and the new set of 11 questions shows no falling-off in practical and interesting points. Up to June last, 637 examinees had gained the preliminary-grade certificate, not to mention those holding intermediate and advanced certificates.

Appointments Vacant.—Testing assistant (45s.) and shift engineer (40s. +), for the Islington B.C. electricity department; junior shift engineer (£156) for the Corporation of Leicester tramways and electricity department; engine attendant (60s. to 70s. +), temporary sub-station attendant (30s. to 40s. +) for the L.C.C. tramways department; assistant draughtsman for Edmundson's Electricity Corporation; meter superintendent (£160 +), engineer in charge (£175 +) for the Hammersmith B.C. electricity department. See our advertisement pages to-day.

New South Wales Labour Troubles.—The latest mail advices from Sydney indicate that the strike is over. The New South Wales Government is working 15 collieries, which should to-day be raising 7,000 tons per day; in the middle of September there was a reserve stock of 200,000 tons of coal. The majority of the mines are being worked at a fixed price per ton, the Government paying the cost of railway fares and the camp expenses of the loyal volunteers. Encamped at the Sydney Cricket Ground and Taronga Park are 6,000 country volunteers, who practically monopolise the wharf labour. A new Union of Waterside Workers has been formed, having as a basis a minimum weekly wage, instead of payment by the hour as at present. Up to the end of September, applications for new registration were received from eight newly-organised Unions by the N.S.W. Government.

Localising Metal in the Human Body.—Dr. F. H. Hackett and Mr. J. W. Greenwood, electrical engineer, both of Halifax, have invented and patented an instrument known as the "metalocophone," on the telephone principle, for the localisation of shrapnel or other metal in the human body. A searcher is moved over the patient's body, and on its approaching metal in the body a humming noise is heard by the operator in a receiver. An incision in the flesh is followed by the insertion of a probe, which, by the same method of sound, guides the operator to the position of the metal. It is further claimed that the appliance also indicates whether the metal is magnetic, in which case it can be extracted by an electromagnet. The instrument weighs 4 lb.

Stealing Tramcar Lamps.—During the past few days no fewer than a score of boys have been before the Liverpool Stipendiary charged with stealing electric glow lamps from the rear of tramcars. A birching has been the usual penalty inflicted.

Volunteer Notes.—COUNTY OF LONDON VOLUNTEER ENGINEERS (FIELD COMPANIES).—Headquarters, Balderton Street, Oxford Street, W. 1.

Orders for the week, by Lieut.-Colonel C.B. Clay, V.D., commanding:—
Officer for the Week.—Second Lieut. H. G. Golding.
Next for Duty.—Second Lieut. P. Bowden.
Drills.—Week ending Saturday, December 8th, 1917:—
 Monday.—No. 3 Company, Left Half. Recruits, signalling, 6.30.
 Tuesday.—Physical drill and layonet exercise, 7.30.
 Wednesday.—No. 1 Company, 6.30.
 Thursday.—No. 2 Company, 6.30; signalling, ambulance, 6.30.
 Friday.—No. 3 Company, Right Half. Recruits, 6.30.
Muster.—Belvedere Road, Tuesday, Wednesday, and Thursday, 5.30 to 7.
 The Medical Officer will attend for examination of recruits, &c., on Thursday, at 6.30.

(By order) MACLEOD YEARSLEY, Capt. and Adjutant.

Institution and Lecture Notes.—Physical Society of London. At the meeting held on November 29th, the President, Prof. C.V. Boys, F.R.S., referred briefly to the great loss which the Society had sustained since the last meeting in the death of its treasurer, Mr. W. Duddell, F.R.S. A paper "On the Thermo-Electric Properties of Fused Metals," by Messrs. C. R. Darling and A. W. Grace, was read by the former. In a previous paper the authors described experiments with bismuth, the apparatus then used only being capable of furnishing readings up to 560° C. Methods have now been devised by which the metals examined may be heated in the tube of an electric furnace, and observations made up to the temperature limit of the furnace. The metals experimented with were lead, tin and antimony up to 1,000° C., and zinc and cadmium up to temperatures approaching the boiling point. No change in thermoelectric properties was noticed at fusion, except in the case of antimony, which, like bismuth, shows an abrupt bend in the E.M.F. temperature curve at the melting point, 632° C. This exceptional behaviour of antimony and bismuth is in keeping with the anomalous properties of these metals, both of which expand on solidification; and it is suggested that an allotropic change occurs at fusion in these metals. In the case of lead, which is used as the reference metal in thermoelectric diagrams, it is shown that extrapolation of lines in the diagram beyond 300° led to serious errors, and that although at low temperatures the E.M.F. temperature curves are approximate parabolas, the departure from this shape above 300° is so marked as to render thermoelectric diagrams of little value.

In the discussion, Mr. Whipple said that this work opened up certain possibilities of commercial importance, as it appeared that information could be obtained of the thermoelectric properties which a particular alloy would have while it was still in the molten state. It would thus be possible, by adding one or other of the constituents as required, to obtain an alloy with any prescribed thermoelectric properties. At present the alloy had to be allowed to cool, and a wire of it drawn and tested. If it were not right, it had to be melted up again and its constitution altered, which was a troublesome method. Northrup had suggested a tin-graphite thermometer for high temperatures up to about 1,700° C., on the same lines as the ordinary mercury-in-glass thermometers. The tin expanding along the stem of the thermometer moved an index wire, by which the temperature was indicated.

Institute of Metals.—The Hon. Sir Charles Parsons is to give the annual May Lecture before the Institute next spring, and will deal with the subject of the formation of diamonds. For over 30 years he has been experimenting upon the production of artificial diamonds, and an account of his researches cannot fail to be of the greatest interest. A ballot for the election of members of the Institute is due to take place on December 12th. Forms of application for membership can be obtained from Mr. G. Shaw Scott, M.Sc., Secretary and Editor, 35, Victoria Street, Westminster, S.W. 1. The present year has witnessed a remarkable growth in the Institute's membership from 660 to over 860.

Keighley Association of Engineers.—Lecturing last week on "Our Sources of Energy and Some Possibilities in Connection with their Fuller Utilisation," Prof. Watkinson, of Liverpool University, alluded to the danger of our present method of drawing upon our reserves of coal and oil. Sixty-five million tons of low-grade fuel, he said, was being wasted annually under present methods, but could be utilised by a proper scheme of electrical distribution, in which form, with a concentration of plants in the neighbourhood of coal fields, very great economy could be effected. By-products could be procured, and from the coal burnt at the present time we ought to be able to get 200 million tons of tar, from which could be got about 8 million tons of tar oil for engine uses and oil traction or shipping. If the coal, also, were properly gasified, benzol and ammonia, and sulphate of ammonia for manure, would be procured in great quantity. The Professor insisted that the distribution under such scheme would have to be taken in hand by the Government, and trunk lines of 70,000 to 100,000 volts should be laid down, these trunks being tapped by the municipalities, who would further distribute the energy. Under present conditions we could look for very little further fuel economy.

Chadwick Public Lectures, Leicester. The second of the Chadwick Lectures at Leicester Museum, on "Electricity and National Welfare," was given by Prof. H. T. Davidge on November 24th, the title being "Electricity and Increased Food Production." After dealing with the heat values of various foods and the connection between the calorific and mechanical work, the problem was approached of the necessity for increasing plant growth by electric action. The case of "Electroculture" was first taken, and various methods were explained. Statistics were given indicating that great increases might be possible in this way, but the lecturer indicated that further accurate quantitative research work was necessary before hard and fast rules could be formulated. Next was shown the importance of nitrogen in the growth of wheat,

and how necessary it was to give a large supply of this element in a form which the plant could assimilate. The fixation of atmospheric nitrogen was explained, and statistics were given showing the growth of the industry. The importance of cheap power was emphasised, and it was made clear that a load of the necessary kind was admirable to level up the "load factor" of large power stations near coal and water. Lastly, under a scheme of high-pressure electric-supply networks extending over large tracts of the country, it was shown that the farmer of the future could tap cheap power for all farm purposes, including haulage transport, and much was to be hoped for from such systems of supply.

A Reliable Machine.—The aeroplane used by the airman who journeyed from England and dropped bombs round Constantinople, last July, was a Handley Page, of British manufacture. The magneto also was British, made by members of the British Ignition Apparatus Association.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station and Tramway Officials.—On November 9th Mr. H. FARADAY PROCTOR celebrated his 25th year of service with the Bristol Corporation as engineer and general manager to the electricity department.

The Bispham (Blackpool) U.D.C. has increased the salary of the electrical engineer from £140 to £200, and that of the assistant electrical engineer from £130 to £180 per year.

The Fleetwood U.D.C. recently advertised for an assistant electrical engineer at £150 a year, rising to £175. Sixty-one applications were received. The appointment has not yet been made.

The salary of Mr. S. KIRKWOOD, assistant engineer at Shrewsbury electricity works, has been advanced by £25 per annum.

Mr. G. W. MALLINS, general manager of the Liverpool Corporation tramways, met with an accident the other day, owing to restricted lighting. He fell on the pavement and injured his knee, and it may be some time before he can resume his duties.

The London County Council Highways Committee recommends that Mr. W. CRAWFORD and Mr. E. T. HOLT, acting assistant permanent-way engineers, be appointed assistant permanent-way engineers in the tramways department at £325, rising by annual increments of £25 to £400 a year.

The Coventry City Council has advanced the salary of Mr. T. R. WHITEHEAD, the tramways engineer, from £600 to £700 per annum.

General.—Mr. J. F. SELLS, of the engineering staff of the National X-ray Reflector Co., has been appointed as consulting illuminating engineer for the new business departments of the Henry L. Doherty Co., central stations.

The St. Pancras Electricity Committee has appointed Com. G. F. PARSONS as its chairman, and Com. W. G. GREY as deputy-chairman.

The *Irish Builder* states that Mr. W. PLEASANCE, M.I.E.E., Belfast, has been appointed teacher of electrical engineering to the Technical Institute at Portadown.

Canada states that Sir HENRY DRAYTON, Chairman of the Board of Railway Commissioners, has been appointed Controller of Production and Distribution of Electrical Energy in the Province of Ontario.

Mr. C. H. WORDINGHAM, President of the Institution of Electrical Engineers, has accepted office as one of the vice-presidents of the British Electrical and Allied Manufacturers' Association (Incorporated).

The Islington Borough Council Electricity Committee has unanimously re-elected Ald. H. B. VOSELEY to the position of Chairman for the 13th year in succession, thus paying a tribute to the value of his services to the electrical undertaking. Com. E. T. LUXLOW, a local electrical man, was unanimously elected Vice-Chairman for the ensuing year. Both of these gentlemen are delegates to the Greater London bulk-supply conference.

The following constitute the Bristol Corporation Electrical Committee for 1917-18:—Ald. G. Pearson (chairman), A. E. Thomas (vice-chairman), Ald. C. P. Billing, I. M. Dunlop, C. T. Enwright, J. H. Gibbs, J. Littleton, J. Milton, E. J. Neale, A. A. Semington, W. G. Pope, C. R. Perrett, and E. H. Stock.

Roll of Honour.—Second-Lieutenant J. W. PARKER, M.C., West Yorks. Regiment, who was on the staff of the Leeds Branch of the General Electric Co., Ltd., died on November 13th as a result of gunshot wounds received in action.

Private J. SNOW, King's (Liverpool) Regiment, who has been killed in action, aged 23, was employed by Messrs. Dick, Kerr & Co., Ltd., of Preston.

Private J. DONOGHUE, killed in action, was employed by Messrs. Baxendale & Co., Ltd., electrical manufacturers, Manchester.

Private A. Fox, A.S.C., killed, was employed in the battery department of the B.I. & Helsby Cables, Ltd., Prescott.

The Military Cross has been awarded to Lieutenant N. Sizer, R.E. (Signallers), for conspicuous gallantry and devotion to duty on October 4th. He was also mentioned in dispatches last spring. Lieutenant Sizer was an electrical engineer at the Westinghouse Works, Manchester, and is an A.M.I.E.E.

Sapper P. HIRST, R.E. (Signal Section), who has been wounded, was in business as an electrician at Huddersfield.

The death from disease at Dar es Salaam, East Africa, is reported of Sergeant H. E. BISHOP, who joined the R.N.A.S. at the outbreak of war, whilst an electrical engineer with the Western Electric Co., at Woolwich.

Private C. B. JONES, Gloucestershire Regiment, who has fallen in action, was in the lamp shipping office of the B.T.H. Co., at Rugby.

Corporal A. S. TASKER, Essex Regiment, who was prior to the war engaged at the Chelmsford works of the Marconi Co., Ltd., has died of wounds received in action.

Corporal A. RICHARDS, who was on the staff at the Torquay Corporation electricity works, is reported killed in action after being missing since May last.

A commission in the Northumberland Fusiliers has been granted to Corporal F. GARSTON, East Lancashire Territorials, who enlisted whilst on the Corporation tramway staff at Blackburn. He gained the D.C.M. for conspicuous gallantry in Gallipoli.

Private R. W. DYKE, who enlisted from the staff at the Grantham electric light works, is reported missing.

Private W. S. PERKS, King's Shropshire L.I., Lewis Gun Section, killed in action after being twice wounded, was in the telegraph construction department of the Post Office.

Second-Lieutenant H. PROCTER, B.Sc., R.E., who was in civil life on the engineering staff of the B.T.H. Co. at Rugby, has died from accidental injuries, aged 30.

The death in action is reported of Private H. PUSEY, for nine years on the staff of the Tonbridge U.D.C. electricity works.

A bar to the Military Medal for restoring communications under particularly hazardous conditions has been awarded to Sergeant A. E. WRIGHT, R.F.A., who was an electrician at Forest Gate, E.

The Military Medal has been awarded to the parents of Lance-Sergeant W. POLLARD, Essex Regiment, recently killed in action, who enlisted from the staff of Messrs. Joslins, Ltd., electrical engineers, of Colchester.

Private H. GUTHRIE, who was formerly employed in the secretary's office of the Electric Supply Co. at Glasgow, has been killed in action.

Lieutenant H. W. MORGAN, attached R.E.C., who was on the office staff of the Liverpool Corporation tramways, was killed in action on November 8th.

Second-Lieutenant A. W. H. PURNELL, R.G.A., aged 21, is reported missing. He took a course of electrical engineering at the State University, Coethen, Hainault, Germany, and returned to the Empress Works, Loughborough, of which his father was a director. He enlisted in October, 1914.

Obituary.—DR. E. F. ROEBER.—From the pages of *Metallurgical and Chemical Engineering*, we learn that the editor of that excellent journal, Dr. E. F. Roeber, died on October 17th at the age of 50. Of Saxon birth, he was exceptionally well trained in science and engineering, and in 1899 he became assistant to Dr. Carl Hering, thus commencing his career as a leading authority on electrochemistry. In 1902 he was appointed editor of *Electrochemical Industry*, later renamed as above. He was an indefatigable worker, a great technical editor, an invaluable supporter (and one-time president) of the American Electrochemical Society, and a "patriotic, loyal American citizen without any reservation," who had left Germany as an hereditary opponent of "Prussianism."

MR. W. STORK.—We regret to record the death of Mr. Wm. Stork, who had been in the employ of Messrs. L. Frankenburg & Sons, Ltd., for several years.

MR. A. M. CHANCE.—We regret to record the death of Mr. Alexander M. Chance, of Messrs. Chance Bros. & Co., of Oldbury and Birmingham, aged 73 years. The deceased gentleman devoted himself assiduously to the interests of his firm's employes and the well-being of their families, many institutions being started by him for their benefit. Twenty-four years ago he read a paper before the Church Congress on the "Duties of Employers toward the Employed." He declined Parliamentary honours, but worked almost ceaselessly in connection with social and other local causes until his removal to Torquay, in the interests of his health, several years ago.

MR. J. C. MERRYWEATHER.—The death occurred on November 24th of Mr. J. C. Merryweather, head of Messrs. Merryweather & Sons, the well-known fire-engine and pumping machinery manufacturers. He was 77 years of age.

MR. A. J. BAKKER.—We regret to learn from the Sloan Electrical Co., Ltd., of the death, which occurred on 18th inst., of Mr. A. J. Bakker, of Messrs. Philips' Glowlamp-works, Ltd., of Eindhoven. Mr. Bakker was well known in this country and the Colonies, and his many friends will receive the news of his death with sorrow.

MR. W. K. PARTINGTON.—We regret to record the death of

Mr. W. K. Partington, a well known electric wiring contractor, which occurred at his residence at Tottenham on 22nd inst. The deceased gentleman served his apprenticeship in the L. & N.W.Ry. workshops at Crewe, and subsequently commenced business as an electrical contractor. He was connected with power and lighting work for over 30 years. We are informed that his business will be continued by Mrs. Partington.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

James Keith & Blackman Co., Ltd.—Satisfaction in full on November 16th, 1917, of second debentures dated January 6th, 1913, and January 7th, 1915, amounting £700.

Re-issue on November 15th, 1917, of £1,100 first debentures, part of a series already registered.

Alfred Danks, Ltd.—Particulars of £14,000 debentures created October 25th, 1917, filed pursuant to Section 94 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Bastian Electric Co., Ltd.—Particulars of £2,000 debentures created September 3rd, and secured by trust deed dated November 12th, 1917, filed pursuant to Section 94 (3) of the Companies (Consolidation) Act, 1908. None of the debentures have been issued at present. Property charged: First, second, and third floors at 185, Warldout Street, W. (dearshold), and the company's other property, present and future, including uncalled capital. Trustees: R. H. Forman & R. G. Warner.

CITY NOTES.

Auckland Electric Tramways Co., Ltd.—At the annual meeting, held in London on November 20th, Mr. TEGETMEIER, who presided, referred to the substantial increase in receipts for the year, and the almost equal increase in working expenses.

The traffic receipts were better by £7,914 than in the previous year, and the passengers carried were nearly a million more. The adverse conditions had not varied much during the year. While they were a long way from showing the expansion of pre-war days, the increase of £15,000 in traffic receipts during the past two years was sufficient to make up for the increase in expenses. When, after Peace, the men of Auckland returned to industrial activity the development of traffic of the war period would make greater progress. In the meantime it was satisfactory that they were able to maintain the dividend at the same rate as for the past few years. Their difficulties with regard to labour and the supply of materials had been intensified. Owing to the coal miners' strike last April it was necessary to curtail the services, but in spite of that fact the car mileage run showed an increase for the year. Power and running expenses increased by £5,835, and repairs and maintenance by £1,674, while £19,391 was expended on renewals and permanent-way reconstruction work. The net profit was £746 better than for the preceding year. The reserves now stood at £263,518. This, considered in relation to their capital and debenture account, and bearing in mind the tenure and terms of purchase of the undertaking by the local authorities, meant that their position was a strong one. The expenses would largely increase during the current year, for they would have much heavier taxation, and the increased scale of wages on the present basis was only operative for part of last year; further, the rise in materials would continue. The traffic receipts showed some improvement, and they hoped that this improvement would continue, so that they might meet the increased expenses without materially reducing the profits.

Castner-Kellner Alkali Co., Ltd.—Net profit £263,322, plus £39,404 brought forward. There is to be placed to depreciation reserve £50,000, and a final dividend of 11 per cent. is to be paid, making 20 per cent. for the year, leaving £45,078 to be carried forward, part of which will be required for further excess profits duty.

Bogotá Telephone Co., Ltd.—In their statement to June 30th, 1917, the directors report continued demands for telephone service. They have been fortunate in being able to proceed with the installation of the new extensions in spite of the difficulty they are experiencing in the exportation of the new plant and apparatus required. The equipment at Bogotá has been efficiently maintained, and the service continues to give satisfaction.

R. Hornsby & Sons, Ltd.—Dividend at the rate of 6½ per cent. per annum, less income-tax, on the ordinary shares for the year.

Northampton Electric Light & Power Co., Ltd.—According to the financial Press subscriptions are being invited for 14,000 "B" shares of £1 each at par.

Power Gas Corporation, Ltd.—Dividend at the rate of 6 per cent. per annum, less income-tax, on the ordinary shares.

Ruston, Proctor & Co., Ltd.—Dividend of 5 per cent. per annum on the ordinary shares.

British Electric Traction Co., Ltd.—The directors have declared the dividend on the 6 per cent. cumulative participating preference stock for the half-year ended September 30th.

Electrical Securities Trust, Ltd.—The accounts for the year show a loss of £629.

Rawlings Bros., Ltd.—The profit for the year ended March, 1917, was £231.

STOCKS AND SHARES.

TUESDAY EVENING.

THE effect of General Byng's splendid victory last Wednesday continues to be the dominating factor in the markets, where cheerfulness and confidence have assisted to fortify prices in most parts. There are a few weak sections, rubber shares, for instance, having given way in consequence of the fall in the price of the material, but investment securities are strong in practically every section, and noticeable activity is again a feature amongst electric manufacturing shares. The campaign in favour of the War Bonds is, of course, diverting capital from Stock Exchange channels to some extent, but there is plenty of money still available for investment, and for speculative investment.

The market for steam railways stocks is steady, but the demands of the railwaymen insist upon the full amount originally asked for in the way of increased wages, and the possibility of trouble by reason of this development is the latest reason for withholding interest from railway stocks generally. Underground Electric Incomes are dull at 82 and the 1s. shares at 6s.

The foreign section is one of the firmest, with the exception of Mexicans, where stagnation continues, accompanied by weaker prices; the truth of the matter is, of course, that no one is buying any Mexican stock at the present time, and until the air clears again they are not likely to do so. Accordingly, the Utilities are depressed, Mexico Trams of both classes showing further falls. Brazilian Traction, however, are a much better market, on account of a fair recovery in the Rio exchange. Anglo-Argentine Tramways Debentures are less in request, the Fives dropping back to 60½, despite the good rate of interest, combined with reasonably good security, which they afford. British Columbia Electrics are also a better market, and the strength of the Indian group is well maintained.

The animation in electric manufacturing shares, as already noticed, is still a feature of the miscellaneous market. General Electric Ordinary have risen to 19½, and business has been marked this week at 19½ and 19½. The Preference are ½ better at 10½. In Electric Constructions there is not so much going on as there was a week ago. The price continues steady at 24s., and the 7 per cent. Cumulative Preference, on which there is a dividend due next month, can be bought at 20s., at which they do not look expensive. Cromptons remain about 13s., and the Preference at 15s. 6d. A very lively market has sprung up in the Ordinary shares of the Hydro-Electric Power & Metallurgical Co. A week or two ago the price stood at 4s.; it crept up gradually to 6s., and this week the shares have been changing hands up to nearly 10s. A Tasmanian undertaking, the company fell upon evil days, and dragged out a dull life until just lately. The most fantastic rumours are current with regard to the profits which the company is said to be making now, but while the price is freely talked to over £1, the cautious observer is inclined to think that the recent movement has been sufficiently rapid, at all events for the present. Victoria Falls Ordinary are firm at 18s. 3d. Edison 15s. paid are steady about 16s. 6d. The fully-paid shares held their rise at 26s. The report is due almost at once, and keen interest is taken in anticipation of what the document may show, it being thought that possibly the directors may take this opportunity of enlightening their fellow-shareholders in regard to rumours which have been current, and which have had the effect of causing the shares practically to double in price. British Insulated 4½ per cent. debenture has risen to 92½, and the 5 per cent. to 92.

Castner-Kellner fell ½ to 3 7/16, on the announcement of the dividend, making 20 per cent. for the year, as against 22 per cent. in the previous twelvemonth. This was a disappointment, and the report will probably explain its reason. It may have to do with the recent prohibition of the export of chemicals abroad, a factor which also is affecting rubber shares to some extent, inasmuch as it is feared that with chemicals forbidden and a large quantity is taken for the rubber estates—trees may suffer for lack of them. At the same time, it is thought that the prohibition may be relaxed in regard to rubber estates, but this for the moment is in the air.

One of the jobbers yesterday complained, with a twinkle in his eye, that he would soon be all money and no stock. In other words, the bulk of the supply which he has on his books was being taken from him, and this is the case with other sources of supply as well. Quotable changes are few, but the difficulty remains of obtaining stock. Globe Ordinary at 13½ are 7s. 6d. up, and Cuba Submarines gained the same amount at 9. The telephone market is also firm, with

Oriental another ½ to the good. Optimism has revived in the Marconi market, the parent shares rising to 3½ and Americans sharply spurring to 24s. 6d. on buying from the North of England; Canadians, Marines, and Marconi Preference also show advances. One of the Stock Exchange tips of the moment is to buy American Marconis, and not for a rise of a few shillings only. Most people who have had experience on them are not enamoured of what they call House tips, but occasionally these turn out to be right, and certainly there is a wide scope for prosperity in the case of the American Marconi concern.

The County of London Electric Supply Co. gives notice of its intention to apply to Parliament for leave to bring in a Bill for specified purposes, namely, to confer the power of paying interest out of capital in certain cases, to extend the time for the compulsory purchase of lands in Barking, and to make certain alterations in the Memorandum and Articles of Association. The price of the shares remains unchanged at 11 for the Ordinary and 10½ for the Preference. A few Westminsters came in, and the price eased off to 6½, but otherwise no alterations have occurred in the list. There is a little business doing in the principal shares, but, as we have so often stated on previous occasions, this is limited by the fact of there being so little floating supply to meet the demand.

Buoynancy has characterised the market in armament shares, though prices came back a little from the best. Iron and steel issues are booming, the demand for them in their local centres being surprisingly large, and overflowing into the London market. Shares connected with the base metals have been active, more particularly those of the Broken Hill group, while the record prices touched for tin have been instrumental in lifting quotations in markets associated with the metal.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.						
	Dividend		Price Nov. 27, 1917.	Rise or fall this week.	Yield p.c.	
	1915.	1916.				
Brompton Ordinary	10	9	6½	—	£6 18	6
Charing Cross Ordinary ..	5	5	4½	—	5 17	8
do. do. do. 4½ Pref. ..	4½	4½	8½	—	6 18	4
Chelsea	4	3	22	—	5 9	1
City of London	8	8	19½	—	6 2	0
do. do. 5 per cent. Pref. ..	8	6	10½	—	5 18	6
County of London	7	7	11	—	6 7	9
do. do. 6 per cent. Pref. ..	8	6	10½	—	5 18	5
Kensington Ordinary	7	6	5½	—	5 11	7
London Electric	8	8	1	—	Nil	
do. do. 5 per cent. Pref. ..	6	4	8½	—	5 6	8
Metropolitan	8	8	8½	—	4 12	4
do. do. 4½ per cent. Pref. ..	4½	4½	8½	—	7 4	0
St. James' and Pall Mall ..	8	8	7	—	5 14	6
South London	5	5	3	—	5 13	4
South Metropolitan Pref. ..	7	7	21/6	—	6 10	6
Westminster Ordinary	7	7	6½	— ½	5 5	8
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	6	6	97	—	6 8	9
do. do. Def.	8½/8	1½	28½	—	6 9	0
Chile Telephone	8	8	7½	—	5 11	4
Cuba Sub. Ord.	5	7	9	+ ½	7 15	7
Eastern Extension	8	8	14½	—	5 7	9
Eastern Tel. Ord.	8	8	149½	—	5 7	0
Globe Tel. and T. Ord. ..	7	7	13½	+ ½	5 11	10
do. do. Pref.	8	6	10½	—	5 17	1
Great Northern Tel.	22	24	89	—	6 1	6
Indo-European	18	19	52½	—	6 9	10
Marconi	10	15	3½	+ ½	4 12	4
Oriental Telephone Ord. ..	10	10	8½	+ ½	3 2	2
United R. Plate Tel.	8	8	6½	—	5 19	6
West India and Pan.	6d.	6d.	1½	—	3 9	6
Western Telegraph	7	8	15	—	5 6	8
HOME RAIL.						
Central London, Ord. Assented	4	4	50½	—	6 12	
Metropolitan	1	1	29	—	4 7	0
do. do. District	Nil	Nil	15½	— ½	Nil	
Underground Electric Ordinary	Nil	Nil	12	—	Nil	
do. do. "A"	Nil	Nil	6½	—	Nil	
do. do. Income	8	4	82	—	4 17	5
FOREIGN TRAMS, &c.						
	Dividend					
	1915.	1916				
Adelaide Sup. 5 per cent. Pref.	6	8	4½	—	6 8	1
Anglo-Arg. Trams, First Pref.	5½	5½	8	—	9 3	4
do. do. 2nd Pref. ..	5½	—	2½	—	—	
do. do. 5 Deb.	5	5	6½	-1½	7 4	0
Brazil Traction	4	4	45	+2	—	
Bombay Electric Pref.	8	8	9½	—	6 3	1
British Columbia Elec. Rly. Pfce.	5	6	41½	+2	11 4	8
do. do. Preferred Nil	Nil	Nil	30	—	Nil	
do. do. Deferred Nil	Nil	Nil	28	—	Nil	
do. do. Deb.	4½	4½	65½	—	7 16	7
Mexico Trams 5 per cent. Bonds	Nil	Nil	42	-2½	N 1	
do. do. 6 per cent. Bonds	Nil	Nil	56	-2	N 1	
Mexican Light Common	Nil	Nil	22½	—	N 1	
do. do. Pref.	Nil	Nil	91	-4	N 1	
do. do. 1st Bonds	Nil	Nil	40½	-2	—	
MANUFACTURING COMPANIES.						
Babcock & Wilcox	15	15	3½	—	4 10	6
British Aluminium Ord. ..	7	10	1½	—	6 5	5
British Insulated Ord.	17½	20	8	—	6 13	4
British Westinghouse Prof. ..	7½	7½	2½	—	5 4	4
Callenders	20	20	14½	—	6 19	0
do. 5 Pref.	5	6	4½	—	6 1	8
Castner-Kellner	22	20	8½	— ½	5 16	3
Edison Swan, fully paid	—	—	2½	—	Nil	
do. do. 4 per cent. Deb. ..	4	4	74½	—	6 7	5
Electric Construction	7½	7½	1½	—	6 6	4
Gen. Elec. Pref.	8	8	10½	+ ½	5 13	0
do. do. Ord.	10	10	12½	+ ½	5 4	0
Honley	25	25	15½	—	7 18	8
do. 4½ Pref.	4½	4½	1	—	6 12	6
India-Rubber	10	10	11½	+ ½	6 19	2
Telegraph Con.	20	20	41½	+ ½	5 15	7

* Dividends paid free of income-tax.

SHOULD THE CHIEF CONCERN HIMSELF WITH DETAIL?

By "ROVER."

Most works have grown from small to big, and often the Chief has grown with them. Present at the inception, he has been cognisant of every detail of the little plant, and has unconsciously grasped every detail of growth. And now has arrived a stage when one small head seems unable to cope with all the particulars, and there is an increasing opinion that the Chief's job is to organise and to decide. Detail is to be dealt with by the subordinate.

The American technical Press, and the more powerful American fiction Press, have almost finished the debate with the decision that the Boss is Boss, and not chief engineer, nor chief electrician, nor chief clerk, nor chief anything but Chief. In big production the man who sets out to know everything is taking on a burden heavier than can be borne, and is inviting breakdown. In America, the man of detail has lost the affection of the crowd, and the hero to-day is the manager who has courage enough to ignore detail as being the proper province of underlings, who makes his decisions with lightning rapidity, who thinks in millions for a short time daily, and prepares himself for this arduous task by assiduous indulgence in golf and other sedate pastimes. He is necessarily not a young man, has personality, and is not technical or narrow.

Years ago a Chief would know all his consumers personally, whereas, to-day, he can hardly be expected to know even his own staff personally. Changing conditions, too, have seriously impaired the usefulness of the Committee system, adhered to by municipal authorities. This system is responsible for the premature ageing of many a Chief, through its insistence on the importance of detail. Members of a Committee have not all the Chief's broad point of view, and some are bound to have that yearning after trifles which was so useful during the earlier years of the undertaking.

The borough electrical engineer is not the only sufferer. Town clerks, surveyors, and accountants, all have his sincere sympathy. However, government by committee is a doomed *régime* unless it adapts itself to the new conditions.

It does not make for smooth working when the Chief descends to detail. This is in the charge of the heads of departments, and when the "old man" begins to worry himself as to why X's account is 5 per cent. higher than usual, or why there was a lamp out in High Street last night, or why there was only 26 in. vacuum on No. 3 turbo, then it is time that the said heads of departments had a new Chief, or the Chief had new assistants. It is an important part of a Chief's job to choose suitable and capable assistants, and if they prove inefficient the blame is his. Even under the Committee system, the Chief must dominate the Committee and choose his own men. A real Chief will do it, too.

One of the most useful functions of a chief clerk is to protect the great man from detail. Only the most important visitors must ever penetrate to the Holy of Holies. Unimportant visitors, trivial letters, and telephone calls, can be attended to by heads of departments, or by the chief clerk. The latter can probably dispose of these much better than the Chief. Further, all good Chiefs have a hankering after attending to detail and must be saved from themselves. They are as avid for work as a D.C. motor. A good chief clerk is at once a body-guard and a male nurse.

Looking back at my own experience of "Chiefs I have known," there are two that stand out as Chiefs in excelsis. Strangely enough, neither of them was an electrical engineer, although both of them were managers of central stations. One was originally a steam railway manager, who later on took charge of a chain of power plants in America, some hydro-electric, some steam-driven, and one hydraulic plant for supplying compressed air, the two ends of the chain being about 150 miles apart. Of technical detail he was ignorant, purposely ignorant, I believe, and yet maintained an admirable grasp of the production, development, and possibilities of each station. He brought the concern triumphantly through successive periods of amalgamation, rapid growth, and bad trade, mainly by organising ability and long-sightedness. He seemed to recognise no unit

smaller than the station, yet on those rare occasions when detail was forced upon him, he dealt with it in such a matter-of-fact and detached manner, and with such fairness and freedom from personal bias, that his rulings were never questioned. I think he looked upon these little interruptions as an enjoyable relaxation from his more strenuous duties, and probably tackled them all the better for this reason.

The other manager was a lawyer in London, who by some freak of fortune had come into possession of a tiny central station in the provinces. He never went to see the plant, but managed it from his London office. I don't believe he was engineer enough to appreciate the old-fashioned boast of "knowing every bolt and nut in the works," yet he, too, guided his little plant successfully through good and bad times. Naturally, he was more concerned with detail than the other manager just referred to, and his daily letters of advice were often shrewd, untechnical solutions of technical problems worked out in the calm atmosphere of a lawyer's office.

From these instances it would appear that the best Chief is born, not made, which is no new discovery. It appears, further, that the best locale for the best Chief is several miles away from the plant he is managing. From this point of view he is able to see the plant in its true perspective, and the fatal detail does not loom up, obscuring the clear vision of the establishment as a whole. It might be advisable, too, for the Electricity Committee to meet at this same retreat, though, even there, breadth of vision could not be guaranteed to all its members.

THE RÖNTGEN SOCIETY.

At the meeting of the Röntgen Society, on November 6th, the new president, Captain G. W. C. Kaye, M.A., D.Sc., delivered the annual address from the chair. He took for his subject "X-rays and the War," but did not limit his matter to that special range. After reviewing the medical applications of X-rays as, for instance, in the examination of questionable recruits, the investigation of wounds and injuries, the detection of embedded bullet and shell fragments and the nature and direction of bone fractures, the diagnosis of chest complaints, and the use of the rays to the army dentist, he pointed out that the value of X-rays did not end with radiography. The rays were achieving wonderful results, not only in the diagnosis, but in the repair of wounds. The radiologist's part in such work was to render scar tissues pliant, to deplete the scalp and skin surfaces concerned, to render the flaps more adaptable to their new position, and to stimulate generally the healing processes in both flaps and bone. For these purposes radiation treatment, either with X-rays or radium, was now being employed.

The electrotherapist, Captain Kaye continued, had also been prominent in war work. Quite one-half, if not more, of war injuries were gunshot wounds of the nerves with paralysis of the muscles. These cases were sent to the electrical departments, which had been established in large numbers in connection with the military hospitals, for electrical examination of the injured nerves and subsequent electrical treatment. The subject of the diagnosis and treatment of cases of paralysis by electrical methods, such as the application of continuous and interrupted currents and condenser discharges, was being studied on a scale never before possible, and invaluable additions to the knowledge of the pathology of therapeutic methods had been made. Many cases of war wounds, more particularly those of the uncomplicated but inert type which refused to heal, were treated electrically, and "trench feet" received benefit by electrical treatment, in some cases ionisation, and in others high frequency and diathermy.

Turning to the physical aspect of radiology, Capt. Kaye said that it was remarkable how slight had been the changes in design experienced by the target tube, but he would be a bold man, nevertheless, who would assert that the present design had approached finality or anything like it. All X-ray tubes were, in fact, extraordinarily inefficient things. The heat they generated was proof of that. Under favourable conditions, use was made of rather less than one part in one thousand of the energy imparted to the cathode rays in an X-ray bulb. It was the question of gas pressure, as well as the space and surface electrification depending on the disposition of the cathode, that was responsible for the fact that two X-ray bulbs, running under the same conditions of current and voltage, did not always emit beams of the same composition. The new Coolidge tube, in which the surface-bound gas was removed entirely by a process of exhaustion more complete and prolonged than had ever before been applied to an X-ray tube, was not entirely free from defect, and its rays were no more homogeneous than those from an ordinary bulb; but its elasticity, precision, ease of control, and freedom from inverse current made it an invaluable addition to the radiologist's equipment. The anticipation that the Coolidge tube would be the means whereby X-rays

would be obtainable which approximated to the hardest gamma rays from radium had not been realised. The radium rays in question had been found to correspond to X-rays generated by voltages between 600,000 and 2,000,000 figures to which no X-ray tube of present-day design could possibly stand up, even if the means were available to produce such voltages on a practical scale. Evidently there was a long way to go before the processes within the radium atom could be imitated.

Capt. Kaye concluded his address by urging the claims of State-aided research, not only applied, but also pure. Research in pure science was rarely appreciated by the general public or the manufacturer, for it could not be done to order. Much of what the research worker could do must be discontinuous and abortive, but he must not be hampered by utilitarian notions being continually rammed down his throat. If he did not solve the original problem, he would probably solve some other which had sprung from it, and one successful discovery might far outweigh all his failures. The speaker pointed out that the half-watt and point-light lamps, as well as high-potential rectifiers and the explanation of atmospheric electricity and of aurora, were the results of the work of a school—the "ionic" school—which 10 or 15 years ago was considered by many to be speculative and theoretical to a degree.

NEW LOCOMOTIVES FOR THE NEW YORK, NEW HAVEN AND HARTFORD RAILROAD.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING CO. is building some new passenger locomotives for the New York, New Haven and Hartford Railroad. These will weigh roughly 180 tons and have six driving axles each, instead of four as in earlier locomotives. The maximum capacity will be 50 per cent. greater than any other electric locomotive on this road: tractive effort,

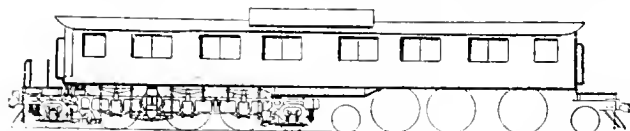


FIG. 1.—NEW HAVEN ELECTRIC PASSENGER LOCOMOTIVE.

47,500 lb. Like other New Haven locomotives, series motors for either A.C. or D.C. will be fitted, the route being third-rail on the New York Central and Pennsylvania tracks, and 11,000-volt trolley on the New York connecting line and at other points.

Geared to each driving axle will be two single-phase series motors. The twelve motors will be divided into four groups, the motors of each group being connected permanently in series. Thus there will be a comparatively low voltage across each individual commutator and the cables in the main motor circuit need only be large enough to carry the current taken by a single motor.

While the new locomotives will be 50 per cent. larger than the present ones, yet on account of the larger hauling requirements

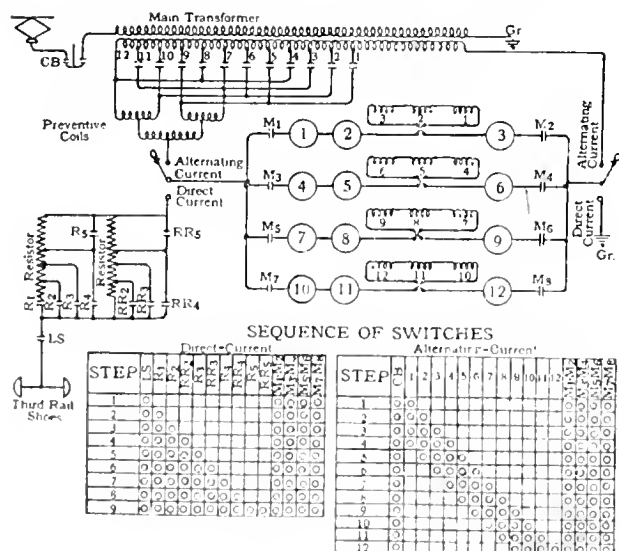


FIG. 2. CONTROL CIRCUITS FOR A.C. AND D.C. OPERATION.

which will eventually exist, it is expected that the trains will operate double headed. The control has, therefore, been developed for multiple unit operation with any of the geared type locomotives now in service on this road. The control circuit connections for both direct-current and alternating-current operation will be as shown in fig. 2. When operating on alternating current the speed control will be obtained by using different transformer taps, preventive coils being provided, so that when changing from one tap to another the transformer coils can be momentarily short circuited

without causing an excessive flow of current. On direct-current operation the usual resistors will be used for starting and for speed control. Temperature coils will be located in the armatures of each pair of motors. These coils will be connected as shown in fig. 3, so that one set can be made the fourth leg of the Wheatstone

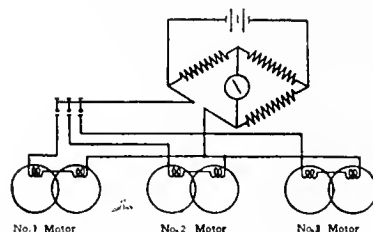


FIG. 3.—TEMPERATURE COIL CONNECTIONS.

bridge. The resistances in the other legs of this bridge are constant and the voltmeter across the bridge is calibrated so that the temperature can be read directly. Thus armature temperatures can be watched and overheating detected.—*Elec. Railway Journal*, Vol. 50, No. 15.

PARLIAMENTARY.

THE *London Gazette* for November 23rd contains official notices concerning the following applications to Parliament and the B. of T. for powers relating to electrical schemes:—

London United Tramways, Ltd.—Various powers, including postponement of date of compulsory purchase of tramways and light railways, increase of fares, abandonment of parts of undertaking, provisions as to supply of energy by the Metropolitan District and London Electric Railway Companies, and as to supply of energy to Kingston Corporation, &c.

County of London Electric Supply Co., Ltd.—Power to pay interest out of capital, to extend time for purchase, &c., of lands at Barking for generating station, and provisions re residual products, by-products, &c.

Rotherham Corporation.—Transfer of electricity undertakings of Mexborough and Swinton Tramways Co. in Rawmarsh and Swinton; extension of area to include Greasborough, Rotherham rural district, and Wortley; acquisition of neighbouring electricity undertakings; supply in bulk; construction of wharf on the Don, and a dam across it; purchase of coke oven and crude gas and heat, &c.

Pontypool Gas and Water Co.—Many provisions, including acquisition of Pontypool Electric Light and Power Co., Ltd.

Gloucestershire Electric Power Co.—Acquisition of lands, construction of generating stations, manufacture of gas and residual products, extension of time under 1902 Act, and enlargement of powers, &c.

Bristol Corporation.—Extension of electric supply area.

South Suburban Gas Co.—Agreements and arrangements with local authorities, companies, &c., with reference to electrical undertakings, supply of energy in bulk, or for heat or power.

Aldershot Gas, Water, and District Lighting Co.—Extension of areas of supply for gas and electricity.

Braintree U.D.C.—Provisional Order for electricity supply.

Stocksbridge U.D.C.—Provisional Order for electricity supply.

Wortley.—Electric Distribution of Yorkshire, Ltd.—Provisional Order for Bradfield, Ecclesfield, and Tankersley.

Leeds.—U.D.C. Provisional Order for electric supply.

Halifax.—Corporation electric supply in Luddenden Foot and Mytholmroyd urban districts.

(To be continued.)

Water Power in Morocco.—In a recent number of *La Nature*, M. Laurent Rigotard discusses the question of utilising the hydraulic resources of Morocco in the economic development of the country. The country has considerable potential water powers which only await utilisation on a large scale. Up to the present, however, it is only in the neighbourhood of Fez that water power has been applied. The writer suggests the granting of concessions of waterfalls of 20,000 to 30,000 h.p. at least, supplying high-tension networks of, say, 50-cycle, three-phase current at 60,000 volts. Many people have objected that Morocco could not possibly utilise this amount of energy, but the writer mentions a steam station established at Casablanca which is already insufficient for port operations and the lighting of the town. He thinks that ten times this power could be easily absorbed for private lighting and power purposes, provided the supply were reasonably cheap. Further, any station prepared for taking five or six groups of turbo-alternators of 5,000 h.p. each could be started running with two groups only, the remainder being installed according to requirements. The writer is also of opinion that the railways could be electrified with advantage.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

Abstract of the Inaugural Address delivered by
MR. C. H. WORDINGHAM, President, November 8th, 1917.
(Concluded from page 502.)

Perhaps the most potent influence in directing the movement changes into the proper channel, as well as in assisting us in our competition with other nations, is education. In the past a large section of the British public has been obsessed in the most extraordinary fashion with the idea of German superiority in science and engineering. I deny this superiority *in toto*; I believe that British scientific men have been in the van of progress from the dawn of science, and that British engineers and manufacturers have led the way, and have only been hampered by the unfair commercial methods of their rivals and by the mistakes that have been made by their own countrymen in regard to matters which cannot properly be touched upon in an address of this character.

A strong agitation has been promoted to elevate science to a pinnacle, and to make it the be-all and end-all of education and existence. Are we so very greatly impressed with the results upon the German nation of the cultivation of science to the exclusion of other human activities? No more powerful argument than this war could be adduced by the enemies of science in favour of those older methods of education which in some directions have no doubt been open to criticism. Let us while giving to science the high position that is its due, keep it in its proper place, and not imagine that it can be a substitute for those moral and religious principles which alone can afford adequate or worthy motives for human action or give courage to fight and persevere, and ultimately to conquer, in a righteous cause.

Engineering and scientific training are absolutely essential to an industrial nation, but it must never be forgotten that they provide but the tools which must be as perfect of their kind as they can be, and without which no work can be done, but it is the human, mental, and moral qualities of the nation which will decide the issue in the world competition.

When the war is over manufacturers will be faced with the need for reorganising for the production of articles of peaceful commerce. It is clear that there will be facilities for production greatly in excess of those existing before the war, and every effort will have to be made to find markets of sufficient magnitude to absorb the output necessary for a profitable return on the capital invested. The capture of the foreign trade required will be greatly facilitated by the retention of the home market in British hands, and it is to be hoped that this will be realised in the proper quarters, and that legislation will be on statesmanlike lines.

POWER SUPPLY.

One of the most pressing and important home problems is the provision of a cheap supply in adequate quantities in all parts of the country of electrical energy for motive power, for furnace work and electrochemical industries, and for factory and other lighting. The matter has fortunately received the attention of the Government, and committees with expert knowledge have been appointed to inquire into and advise on it. If we had to begin now, not only with our present knowledge and facilities, but also, and let me emphasise this, with the present demand and state of public knowledge and opinion of electrical appliances, we should put down a relatively small number of large stations in positions chosen for their facilities for economical generation, all working on an identical system, and suitably interconnected.

But we are not starting now, and those of us who have been engaged in the business of electric supply from the earliest days know full well how arduous has been the task, and how heavy the cost of gaining the knowledge that is now the common possession of the industry. Any scheme which is brought forward cannot, in common justice, ignore the claims of those who are now carrying on the business which they have built up by their capital, by their work, and by their skill. Due provision must be made for the gradual wiping off of the existing capital, and adequate compensation must be given to those displaced, whose lives have been devoted to what they had every right to expect would be a lifelong business.

The objects in view will best be attained by developing what is good in existing systems and eliminating what is bad, rather than by attempting to supersede all that has been done suddenly and abruptly.

There are a number of existing stations in which the generating units are large and well-nigh as efficient as any that can be devised at the present day, and which are well situated for economical working. Let these be linked up to adjacent stations, and let them be worked to their utmost, in some instances being extended, and let the smaller gradually be eliminated, the worst being shut down at once, and the others worked in such a way as to contribute what they can efficiently to the general supply until the cost of their plant is wiped out. It may quite possibly be more economical to work inefficient plant already in existence to provide stand-by supply than to purchase new and more efficient plant for the purpose. Side by side with this development let new stations

on ideal lines be erected to supplement the old, which in due course they will supplant.

We must again have co-operation and co-ordination of existing concerns. However powerfully supported any new scheme may be, it cannot be denied that the vested interests in existence are very strong, and it must render progress much more rapid and tend to secure much earlier realisation of ideal conditions if the opposition of such vested interests is disarmed and their assistance even obtained.

ECONOMY OF FUEL.

Closely connected with the problem of power supply is that of national economy of fuel. There is a tendency to confuse economy of fuel with cheap power supply, but the two are quite distinct, though closely connected. In regard to these matters, electrical engineers have been apt to arrogate to themselves too prominent a position. It is little short of ludicrous to ignore the great gas industry, either in respect of their consumption of coal or of the experience of their engineers and managers. While for motive power and lighting, and for certain kinds of furnace work, electrical operation is pre-eminent, and will almost certainly in the fullness of time be universal, there will still be an immense field for heating by gas. Apart from this, however, I hold most strongly that gas production will be an intermediary between the raw fuel and the live steam, and so be concerned in the generation of the whole of the electrical energy used. I have for many years advocated the close co-operation, if not the fusion, of gas and electric interests, and I believe an appreciation of the soundness of this view is gaining ground.

The whole of the coal raised should be treated as near the pit as practicable for the extraction of those substances usually referred to by the generic name of by-products, and for the production of a fuel, whether solid, liquid, or gaseous, or one or more combined, which can be conveniently used for the direct production of steam. At this point the electrical engineer should take the matter in hand, and produce his steam and conduct the other operations necessary to provide the electrical energy for transmission at high pressure to the distributing centres.

I do not think the proposal which has been made is sound to draw the dividing line later, and let the gas works supply the steam. Electrical engineers have made the production and utilisation of steam their own field, and they are pre-eminently expert in it, while gas engineers have not been called upon to consider this problem to any great extent, nor under the conditions imposed by a generating station. Moreover, I think there would be practical operating objections to this line of demarcation.

In the new circumstances, it is obvious that the sites of generating stations will be determined in future solely by the facilities for carrying on the operations named, and will be uninfluenced to any material extent by their proximity to centres of demand. The only way in which the interests of fuel economy and efficient distribution can be reconciled is by the use of extremely high pressures of transmission, and by other means for the reduction of the cost of mains; even so, it may well be that the cheapest, as distinguished from the most efficient, supply of a given quantity of energy at a given point may not be realised, although on the whole the most economical use of the fuel will have been made.

The problem of the production of heat in detail to supply a distributed demand for warming buildings and for cooking purposes will require careful study. The present crude methods are cheap, simple, and to a large extent convenient, but they are criminally inefficient.

Electric cooking will probably be very largely used on account of its intrinsic merits; with increased demand we may look forward to robustly designed simple appliances that can be handled without damage by the ordinary domestic servant, and that will be sold at prices comparable with those of the articles displaced. Electric heating of rooms will also have a large field in those cases in which convenience is an overwhelming consideration, such as in rooms used occasionally or for a few hours a day. I do not believe that electric heating will be employed for steady, all-day heating, or for boiling the large quantities of water required for domestic and trade purposes, because it will never be cheap or economical to do so. This heating will probably be done to a large extent in the smaller houses by gas or by some solid fuel produced in the gasification of coal. In large establishments, blocks of offices, factories, and all large buildings some form of central heating, in which the heat is produced by solid fuel of the kind I have indicated, or possibly by liquid fuel, will probably be introduced on the grounds of cheapness and economy, though certainly not of comfort or health.

Our practice in distribution is undergoing development in consequence of the increase in the amount of power to be conveyed. In all probability there will be a double system of high and low-pressure distribution, large consumers of power being connected to the high, and domestic and shop requirements being provided from the low.

The developments in store promise to be of the greatest interest, and will bring back the earlier days of electric supply when new problems, which had to be met one way or the other, were arising every day, and they will lift central-station work out of the dull routine into which it seemed likely to settle down.

ELECTRICAL ENGINEERS.

There is a tendency at the present time to regard manufacturing as synonymous with electrical engineering, and to disregard the other branches of the latter, more especially to belittle the consulting engineer, many going so far as to say that he will shortly disappear. I think it would be a distinct loss to the profession were the consulting engineer to be eliminated and his work taken over by the manufacturer. From the manufacturer's point of view, it is clearly advantageous to have someone who can state the purchaser's requirements in a definite manner in terms that can be understood without ambiguity, so that all tenders are on an equal footing, and who is able to appreciate the relative values of the offers firms make irrespective of the persuasive powers of their representatives. From the purchaser's standpoint, the consultant necessarily takes a broader view, and his advice is likely to be more reliable than that of any individual firm of manufacturers who, however honest in intention, must necessarily be biased in favour of their own methods of attacking a problem, and who will be tied largely to their own designs, which may not be uniformly the best. In my experience, also, the consultant is often able materially to assist manufacturers by putting before them the needs of users that they would never have thought of, and by defining precisely the conditions to be fulfilled in a manner that the user never could on account of his not possessing the necessary technical knowledge to enable him to do so.

I venture to think that all parties would benefit by a stricter etiquette than now exists. Manufacturers should support the consultant in the same way that the general practitioner does the Harley Street specialist, or the solicitor the King's Counsel, instead of providing advice gratis and ousting the consultant. On the other hand, the consultant (as all the leading men do) should confine himself strictly to occupying an advisory position without interest, however remote, in any manufacturing concern, and abstain from indulging in his own fads, a practice that has greatly irritated manufacturers and contributed largely to the present situation.

A reform greatly needed in connection with engineering concerns is the appointment of men of high technical qualifications, instead of clerks, to the position of manager or secretary. It is monstrous that engineers should undergo a lengthy and arduous training, and provide the skill, inventiveness, and high qualities necessary for the efficient management of men, to find themselves in receipt of rewards only a fraction of those bestowed on an individual whose attainments are purely clerical, and who has it in his power to mar their efforts, and to whom they must to a large extent be subservient. It is absurd to argue that the engineer often has no business capacity; if he has any real claim to be called an engineer he must possess commercial ability, for it is this very attribute which distinguishes him from the man of pure science; he has got to make his designs pay. There is no training so calculated to cultivate the intellect and to broaden a man's outlook as engineering, and an engineer will grasp business problems infinitely better than a clerk. An engineering undertaking should be managed by an engineer; engineers have the power to ensure this entirely in their own hands; they are absolutely indispensable, and if properly organised can secure their proper position in commercial undertakings.

It is a matter for surprise that engineers should count for so little in the public eye. They have let others occupy the prominent positions that are theirs by right, those positions which bring them most into contact with their non-engineering fellow-men, and have perhaps been apt to look with contempt on popular appreciation and on the shifts of notoriety seekers. Unquestionably the public has had brought home to it the resourcefulness and widespread power of the engineer, and a large number of people have acquired a smattering of engineering which, however small, must tend to increase respect for our profession. The time, therefore, seems ripe for a change.

We ought to start and maintain an organisation that shall ensure that the technically trained material in the country shall be applied with maximum effect immediately war breaks out, and avoid the lamentable waste that has occurred in the present war by disregarding the technical qualifications of many, and by giving others technical work for which their training has been unsuited. Not only should all individual engineers be classified according to a well thought-out scheme, but actual posts in a war organisation should be assigned to them. Similarly, all factories should be organised so that each would in war-time contribute a definite product in definite quantities when the war need arose.

A word as to engineering as a profession; it surely, rightly apprehended, is one of the most ennobling. It requires an active brain, making, as it does, a direct appeal to the intellect, and it brings a man into intimate contact with the laws and processes of Nature, and their everlasting truths, while constructive work is the nearest approach to creation possible to a created being.

I would particularly impress on the young engineer the need for thoroughness in all he does—"Whatsoever thy hand findeth to do, do it with thy might" is a maxim applying with peculiar force to engineering. Strive after perfection, and do not regard the smallest job as unworthy of your best efforts. Let love of your work for the work's sake be your

dominant motive, and do not aim lower than perfection, even though absolute perfection may be unobtainable; believe me, the more material benefits will be added to you.

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

- 16,561. "Switch for electric incandescent lamps." J. F. SMITH. November 12th.
- 16,568. "Portable electric torches, lamps, &c." J. M. COPLANS & S. H. COPLANS. November 12th.
- 16,581. "Maximum-demand controller and load-indicator for electric power installations." C. C. GOW. November 12th.
- 16,591. "Electric detonator fuses for blasting." T. C. FUTERS. November 12th.
- 16,601. "Sparkign plugs for internal-combustion engines." F. MURTAGH. November 13th.
- 16,637. "Manufacture of electric cables." C. J. BEAVER & E. A. CLAREMONT. November 13th.
- 16,645. "Electrolytic gas generators." I. H. LEVIN. November 13th. (U.S.A., November 18th, 1916.)
- 16,658. "Electric lamps." A. C. HVOE. November 13th.
- 16,676. "Voltage regulation of alternators." F. E. BERRY. November 13th.
- 16,677. "Improvements in electrical transformers for regulating or varying voltage of current supplied therefrom." F. E. BERRY. November 13th.
- 16,701. "Electric cigar-lighters, &c." R. J. H. HILL & M. J. RAILING. November 14th.
- 16,708. "Protective devices for alternating-current electric systems." A. E. McCOLL. November 14th.
- 16,713. "Manufacture of incandescent electric lamps." DEUTSCHE GAS-LEUCHT AKT. GES. (Auerger.) November 14th. (Germany, November 14th, 1916.)
- 16,717. "Frequency transformers." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.) November 13th.
- 16,721. "Electric lampholders." FULLER ACCUMULATOR CO. & A. P. WELCH. November 14th.
- 16,722. "Magnetic locks or fastenings for electric lamps, &c." FULLER ACCUMULATOR CO. & A. P. WELCH. November 14th.
- 16,726. "Electric lamps." F. WESTWOOD. November 14th.
- 16,738. "Oscillation-current method and apparatus." AJAX METAL CO. November 14th. (U.S.A., November 25th, 1916.)
- 16,746. "Electrical relays." F. G. BELL, W. C. DAVEY, & STERLING TELEPHONE & ELECTRIC CO. November 14th.
- 16,749. "Electromagnetic clutches for driving and change-speed gear of motor vehicles, &c." MENDO-ELMA SYNDICATE & G. POLLARD. November 14th.
- 16,756. "Systems of electrical distribution." H. A. GILL & U.S. LIGHT AND HEAT CORPORATION. November 14th.
- 16,760. "Systems for transmission and reception of electro-radiant energy." J. H. HAMMOND. November 14th. (U.S.A., September 28th, 1916.)
- 16,773. "Continuous-working resistance electric furnace for reactions at high temperature between carbon and other substances." D. HELBIG. November 15th. (Italy, October 9th, 1916.)
- 16,781. "Means for varying intensity of electric light." J. BRADLEY. November 15th.
- 16,800. "Sparkign plugs for explosion motors." P. G. MITARO. November 15th.
- 16,816. "Recording magnetic compass." L. G. W. GUEST. November 15th.
- 16,819/20/21. "Magnet steel." K. HONDA. November 15th.
- 16,825. "Incandescent electric lights and signals." R. J. RAR. November 15th.
- 16,849. "Means for cooling collector rings of dynamo-electric machines." SVENSK TRYCKFABRIKS AKTIEBOLAGET LJUNGSTROM. November 15th. Sweden August 6th.
- 16,856. "Sparkign plugs for explosion motors." A. CEFFALL. November 15th. (Italy, May 10th.)
- 16,868. "Flashlamps." J. J. B. ARTER & JAMES CYCLE CO. November 16th.
- 16,883. "Automatic self-cleaning sparking plug." H. S. WALKER. November 16th.
- 16,881. "Electric dynamos." D. SUCHSPAWER. November 16th.
- 16,906. "Thermo-electric generator." F. FELEUMER. November 16th. (Germany, October 28th, 1916.)
- 16,908. "Starters for internal-combustion engines." A. H. MIDGLEY AND C. A. VANDERVELL & CO. November 16th.
- 16,914/5/6/7. "Magnets having a stationary armature." E. C. R. MARKS & SOC. ANON. DES ETABLISSEMENTS L. BLERIOT. November 16th.
- 16,931. "Carbon brushes and brush-holders of electric motors and generators." C. R. ALLEN & VERTIVUS, LTD. November 17th.
- 16,932. "Electrically-operated lifting gear." W. H. VAUGHAN & F. WOOD. November 17th.
- 16,933. "Electrically-operated overhead lifting gear." H. BAGULEY, W. H. VAUGHAN & F. WOOD. November 17th.
- 16,943. "Electrically-heated sheets, rugs, mattresses, foot-warmers, &c." C. S. DAVIDSON. November 17th.
- 16,966. "Secondary electric batteries, &c." CHLORIDE ELECTRICAL STORAGE CO. & W. S. NAYLOR. November 17th.
- 16,975. "Electric ignition distributors for internal-combustion engines." H. W. F. IRELAND. November 17th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and bill subsequent proceedings will be taken.

1914.

- 20,478. MEANS FOR CARRYING RESERVE OR SPARE ELECTRIC LAMP BULBS ON MOTOR-DRIVEN VEHICLES. Whalley. October 3rd, 1914.

1916.

- 7,115. MEANS FOR SUPPORTING LAMPS, FLAGS AND OTHER ARTICLES. L. BRANDS. May 18th, 1916. (Convention date not granted.) (100,497.)
- 13,486. ELECTRICALLY-HEATED SOLDERING BOLT OR BIT. A. E. Woodhouse and F. Husband. September 22nd, 1916. (110,564.)
- 14,957. ELECTRIC REFRIG. S. Oulianine. October 20th, 1916. (110,569.)
- 15,927. MECHANISM APPLIANCE FOR AUTOMATICALLY SHUTTING OFF THE SUPPLY GAS AND/OR SWITCHING OFF CURRENT OF ELECTRICITY AT ANY DESIRED TIME. D. Braucher. October 23rd, 1916. (110,572.)
- 15,936. ELECTRIC INTENSIFYING SYSTEM. H. G. Longford, W. W. Longford, W. A. Clark & T. Morris. October 23rd, 1916. (110,574.)
- 15,976. OVERLOAD ELECTRIC SWITCHES OR CUT-OUTS. P. G. van Wijk. June 15th, 1916. (107,365.)
- 15,977. LOADING COILS FOR SUPERIMPOSED TELEPHONE WORKING AND OTHER PURPOSES. C. E. Hay & H. W. Sullivan. October 23rd, 1916. (110,578.)
- 15,131. GYROSCOPIC COMPASSES. H. L. Tanner. June 28th, 1916. (107,572.)

THE ELECTRICAL REVIEW.

VOL. LXXXI.

DECEMBER 7, 1917.

No. 2,089.

ELECTRICAL REVIEW.

THE METRIC SYSTEM.

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On Thursday next the Institution of Electrical Engineers will meet to discuss the metric system, not from the point of view of its merits in comparison with our existing systems, or want of system, but with regard to the difficulties which may be experienced in putting it in operation in the British Empire. Its advantages have been fully demonstrated, not only in the theatre, but also in the workshop, and the Institution, through its Council, has definitely recommended the Board of Trade to hasten its introduction as a compulsory measure; now it is proposed to consider its disadvantages and the best means to overcome them, and we commend the wisdom of this course.

Not even the most zealous advocates of the metric system will pretend for one moment that there are no difficulties to be faced or problems to be solved in carrying out so important and far-reaching a reform; undoubtedly there are some very serious obstacles to its adoption—but none which cannot be negotiated successfully. We take the opportunity to suggest that the question should be approached not with a mandatory attitude of mind, but with the spirit of conciliation, co-operation, and good fellowship, and that every endeavour be made to find satisfactory means of removing or mitigating the objections that will inevitably be raised in various quarters. The public welfare is the consideration which energises us who advocate the compulsory adoption of the metric system, and we most earnestly desire that no man shall suffer in any way from the effects of the change. But equally we trust that even those who firmly believe that it would adversely affect their own interests, will take the broad view and endeavour impartially to judge whether the nation as a whole would benefit by it, and if so, that they also will consider how best their own difficulties can be tackled and minimised, instead of utilising them as obstacles to thrust in the way of the proposed change of system.

The matter is of such great importance to our commercial and industrial future that we hope the speakers in the discussion will not be confined mainly to London residents, but will include many provincial works managers and others who are directly interested in the subject, whether for or against the change: the metrists do not wish to turn a blind eye or a deaf ear to objections—they wish to have the real objections tabled before them, and to join in friendly discussion regarding them. By "real" objections we mean not theoretical or sentimental considerations but actual practical points such as the question of standards, the conversion of weighing machines and instruments such as gas meters, the supply of merchant rods and bars to metric measures, &c. We know that practical experience on such questions has already been gained, for many of our engineering workshops have for a long time used metric weights and measures more or less extensively—and, incidentally, we may add that they have overcome any difficulties arising from internal sources.

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

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Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 6d.; Canada, £1 8s. 10d. (\$5.80). To all other countries, £1 10s.

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JOHANNESBURG, CAPE TOWN, BLOEMFONTEIN, DURBAN, PORT ELIZABETH, &c.: Central News Agency, Ltd.	ROME: Loescher & Co., Corso Umberto I° 307.
LAUNCESTON: Gordon & Gotch, Cimitiere Street.	SYDNEY: The Mining & Engineering Review, 273, George Street; Gordon and Gotch, Pitt Street.
	TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.
	WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

THE "ELECTRICAL REVIEW'S"

ELECTRICAL & ALLIED TRADES DIRECTORY

(THE RED BOOK),

1917 EDITION.

H. ALABASTER, GATEHOUSE & KEMPE,
4, Ludgate Hill, London, E.C. 4.

We look forward to a highly interesting and useful discussion, free from digressions involving the "Belgic yard," attempts to modify our existing units, or other obvious futilities, and we should be glad to see a committee appointed for the purpose of collecting and tabulating particulars of all *bona-fide* difficulties with a view to devising ways and means for overcoming them at the minimum of expense and inconvenience.

The question now is not so much *whether* we shall adopt the metric system, as *how* and *when* we shall adopt it; and whether we shall give a lead to the United States in this important matter, or wait—and see ourselves compelled to follow in its footsteps. Against the cost of establishing the system must be set the cost of going on as we are—not only now, but in the strenuous days that are coming—heavily handicapped in our relations with foreign customers and with foreign manufacturers, and in our internal organisation to a degree second only to the former.

It is to be hoped that works managers and others who have had actual experience of the use of the metric system in their workshops, and in their export trade, will come forward and give the results of their experience; for there is no test to compare with the practical test, and certainly no argument so convincing as the irrefutable "I have tried it myself, and *know* that it is good." In this connection we have found it interesting to turn over the replies received to our circular inquiry of September, 1915, when a verdict in favour of the metric system was returned by the handsome majority of four to one; of the many firms that were using the metric system in their shops, a large proportion were enthusiastic advocates of its general adoption, and not one reported any special difficulty in applying it. Further, of those who dissented from its compulsory introduction, not one stated that he had tried it unsuccessfully. We are inclined to believe, as the result of this and other evidence, that the difficulties which bulk so large in the distance are found to melt away when the matter is grappled with at close quarters. In all our reading of the arguments of anti-metric writers, we do not recollect a single instance of difficulty in teaching the workmen to use metric units—they are so simple that anyone who can read an English scale can use a metric scale with greater ease.

One of the commonest mistakes in dealing with this subject is the assumption, quite groundless, that English units cannot be converted into metric without the use of several places of decimals. We went to considerable trouble in 1915 to show beyond cavil that, as the millimetre is a much smaller unit than the inch, drawings figured to the nearest millimetre could not be more than 20 mils in error; if figured to the tenth of a millimetre, the error was less than 2 mils, which is about the average error of measurement met with in the workshop; and if figured to the hundredth of a millimetre, the error (less than 2/10 mil) could only be distinguished by refined methods of measurement such as are rarely employed in the workshop. Jigs and gauges need no alteration whatever. Moreover, it is seldom possible to arrange for more than a very few of the dimensions of a metal part to be simple figures in inch measurements, and there is, therefore, no reason to cavil at a corresponding inability in the case of the metric system (though, owing to the inch containing 25 mm., integral mm. dimensions should occur about 25 times as frequently).

Many other arguments were advanced by our correspondents and by ourselves in our long series of articles on this subject, which will be found in our issues of October 15th to November 26th, 1915, and in that of March 23rd, 1917, together with evidence derived from actual workshop experience in various countries.

We recently read in our American namesake that

as a result of war orders, factories all over the United States were working to metric measurements, and thousands of workmen were becoming familiar with the centimetre and the gramme. The validity of the argument that the adoption of the metric system involved serious difficulties in the adaptation of mechanical appliances to a different scale had been quite destroyed by the comparative ease with which adjustments were made to suit the new conditions, and our contemporary urged that "right now" the metric system should be made the national as well as the international language of commerce and industry. We think so, too.

Water Power in Sweden.

THE Year-book for 1916 of the Swedish Chamber of Commerce for the United Kingdom contains an interesting article on the Svenska Vattenkraftforeningen, or Swedish Water-Power Association, the aims of which are to promote the national economic utilisation of the water-power resources of Sweden, and especially to attain a precise knowledge of the country's resources in available water power, to ascertain the best means of turning such resources to account from a technical and economic point of view, to promote and assist schemes for the conservation and regulation of lakes and rivers, and, generally, to apply the experience gained both in Sweden and abroad in the solution of such questions.

The utilisation of the abundant water power of Sweden has from year to year become of greater importance as a lever in the extension of its industry and development. Until, however, the Association was formed, towards the end of 1909, there was no uniformity in the methods adopted for dealing with the problem. One great drawback experienced was the over-rating of the water power as a direct source of income and subject for taxation, while another was a movement towards limiting the rights of strandowners to the disposal of the water, under cover of which the water-power utilisation industry had up to then been developed.

Since its establishment, the Association has had numerous opportunities for activity, among the matters dealt with having been the following: Proposals to the Riksdag, or Swedish Parliament, for the administration of certain waterfalls belonging to the State; for a law regarding waterfall rights; for ensuring the fulfilment of contracts for the delivery of electric power; for the introduction of concession laws relating to waterfalls and power stations; and, finally, the framing of a new water-right law.

To increase the knowledge of the water power in Sweden, the Association has compiled comprehensive statistics, and has issued special survey maps based thereon. It has also arranged water-power exhibitions, where the Swedish water-power technicalities and the progress of the Swedish water-power industry have been illustrated by numerous collections of drawings, photographs, statistical tables, &c. In recent years, the Association, which now comprises 260 private members, 100 commercial undertakings, 12 societies and other corporations, and six foreign societies and corresponding members, has specially endeavoured to prepare for an increased consumption of water power, with the view of lessening Sweden's dependence on fuel from abroad. By means of its information department, the Association publishes, as occasion arises, a series of pamphlets, about 80 having up to the present been issued. Lectures are also given and papers read before technical societies, chambers of commerce, &c., in the country with the view of disseminating information regarding water power and its utilisation.

MODERN ARC LAMPS AND INCANDESCENT LAMPS.

EVER since the "half-watt," gas-filled tungsten filament lamp was first placed on the market, it has been a subject of discussion to what extent the filament lamp could economically replace the arc lamp. Many writers have asserted that one lamp or the other would ultimately attain to virtual supremacy, but we have maintained consistently that there is, and will always be, a field of application for both types. This view is supported by a comparative study due to Heyck* (chief engineer to Körting & Mathiesen). The author's attitude appears to be impartial, and he gives many data hitherto available only in scattered form, if at all.

Special types of arc lamp, such as those used for projection, reproduction or copying processes, "daylight" lamps, and searchlight arcs, are in a practically unassailable position. On the other hand, arc lamps burning plain carbons and small enclosed arc lamps are practically obsolete for general lighting purposes. The types of arc lamp concerning the prospects of which, in competition with high-power filament lamps, it is most difficult to reach a decision, are open lamps burning impregnated carbons mounted side by side, and enclosed lamps burning impregnated carbons mounted one above the other. Considerations which have practically established the supremacy of half-watt lamps over the smaller and less efficient types of arc lamp are: The lower first cost of the filament lamp; the simpler installation and maintenance of the latter; the steady "white" light given by the filament lamp and the fact that the latter can be used singly (not in series connection) even where a comparatively small lighting unit is required and the supply voltage is high. Also a filament lamp of higher or lower candle-power can be substituted easily for another; this practice may easily be abused, but it is often very convenient. Some forms of arc lamp give a better approximation to white light than the tungsten lamp, but none can claim equal steadiness of lighting, and the difference in colour is not often a determinative factor.

The arc lamp burning plain carbons costs more than the tungsten filament lamp both in direct and indirect working costs. The cost of carbons has to be set against the cost of bulb replacements, and the efficiency of the half-watt lamp compares favourably with that of the ordinary plain carbon arc, or that of the long-hour enclosed arc. When used in a suitable fitting the "half-watt" lamp consumes 0.55 to 0.9 watt per c.p.† This may be compared with 0.68 to 1.0 watt per c.p. for D.C. plain carbon arc lamps of the open type used two in series on 110-volt supply; or with 0.57 to 0.73 watt per c.p. for similar lamps used three in series on 110-volt supply. Enclosed arcs with plain carbons consume 0.8 to 1.1 watt per c.p. if used singly on 110 volts; and from 0.7 to 0.8 watt per c.p. if used three in series on 220 volts.

Plain carbon arc lamps can only be considered for indoor lighting purposes at the present day (the flame arc holding the field for external arc lighting) and in indoor illumination the power expenditure per foot-candle per square foot of floor area is a more important factor than the watts per candle-power. On the basis of watts per foot-candle per square foot, the half-watt lamp compares very favourably with the plain carbon arc, whether for direct, semi-direct or indirect lighting. For purposes of comparison, the data in Table I are useful, these being averages for a room 33 x 20 ft., with white ceiling, white frieze and grey walls. The arc lamps are supposed to be provided with opal globes, and the data for half-watt lamps assume a 300-watt lamp with an opal globe for direct lighting and "Kandem" fittings for semi-direct and indirect lighting:—

TABLE I. AVERAGE WATTS PER CANDLE-FOOT PER SQUARE FOOT OF FLOOR.

Type of lamp.	Watts per candle foot per square foot (or per candle metre per square metre).		
	Direct lighting.	Semi-direct lighting.	Indirect lighting.
Plain carbon arc: open type.			
D.C.: two in series on 110 v....	0.17	0.23	0.18*
D.C.: three in series on 110 v....	0.11	0.16	0.25
A.C.: connections not stated...	0.25	0.27	0.36
Plain carbon arc: enclosed type.			
D.C.: singly on 110 v....	0.20	0.30	
D.C.: three in series on 220 v....	0.11	0.23	
Half-watt lamp (300 watts) ...	0.12†	0.11	0.11

* Burning with positive carbon beneath; only practicable with two lamps in series and not with enclosed arcs. † Opal globe.

The data in Table I indicate, on the basis which is of primary importance in lighting interiors, a surprising economy in the gas-filled tungsten filament lamp, particularly in semi-direct lighting. The fact that *semi-direct lighting is cheaper than direct lighting* (or, for practical purposes, equally cheap) where half-watt lamps are used and

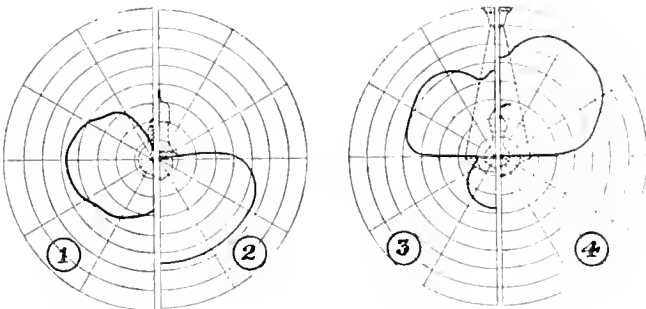


FIG. 1. FIG. 2. FIG. 3. FIG. 4.

the ceiling is white, is due to the fact that this type of lamp emits practically equal quantities of light upwards and downwards. Fig. 1 shows a typical candle-power curve for a bare 500-watt half-watt lamp of 695 m.s.c.p.: 660 m.b.-s.c.p. (upper); and 730 m.b.-s.c.p. (lower). The cap of the lamp offers a certain obstruction to up-going light. The remainder of the latter, when the lamp is used in an opal globe for direct lighting, is reflected downwards by a shade with an efficiency of reflection of 50 to 60 per cent. Generally, light so reflected has still to pass through the opal globe, and is thereby weakened another 15 to 25 per cent., so that only 40 to 50 per cent. of the light sent out by the lamp above the horizontal is available for downwards illumination. On the other hand, light going upwards from a semi-direct fitting is reflected downwards by a white ceiling with practically the same loss as is occasioned by the enamelled shade of a direct lighting fitting, but after reflection from the ceiling, light is subject to no globe loss, hence semi-direct lighting (using globe lamps) is as efficient as, or even a little more efficient, than direct lighting. The lower efficiency of indirect lighting is due to light originally sent downwards having to submit to double reflection (from the fitting and from the ceiling) before it proceeds to the working plane. It will be seen, however, from Table I, that indirect lighting is only about 20 per cent. dearer than direct lighting and 30 per cent. dearer than semi-direct lighting; it is *not* twice as dear as direct lighting.* Figs. 2—4 show typical polar curves of candle-power for direct, semi-direct, and indirect lighting units using half-watt lamps.

Semi-direct lighting has become very popular during the past few years, and obviously not without sound justification, in respect of high efficiency. Lest it should be objected that everything depends on the ceiling being cleaner than it can be kept in practice, it may be noted that

* Table I assumes equal illumination in each case, but it is generally necessary to provide higher mean illumination with indirect lighting than is needed when there is a high percentage of direct illumination. This necessity makes indirect lighting relatively more costly than indicated by Table I.—[Eps.].

* Zeitschrift des Vereines Deutscher Ingenieure.
† Here and hereafter reference is to mean lower hemispherical British candle-power, unless otherwise stated.

the figures in Table 1 are based on tests made beneath a ceiling which had not been whitewashed for five years. Electric lamps themselves do not soil the ceiling, and in living rooms, offices, and workshops, where no very dirty work is performed, it is sufficient to whitewash ceilings every two years in order to maintain the efficiency of semi-direct or indirect lighting. It is much more important that the lamp bulb and reflecting surfaces of the fitting be kept clean: due to the brisk local circulation of air maintained by the heat of the lamp, dust accumulates fairly rapidly on these parts, and to prevent its becoming "burnt on," and causing great loss of light, the lamp and fittings should be cleaned regularly (generally at intervals not exceeding one month).

A point which is not unimportant in interior work is that glow lamp fittings can be varied to a far greater extent than are lamps, in order to harmonise with architecture and decorations.

(To be continued.)

THE EDUCATION AND TRAINING OF ENGINEERS.

By "RADIX."

(Continued from page 508.)

The attempts of Labour to coerce payment on the highest possible scale by taking advantage of the necessities of Capital, and the efforts of Capital to grind as much as possible out of Labour without regard to the fact that the labourer is a human being, have resulted in measures being adopted by both sides which "kill the goose that lays the golden eggs." The canker of individualism has eaten into our whole social system.

A skilful dialectician may, no doubt, be able to make out a case for individualism, but in the long run the man who seeks to grind his own axe only, ends either by cutting himself badly, or by falling a victim to the natural feelings of rancour aroused in those who have suffered by his inconsiderate egotism.

Is it not the fact that nowadays the majority of us are more concerned with our legal than with our moral position? Is it not general experience that if a man is honest, it is—more often than not—because he is too great a fool to be anything else? Do we not find that the number of business men who "understand legal liability and limited liability, but know nothing of moral liability," is increasing? Is not everyone familiar with the aphorism "truth is sometimes met with in this world, even in an affidavit"? And does not one's personal experience of affidavits show that there is solid foundation in fact for this seemingly cynical utterance?

Trade Unions have introduced rules and regulations which tend to create in the minds of members (and particularly young members) the habit of thinking only of their rights and privileges, and ignoring the fact that duties and responsibilities are necessary concomitants of rights and privileges—in other words, to destroy instead of to preserve the "nice equilibrium between the subjective and the objective faculties." That a journeyman mechanic should receive the same rate of pay whether he be a highly skilled man with 20 years' experience or whether he be an apprentice just out of his time is a manifest absurdity, and tends to kill all desire to excel. On the other hand, the principle adopted by some employers to "overload the willing horse and say nothing" is equally pernicious. In either case the mechanic is deprived of any stimulus to take pride in his work, or to improve in his art. The standard of skill is lowered, and the factor of conscientiousness dwindles towards zero. This reacts

upon the productivity of the nation, and constitutes a serious handicap in national progress.

The word "bargain" has come to mean an exchange in which one party obtains an undue advantage. In the original sense of the word, the essence of a bargain was that each party rendered to the other a just equivalent. Were this principle more rigidly observed it is safe to say that nine-tenths of the sources of dispute between Capital and Labour would disappear.

Trace any human action back to its source and we finally come to an act of volition. In fact, we have no experience of any cause but Will.*

Leaving on one side any metaphysical speculations as to the origin or function of Will, we are face to face with the indisputable fact that in the ultimate analysis the action of a man placed in supreme authority is controlled, humanly speaking, by nothing but his Will. Is it not the fact that, so far as human beings generally are concerned, "goodness" or "badness" is a function of ability to resist temptation? Do not the numerous cases of misappropriation of trust funds by men who enjoyed the highest reputations for honesty and integrity bear this out? What is there to impel a man to do right simply because it is right, except the possession of an invincible moral sense? And is the inculcation of the imperative necessity of observing the moral law accomplished by the training of the rational faculty alone, be it in the direction of scientific research or of mechanical skill? We surely do not need any more convincing object-lesson in the futility of any attempt to base the moral law upon reason only, than is found in the inverted moral sense of the German Empire of to-day, as exhibited in the utterances of their leaders of thought and in their methods in warfare.†

During the discussion at the meeting, Mr. Berri-man made a point of the great advantage that would accrue from the cultivation of relations of friendship between masters and men; Prof. Dalby said something to the same effect; Mr. Longridge caused a gasp of amazement by the use of the word "religious" in his speech; Sir John Wolfe Barry insisted upon the necessity of raising the moral tone; Mr. Hadow said that "we needed not only skilled men, but good men."

All very true, but this will not be accomplished if reform in the education and training of engineers is confined to means for raising the standard of skill and for imparting a knowledge of theory. The attainment of a high degree of mechanical skill will not impel a mechanic to give a fair day's work for a fair day's pay, nor will the possession of an engineering degree impel an employer to pay a fair day's wage for a fair day's work. Education (or

* "It seems absurd one white man sitting in the house of the King of hundreds of thousands of subjects and dictating, and not only that, but being attended to and obeyed. And this is the power the white man has, what it is I can't say, but whatever it may be, it is that power, and not all the black troops we may raise, that enables us to stay in the country. It is a very curious thing to think over, but here we hold this vast country (and it is the same, of course, all the world over) simply by Will power or whatever it may be termed; by nothing else, for the natives could rise up and drive every white man into the sea to-morrow if they wished." —(Extract from a letter written at Ilorin, Nigeria, by David Wymford Carnegie.)

† In this connection, the words of Cardinal Manning, written about 40 years ago, are worth recalling:—"A fatal extinction of supernatural light, the aberration of false philosophy, the inflation of false science, the pride of unbelief, and a contemptuous scorn of those who believe, are preparing Germany for an overthrow or for suicide."

The event has shown these words to have been prophetic. In the September issue of the "Nineteenth Century and After," Mr. Ellis Barker, a well-known writer on Germany and the Germans, concludes an essay, entitled "How Education has Degraded the German Character," with these words:—"Education, far from enlightening the German nation, has blinded, debased, and dehumanised it."

what passes for such to-day) and morality are not correlatives. "The belief in the moralising effects of intellectual culture, flatly contradicted by facts," says Herbert Spencer, "is absurd *a priori* . . . One who should by lessons in Latin hope to give a knowledge of geometry would be thought fit for an asylum; and yet he would be scarcely more irrational than are those who by discipline of the intellectual faculties expect to produce better feelings." (Study of Sociology, Chap. VIII, p. 363.)

It may be said that all this is not the business of the Committee it is proposed to appoint. Possibly not—directly. But it has got to be somebody's business because just as "the modern world has recently learned that it is useless to try to educate a child that is not fed," so it will prove useless to try and turn out "good men as well as skilled men" unless the men possess the potentiality of goodness as well as of skill. You cannot make a silk purse out of a sow's ear.

The evils from which humanity is suffering to-day are largely traceable to the persistent neglect, throughout generations, of the training and development of Will and character in the young. At present the moral training of our children, our young men, and young women, gives some of us rather less concern than the selection of our daily food.

(To be continued).

PYROMETERS AND PYROMETRY.

THE Faraday Society opened their session on November 7th, meeting in the rooms of the Royal Society of Arts, when a large gathering contributed to the success of the general discussion on "Pyrometers and Pyrometry," which filled—and more than filled—the evening's programme. Owing to the regretted absence of the President, Sir Robert Hadfield, to whose initiative the discussion was due, the chair was filled, appropriately enough, by Sir RICHARD GLAZE BROOK, C.B., F.R.S., Past-President, the Director of the National Physical Laboratory, where so much valuable work on heat and its measurement has been carried out almost since its foundation. This early work was referred to by the Director in the interesting contribution to the discussion with which he opened the proceedings. In those early days the old Kew thermometer represented the national means of measuring temperature, and it was due to Sir Andrew Noble that Dr. Harker was able to begin the investigation of the relation between the air thermometer and Callendar's platinum resistance thermometer. It was not until 1913 that the standardisation of higher temperatures was attempted, and this aspect of the subject was dealt with by Dr. EZER GRIFFITHS and Mr. F. H. SCHOFIELD. It had been arranged to hold a conference at Berlin in September, 1914, to introduce an international scale of high temperature, up to and possibly beyond 1,300 deg. C., but under the circumstances an agreement between the Washington Bureau of Standards and the National Physical Laboratory was all that had been reached. Sir Richard gave some striking illustrations of the importance of exact high temperature measurements to modern industry. It was found, for example, that in a particular heat treatment process 40 or 50 per cent. of the steel articles had to be rejected, because the temperature of quenching had only been judged by the skill of an experienced workman instead of measured by a pyrometer.

Pyrometer Standardisation.—The paper by Griffiths and Schofield already referred to gave an account of methods at present in use at the National Physical Laboratory. The standard scale of temperature is thermodynamic, but in practice the problem of standardisation resolves itself into an empirical calibration of the pyrometer against a gas thermometer, but the comparison not being always a direct one takes place through the following stages:—

1. Comparison of gas thermometer with a thermoelement.
2. This thermoelement is employed to determine the freezing points of a number of pure metals.
3. The freezing-point determinations are used by the observer who wishes to calibrate a pyrometer for the standardisation of his thermoelement, who then compares the pyrometer and thermoelement under suitable conditions.

In practice the constant-volume hydrogen thermometer is used to realise the scale between 0 deg. C. and 100 deg. C., and calibrated against this, but extending over the range between the freezing point of mercury (38.88 deg. C.) and the boiling point of sulphur (444.5 deg. C.), the platinum resist-

ance thermometer is employed. The paper proceeds to give the best determinations now available of the fixed points on the thermometer scale up to the melting point of copper (1,083 deg. C.). Above this temperature few investigations have been made with the gas thermometer, but Day and Sosman, using a rhodium-alloy bulb, have arrived at 1,549 deg. C. as the melting point of palladium, and by extrapolation 1,755 deg. C. as that of platinum. Up to 1,550 deg. Day and Sosman's "fixed points" are usually accepted as standards, but above that temperature the scale should be extended on the basis of the radiation laws.

Mr. JOHN RHODIN, in the discussion, raised the interesting point as to whether it would not be better to base the whole of our thermometric scale on the laws of radiation, which have a sound theoretical basis. Messrs. Griffiths and Schofield went on to describe the apparatus employed for calibrating the thermometric pyrometer by means of the accepted "fixed points," and they discussed in some detail the sources of error to be looked for and avoided. Finally the calibration of total radiation and optical pyrometers was dealt with, the electric furnaces used for the purpose, an example of which was exhibited at the meeting, also being briefly described.

Recent Developments in Pyrometric Apparatus.—Of the group of papers describing recent forms of pyrometers and of apparatus for obtaining high temperatures, the most interesting were contributed from America. That sent by Dr. E. F. NORTHRUP was particularly illuminating and suggestive. After pointing out the objections to existing types of electric furnaces, particularly those used for fusing chemically-pure products requiring very high temperatures, he laid down the condition that in the ideal furnace the heat should actually be produced *within* the crucible. This requires an electric induction furnace, but for various reasons which are set forth

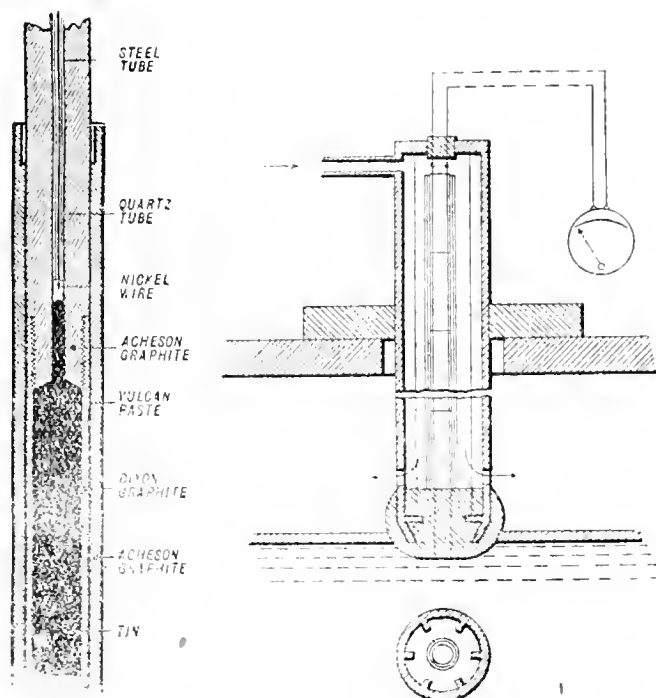


FIG. 1.—TIN PYROMETER.

FIG. 2.—ROGERS PYROMETER.

it must be a furnace obtained without the use of iron. Such a furnace, of 20-kw. capacity, Dr. Northrup has succeeded in constructing by employing high-frequency currents (up to 25,000 cycles per second at 7,000 volts) in an induction coil of some 50 turns to induce very large currents in the crucible—walls or contents—which it surrounds. The primary currents are oscillatory, and produced from the discharge through condensers of a two-phase, 60-cycle, 220-volt supply. The apparatus seems complex; in reality it is very simple, and in peace times—as pointed out by Mr. E. H. RAYNER—is an ordinary marketable wireless outfit of somewhat high power. The thermal efficiency of the 20-kw. furnace is as high as 60 per cent.; it will melt 45 lb. of brass in 35 minutes, and the vacuum type will bring a 14-cm. diameter graphite furnace filled with tin or glass to a temperature well over 1,600 deg. C. in 40 or 50 minutes. Dr. Northrup was in hopes of attaining 2,000 deg. C., and the building of furnaces of large units was in contemplation. The furnace, which is made by the Ajax Metal Co., of Philadelphia, was most favourably received by those competent to judge, and the type was considered to have a future before it. Certainly a furnace in which metals like tungsten and its alloys can be melted *in vacuo*, free from carbon, is one which metallurgists keenly desire.

Dr. Northrup's latest appliances for measuring high temperatures were no less interesting. Up to 1,300 deg. C., temperatures in any kind of atmosphere can be accurately measured by means of well-constructed platinum-rhodium thermocouples, but the potentiometer on which the E.M.F. is

measured must be of a robust, portable type. Such an instrument, used in connection with a direct deflection millivoltmeter (that can be calibrated to degrees), and known as the "Northrup Pyrovoltmeter," was described in the paper. It being a deflection instrument, its accuracy and permanency depend upon the permanence of a permanent magnet rather than upon that of a standard cell, and as the voltmeter is introduced into the circuit after balance has been obtained in substitution for a copper coil of equal resistance, its temperature coefficient introduces no errors. We believe that in this country Dr. Rosenhain has also designed a workshop type of potentiometer.

A somewhat similar type of potentiometer was described in a paper communicated by Mr. RICHARD P. BROWN, of Philadelphia. In this a direct reading on a high-resistance millivoltmeter from the thermocouple is measured by comparison with an equal voltage from a dry-cell circuit. The temperature coefficient of the meter is likewise eliminated by furnishing a copper resistor in the meter equivalent to the copper or aluminium of the coil. The high resistance of the voltmeter, up to 1,000 ohms, is secured by reducing the weight of the moving element to a minimum. It is made of an aluminium alloy wire 0.003 in. dia. enamelled for insulation.

Thermocouples and High-temperature Thermometers.—Mr. Brown tells us that in the States nitrogen thermometers, taking the form of a copper bulb actuating through capillary tubing an expansive spring, are considered the most satisfactory instruments to use up to 425 deg. C. Mr. J. C. RHODIN drew attention in this connection to the Wiborgh pyrometer, which was successfully used for controlling the temperature of an air blast-furnace up to 800 deg. C. This was a gas thermometer in which a known quantity of air under a known pressure was pressed into the bulb. For temperatures up to 1,100 deg. C. a base-metal thermocouple, usually compounded of 90 per cent. nickel and 10 per cent. chromium, and 98 per cent. nickel and 2 per cent. aluminium, is generally employed in America. For temperatures up to about 1,300 deg. C. platinum and rhodium thermocouples are in vogue in America as well as in this country, but they are unsatisfactory. Dr. Northrup tells us, in a reducing atmosphere above about 145 deg. C. A thermocouple of tungsten-molybdenum though giving a small E.M.F., can be used to measure extreme temperatures if protected from hot gases.

For temperatures up to nearly 1,700 deg. C., Dr. Northrup recommends the use of molten tin (boiling point 2,270 deg. C.) as the pyrometric substance, and he describes a form of molten-tin thermometer with a bulb and stem of graphite, in which the height of the column is determined by electrical contact. A cross-sectional view is shown in the accompanying figure (p. 533). Dr. Northrup urges investigations into the possibilities of molten tin for extending the fundamental temperature scale above the limits of the gas thermometer.

Base-metal thermocouples were also discussed by Mr. C. R. DARLING and Mr. G. E. M. STONE. Mr. Darling and Mr. A. W. Grace have shown that in general the E.M.F. of a couple is not affected by the fusion of one or both of its elements, and if, therefore, provision be made for either element to fuse without breaking the circuit, the employment of such couples is feasible up to 1,500 deg. C. Mr. Stone's paper, which was of considerable practical interest, dealt with remediable causes of unreliability encountered in thermoelectric pyrometry, especially in base-metal systems. A very common source of trouble could be traced to the low terminal resistances of instruments.

In work where high accuracy is desired, the temperature of the cold junction needs careful watching, and Mr. R. S. WHITTLE advocated burying this some 10 ft. or more beneath the floor, protecting it by a metal sheath filled with bitumen or powdered magnesia. Such buried thermocouples are being successfully used in works practice, and, as Mr. Whittle has one great difficulty in using thermocouples at high temperatures is the protection of the couple from direct contact with the molten metal of the furnace, under measurement, Dr. H. ROGERS boldly cut this Gordian knot by letting the tips of the elements—not, otherwise, united—actually dip into the molten metal (fig. 2). Only a very short immersion is necessary for a steady reading, so there should not be unduly rapid deterioration of the expensive wires composing the elements. The method deserves a good trial. Incidentally, we may refer here to a rough workshop method, Mr. S. N. BRAYSHAW uses for standardising pyrometers, in which he melts a 60/40 copper-iron alloy in a crucible of wonderful stability, in a deep graphite crucible in an atmosphere of coal gas, covering the molten alloy with charcoal. This gives a fixed point of 1,112 deg. C. which happens to be the α/β transformation point of iron-based 1.1 per cent. carbon, and 0.5 per cent. tungsten commercial steel.

Automatic Control Pyrometry.—Several speakers touched on this important subject, and Mr. C. E. ROSSIE expressed a widely-held view, which manufacturers should take note of, that the automatic control of a furnace by means of a pyrometer, although presenting many difficulties, was a practical proposition with a future before it. Mr. S. A. MAX, of Melton, Hayfields, Ltd., exhibited an automatic control instrument for operation on electric furnaces. In this a nickel-chromium alloy thermocouple actuates a high-resistance millivoltmeter. A small motor or clock depresses the instrument pointer every 10 seconds, and thus brings together two con-

tacts which, working through relays, actuate the switch controlling the furnace current. A valve of a gas or oil furnace can be similarly controlled, and the principle may be applied to signalling pyrometers showing red, white, or green lights according as the temperature is too low, within limits, or too high.

(To be concluded.)

THE NITROGEN PROBLEM.

THE war has forcibly brought home the vast service that science can render to trade and industry. In almost every branch of business the chemist and scientist can reduce costs, increase profits, and open up new fields for the merchant to conquer. Research incidental to the conduct of the war has shown that this applies particularly to those industries dependent on nitrogen compounds. Forced by circumstances to face the problems connected with the provision of ammonia and of nitric acid by the newer synthetic processes, we are well on the way, thanks to the valuable work of the Nitrogen Products Committee of the Munitions Inventions Department, to solutions that promise permanent benefit to the agriculture and commerce of Great Britain, apart from the immediate assistance rendered towards the successful prosecution of the war.

Nitrogen compounds are essential for explosives, and in the form of fertilisers for agriculture. The world's consumption for agricultural purposes almost doubles every 10 years; in 1913 it was no less than 2½ million tons of Chile nitrate, and about 1½ million tons of sulphate of ammonia. As long ago as 1898 Sir William Crookes predicted a shortage in the world's wheat supply, and urged the vital importance of finding other sources of nitrogenous fertilisers in view of the fact that the natural deposits of Chile nitrate were limited in quantity. Sir William himself experimented in obtaining nitrogen from the air, in which it exists in unlimited quantities. Other countries appreciated the possibilities thus indicated, and set to work on the problem of nitrogen fixation. Norway, being at an advantage with cheap water power, adopted the arc process, which produces nitric acid direct from atmospheric nitrogen and oxygen, but only by an enormous consumption of power. Germany, on the other hand, concentrated, in the main, on bringing to a commercial success a process worked by Prof. Haber for producing ammonia by the union of hydrogen and atmospheric nitrogen at extremely high pressures and at an elevated temperature. We, however, with whom the idea of nitrogen fixation originated, did nothing, the ammonia recovered at gasworks and coke ovens being practically the only form of combined nitrogen produced in this country.

When the war began, the Central Powers, by extending their established nitrogen fixation processes, and by developing others, such as the cyanamide process for the production of nitrolin or ammonia, and the oxidation process for converting ammonia into nitric acid, became self-sustaining. Although the command of the seas enabled us to import from Chile all the nitrate of soda we needed for munitions and agriculture, and so escape the consequence of our scientific neglect, the beginning of the submarine campaign in February, 1916, forced us to review the position.

In June, the Nitrogen Products Committee was set up under the chairmanship of the Comptroller of the Munitions Inventions Department of the Ministry. Before the Committee lay the difficult task not only of discovering the working details of some of the more important processes which are carefully guarded by the foreign firms who are working them, but of making the processes commercially practicable. Because of the pre-eminent position held by the Haber process in Germany, where the economic conditions as regards coal supplies and the comparative absence of water power are similar to those here, and because it was plain that the research would be especially difficult owing to our limited knowledge of the process, attention was first directed to the problem of the production of synthetic ammonia. The Committee then turned its energies to bringing to a commercial stage the ammonia oxidation process for producing nitric acid from gasworks and other forms of ammonia, a process which had not hitherto been practised in England, although worked to some extent on the Continent.

The fruitfulness of the Committee's inquiries led to the issue of an interim report in February, 1917, and on this the Minister (Mr. Addison) decided to take action, among other things upon the ammonia oxidation process. The Explosives Department has since taken over the task of establishing the process on a commercial basis. Manufacturers interested in ammonia oxidation met the Comptroller and the research staff, with the practical outcome that in several of our largest chemical works the process is being introduced to take the place of the nitric pots used in the making of sulphuric acid by the Chamber method. Seeing that before British chemists concentrated their attention on this problem the annual consumption of Chile nitrate for the purpose in question was 1,500,000 tons, the saving of 1,000,000 tons by the adoption of the ammonia oxidation process may become very material. The investigation of the Haber process has involved the

solution of several difficult chemical engineering problems, as was to be anticipated in operations necessitating the compression and manipulation of gases at extremely high pressures. The whole of the conditions governing the process have been thoroughly studied, with the result that a method of working has been devised whereby the output of ammonia per unit of plant has been increased to a figure which, as far as is known, has never been approached, even in Germany, the home of the process. A semi-technical Haber unit is now in operation, and is providing data concerning the few further details to be elucidated prior to the erection of a full-sized unit. As an outcome of this synthetic ammonia research work, a process has been discovered for the preparation on a large scale of the purest hydrogen, and the promise displayed in small-scale work is now being put to the test by semi-commercial trials.

Although the Committee has concentrated particularly on processes valuable as war measures, the possibilities of nitrogen fixation in relation to agricultural and commercial requirements after the war have not been lost sight of. The manufacture of cyanamide or nitrolim, a valuable fertiliser, has been investigated by a deputation which proceeded abroad for the purpose. It is not unlikely that the industry may be established in this country to meet the demand for fertiliser that is anticipated as a result of the Board of Agriculture's new policy, which will bring several million additional acres into cultivation.

To establish certain nitrogen fixation processes on a sound basis cheaper electric power will be imperative. An inquiry has been made as to the possibility of cheapening the production of electric power from coal by the use of methods permitting of the recovery of ammonia, fuel oils, and other by-products hitherto wasted when raw coal has been directly used. Schemes for the utilisation of various undeveloped water powers in this country for electric power production have also been examined. The survey of a particular drainage area has recently been completed, and has revealed a potential source of 40,000 electrical horse-power in an important industrial area. Finally, the Nitrogen Products Committee has investigated the probable requirements of this country for nitrogen compounds, and has gone carefully into the probable costs of manufacture by the various synthetic and non-synthetic methods in the light of experience in allied industries.

Moreover, in order to review the nitrogen problem as it affects the Empire, the Committee has got into direct communication with official representatives of Australia, Canada, New Zealand, South Africa, Egypt, and India. It is in touch, too, with Allied countries; France, Italy, and Russia have representatives acting in liaison with the Inventions Department on the nitrogen problem.

The final report of the Committee, which it is hoped will not be long delayed, will form an impressive record of scientific industry and resource, bearing testimony to the truth that Great Britain, once she is roused, is equal to any emergency.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

British Methods in Foreign Trade.

A letter from India recently appeared under the above heading in some of the electrical papers from "Trumpeter," and I crave leave to give a small example of how things should not be done.

In September, 1916, when on the point of returning to India, I personally gave an order to a very well-known London firm for an electric toaster, paying the cost there and then—some 22s., I think. I was, of course, fully prepared for delay, as none of these were in stock at the moment. Dispatch was advised a few months ago, and the toaster arrived in September, 1917. I used it at breakfast for exactly six days before it burnt out, the pressure being correct (220 volts) within a small margin. But the point is that it *would not make toast*. The elements are placed at the two sides with a wide vertical strip in between, so that no ingenuity could prevail on the bread to toast down the middle. The engineer of the Simla supply, whose electric fires and water heaters are ahead of most types I have met, re-wired the device for me in a sensible manner, and now it makes good toast.

J. W. Meares.

Simla, October 13th, 1917.

The E.T.U. or the A.E.S.E.?

I am desired by the members of the Marylebone Branch of the National Amalgamated Union of Enginemen, Firemen, and Electrical Workers to call the attention of "Progress" to the fact that there are about 11 or 12 Unions catering for

the employees of the generating stations. Up to the present moment Mr. Meakin is the only trade union agent known to us who took the initiative in trying to get a base rate for London and suburbs in the power stations. Something like two years have passed since inquiries were made in a certain direction on the part of the N.A.E.U. which ultimately led to the matter being placed before Sir Geo. Askwith. The official figures submitted were so startlingly diverse with respect to the wages of the generating and distributing staffs of 10 leading power stations that the Marylebone Branch decided to commission Mr. Meakin to make inquiries all round. He started straight away, and the task is not yet completed. We would like to ask why another union is to be formed only to go over the same ground as we have traversed? To put an end to this piecemeal method of working, it has been suggested by an official of another trade union that a round-table conference of all the secretaries of the trade unions interested should be arranged. I make the suggestion as it was given out, and perhaps some of your readers would like to offer opinions through your columns.

J. Vincent,

Branch Secretary.

The National Amalgamated Union of Enginemen, Firemen, Mechanics, Motormen and Electrical Workers.

London, N.W., December 3rd, 1917.

I read with great interest the letter from "Progress," but before starting a new trade union would it not be just as well for some of the older ones to declare their policy? In common with many others, I have been asked to join the E.T.U., but I am in doubt on one vital point, viz., shall I ever be asked to come out on strike to support wiremen who may be asking for a rise in wages?

Puzzled Engineer.

The Status of Draughtsmen.

Among the mass of correspondence dealing with industrial questions, the claims of draughtsmen have not received that attention which is undoubtedly their due. Possibly this is owing to the draughtsman's unfortunate habit of brooding over his grievances, rather than openly ventilating them; and it is this peculiarity which has unquestionably led to the passive acceptance of his present relatively low status.

Now, it is quite obvious to everyone that the successful prosecution of the war depends upon the speedy turning out of ships, aircraft, guns, together with a variety of electrical and mechanical devices; but what perhaps is not so generally recognised is the fact that without the draughtsman's skill and ingenuity none of these things could possibly materialise.

In other words, the draughtsman's work is the keystone to the whole of the shipbuilding, engineering, and electrical industries.

The patriotic example shown by draughtsmen in consistently sticking to their work during the national upheaval, when other trades have so easily obtained their objects by other and more drastic methods, has met with little response on the part of the powers that be; but this is only in keeping with the attitude hitherto adopted by those in authority of deliberately refusing to recognise openly the draughtsman's true importance in the industrial world.

As, therefore, it is obviously futile to place reliance in human sympathy and sense of fairness, draughtsmen must look to themselves, and by combined and concerted effort see that the causes which have created this feeling of suspicion and unrest are finally and positively removed.

Might I point out to your readers that the Draughtsmen's Association has already done magnificent pioneer work in this direction, and only the loyal support of all draughtsmen is needed to enable its aims to be successfully achieved.

J. D. Murray.

President, Merseyside Branch of the Association of Engineering and Shipbuilding Draughtsmen.

Birkenhead, November 30th, 1917.

[We are fully aware of the high value of draughtsmen's work, and of the low esteem in which, for some inexplicable reason, it is held by the engineering world outside their ranks; and we cordially sympathise with them.—Eds. Elec. Rev.]

Concert.—The Association of Engineering and Shipbuilding Draughtsmen (London Branch) are holding their first Bohemian Concert to-morrow (Saturday) at 7 p.m., at the "Caledonian Salon," Holborn Restaurant. The following are the artists:—Miss Diana Hughes, soprano; Mrs. E. M. Pearson, mezzo soprano; Miss Winifred G. Winter, songs at the piano; Mr. E. H. Walker, tenor; Mr. Reginald Yates, baritone; Mr. W. Hanson Crossland, tenor; Mr. Fred. Emerton, entertainer; Mr. Albert L. Walter, solo pianoforte; Mr. F. Ollerenshaw, tenor.

WAR ITEMS.

Building Work to be Further Restricted.—At present no building work costing more than £500 may be proceeded with without special permission from the Government. The *Times* states that the regulation is to be carried further. The new Rule will prohibit "any form of constructional or decorative work, with few exceptions, without express permission." The object is to prevent unnecessary work being undertaken while there is a pressing need for men accustomed to such labour for urgent war purposes.

The Coventry Strike.—The strike of 50,000 workers at Coventry, which ended early in the week, represented, says the *Daily Telegraph*, on an eight-hours day basis, the loss beyond recall of 3,200,000 hours of labour on aeroplane production.

Industrial Reconstruction.—Under the auspices of the Employers' Parliamentary Council a national conference will be held at the Central Hall, Westminster, on Wednesday, December 12th, to discuss and determine a united policy in regard to the proposals of the Government with respect to reconstruction and to industry and trade after the war. A resolution will be submitted welcoming the recommendations of the Whitley report, but submitting that to successfully give effect to the proposals it would be essential that agreements between organisations of employers and employed should be legally enforceable; that all combinations of Capital and Labour should be subject to the ordinary law of the land; and that the provisions of the Trade Disputes Act which gave immunity in this respect should be repealed.

A Government Labour Committee.—The War Cabinet has appointed a Government Labour Committee, consisting of the following members:—Rt. Hon. G. N. Barnes, M.P. (Chairman), Sir Auckland Geddes, K.C.B., M.P. (Vice-Chairman), Sir George Askwith, K.C.B., K.C., Mr. Guy Calthrop, Sir Lynden Macassey, K.B.E., Mr. I. H. Mitchell, and Mr. U. Wolff.

The Committee will deal with questions of wages (including the interpretation of the Orders relating to the increase of 12½ per cent. recently granted to plain time-workers in certain industries) and to co-ordinate the settlement of labour questions affecting Government Departments. The committee may confer with a consultative committee consisting of representatives of the principal Government Departments concerned with industrial questions. The functions of the Government Labour Committee will not supersede those of the arbitration tribunals set up under the Munitions of War Acts by the Ministry of Labour.

Exemption Applications.—At Southwark, Messrs. W. P. Catterson & Sons, manufacturers of gas and electric lamps, of Newington Causeway, were requested to show cause why certificates of conditional exemption should not be withdrawn granted to their buyer, 41, in grade 3; a head counter-man, 40, fit for labour abroad (B2); a salesman, 36, in grade 3; and another salesman, 38, fit for sedentary work at home. The firm now employed 15 other men, all over military age, and nine women in the office, who had taken the places of men who had joined up. The bulk of their work was for Government Departments. The counter-man had been with the firm 19 years, and was now doing the work of three men. Ald. Hewitt: Will you tell us the number of articles you deal in? Mr. Catterson replied that their catalogue contained over 6,000 articles. Coun. Weaver: It does not appear as if the business would be ruined if we took the counter-man. Coun. King: What is to prevent you having a lady in your showroom? Mr. Catterson said that Government contractors called at the showrooms to see if they could obtain substitutes for various articles, and it was essential that there should be a man there with an intimate knowledge of the goods. They had 45 men before the war, but now had only 22. The National Service Representative said the firm was lucky to have three men in low medical categories. These were granted six months' exemption each, and the appeal for the counter-man was dismissed, the National Service Representative undertaking not to call him up for three months.

A Glasgow Corporation tramway motorman, 39 years of age, appealed to the Lanarkshire Military Appeal Tribunal against the withdrawal of his exemption. He had been 21 years in the Army, was mobilised on the outbreak of war, and served in Gallipoli and Egypt. He appealed on the ground that he was in a certified occupation. He had been in the Corporation tramways service since 1901. The Sheriff and appellant was in a certified occupation, and exemption was granted.

The Midale Tribunal put back nine tramway employees, all A, B1 or C1 men, to February 28th. Mr. G. Webster, the tramways manager, said there was a shortage of drivers, and the employees had often to work seven days a week and very long hours. Four cars had to be taken off the service in order that the men could appear before the Tribunal.

At the Shoeburyness Tribunal, Mr. Lewis Davis, of Curtain Road, E.C., who covered up electrical fittings, appealed on business grounds for G. W. Hardy, aged 39 years, classed A, for a final offer, for the fourth time. Mr. Davis said that as an electrical work they were engaged on. They made the double wire and wiring. There were about 120 yards

engaged, and he did not know what would happen if this man had to go. It was highly technical work. His wages were 49s. a week. He felt convinced that many of the girls would be thrown out of work if he had to go. The Tribunal discussed the small wages paid to the man. Hardy said there were about 200 machines running, and he looked after the motors. The Tribunal decided to grant four months, and the Town Clerk said it was the opinion of the Tribunal that this man could not be claimed as indispensable when he was paid so little.

At Windsor, Mr. H. Fowler, electrician, appealed for F. G. Isgrove (18, B1), his apprentice. Mr. Fowler is in the R.N.A.S., and Mrs. Fowler stated that if Isgrove was taken there would be no skilled person to carry on the business. There was another apprentice, aged 16; both worked together, but the younger lad could not manage the work alone. Five, including her husband, had enlisted from the business, which was the only one of its kind in Windsor. A month's respite was granted to see if anyone could be obtained to replace Isgrove.

At Stratford-on-Avon, there was a Military review of the case of A. Baldwin (40, B1), electrician to Mr. J. Fielden, Little Kington. The Military were willing that the man should remain until a capable substitute was found, and Mr. Fielden stated that the man was in charge of his electric light plant, which provided light for the hospital. The Military suggestion was agreed to.

Elland Tribunal has refused an appeal by J. Sykes, electrician, but he is not to be called before the end of January.

Surrey Appeal Court has granted three months' exemption to E. Lown (31), who is in charge of the electric plant at the Farcombe Paper Mills.

East Kent Appeal Court has granted exemption until May 26th to Mr. C. Campbell (41), managing secretary to the Whitstable Electric Co., Ltd.

At Southend-on-Sea, exemption until February 1st was granted to C. C. McBride (18), electrician's apprentice, of Westchill, to enable him to obtain a commission. He had already been in the Army.

Leyton Tribunal has granted six months' exemption to W. H. Ruddock (31, C3), electrical mechanic at the Alliance Kinema.

At Southwark, the National Service Representative drew attention to the cases of men granted certificates under the Protected Trades Schedule, pointing out that these men, many of them young and passed for general service or garrison duty abroad or at home, were not called upon when granted their certificates to join the V.T.C. or the Special Police. There was a feeling in the borough, as well as throughout London, by men granted exemption by tribunals who were compelled to join these forces as a condition of their exemption, that the men in munition works should also be compelled to do something of national importance. He thought that these men in munition works were capable of becoming efficient members of the defensive forces. The Tribunal decided to communicate with the department responsible for granting the certificates, urging that it should be a condition that the men securing them should join either the V.T.C., the Special Police, or the Red Cross.

LEGAL.

GAS LIGHT AND COKE CO. v. HACKNEY BOROUGH COUNCIL.

In the Court of Appeal, before Lords Justices Swinfen Eady, Warrington, and Scrutton, on Thursday, November 29th, the case of the Attorney-General, at the relation of the Gas Light and Coke Co., Ltd., v. the Metropolitan Borough of Hackney was heard, upon the appeal of the Gas Light and Coke Co. from the judgment of Mr. Justice Astbury in the Chancery Division.

MR. COLEFAX, K.C., in support of the appeal, said Mr. Justice Astbury had dismissed the action with costs, and shortly stated the point had reference to the charges for electricity that were made by the Borough of Hackney—whether or not in their charge for power they infringed the provisions of Sections 19 and 20 of the Electric Lighting Act. The plaintiffs' submission was that Mr. Justice Astbury had not given effect to the judgment of the Court of Appeal in the Long Eaton case, and, further, that he had unduly made distinctions between that case and the present one. In the Long Eaton case the facts were that persons using power for running their machines, if they took all their light from the company, got it at a cheaper rate, while, on the other hand, if they only took it for one purpose, they did not get it at the cheaper rate. The Borough of Hackney had given to the power user a reduced charge in respect of lighting up to the extent of 20 per cent. of the energy user's other charge, thereby giving the user a benefit over one who only took electrical energy for light. The charges were divided under two heads—one for light and one for power, with alternatives for lighting; and the circular of which his clients complained in the present proceedings went on to say that consumers paying under this scale (that was for power) were allowed to use 20 per cent. of the energy supplied, for lighting. Plaintiffs admitted that a power user in respect of electrical energy for power had a better load factor and a better diversity factor than a light user under ordinary circumstances; but the power user when he used

light worsened the position at the central power station, and in fact, *quid* the user of light, he was no better for the power station—if so good—than the ordinary user of light and the non-power user of light. His broad point was that the Borough of Hackney, having regard to the Long Eaton case, was not entitled to give to a power user a preferential charge in respect of light. It was an inducement to the power user to cheapen the cost of his power by taking light without any corresponding benefit to the station. In the Court below, evidence was given that the charges of the Borough Council of Hackney for power resulted in a loss; but as the learned Judge was of opinion that the evidence was irrelevant, he would not go into that part of the case. He contended that the present case was on all fours with the Long Eaton case.

On Friday MR. WALTER, on behalf of the respondents, in support of the judgment of the Court below, said the appellants' case was based on a misconception as to the true effect of Secs. 19 and 20 of the Act. What they had sought to do was to read the Act as though the sections were not framed to prevent different charges to different consumers but between a different consumption. Electric supply undertakings supplied one thing, and that was electricity. The only interest they had was in the use of the energy supply, in so far as that use affected their cost of supply. An electric light undertaking had to be on a scale to meet the maximum demand which at any time might be imposed on the plant. That was of fundamental importance in considering the question of cost. Capital charges went on whether they generated little or much electricity. The ordinary lighting was only for about two hours a day, taking the year through. Therefore all electric light undertakings endeavoured, as far as they could, to extend the useful work of their station. What the Court was asked to say was that the customer who used the plant for but two of the 24 hours could not be charged differently to the man who used the plant for 11 hours. That was really what the appellants were asking. All the authorities were absolutely in favour of the respondents. If they had to make separate charges to consumers who used both power and light, they would have to have separate meters and separate wiring, which would probably cost thousands of pounds. The Act of Parliament had nothing to do with power, nothing to do with light, and nothing to do with charges. They had power to distinguish between the classes of consumption and the classes of consumers. There was no such distinction known as a differentiation between power and light for the purposes of the Act. No evidence had been given at the trial that there was any undue preference. The prices were based on the fact that if they got a customer of a certain kind the prices charged by the station would be remunerative. There was no suggestion in the evidence that the rates were not perfectly fair. The only thing that was suggested was that the respondents were not entitled to charge the consumers on that basis.

The further hearing was adjourned until Monday.

RE TAYLOR & CO. (HATTON GARDEN), LTD.

IN the Chancery Division, on Friday, Mr. Justice Astbury granted an injunction restraining Taylor & Co. (Hatton Garden), Ltd., and Miss Julia Taylor and Ernest W. Tester, the signatories and shareholders of the company, from using the name Taylor & Co. (Hatton Garden), Ltd.

MR. F. RUSSELL, K.C., who appeared for the plaintiff, Moritz Bergl, an Associate Member of the Institution of Electrical Engineers, said he had a considerable experience in the mica trade, and in 1912 he came in touch with the defendant, Miss Taylor, who was the sole owner of the business in Hatton Garden of Taylor and Co. They entered into a partnership, which eventually was dissolved, and the partnership assets were to be sold. In the meantime, the defendants had registered the name of the defendant company, and the plaintiff only discovered this from an announcement in the ELECTRICAL REVIEW. He (counsel) submitted that no one knowing that a company with this name had been formed would bid at the sale for the partnership goodwill, and the sale would be prejudiced by the name being allowed to remain on the register.

MR. RAM, for the defendants, said Miss Taylor had not intended to do anything wrong; she hoped that no one from the outside would attend the sale, and that she would secure the business. She intended to do nothing with the company until the sale was completed.

His LORDSHIP said the case for the defendants was hopeless, although he was not satisfied that the lady intended to do wrong. The injunction must go with costs. Both parties then agreed to the appointment of a Receiver of the partnership business.

TRAMCAR FATALITY CLAIM.

AT Leeds Assizes, last week, Miranda Dickinson, widow of a Huddersfield Corporation tramcar driver, claimed £500 damages against the Great Northern Railway Co. in respect of the death of her husband, Lewis Dickinson, who died as the result of injuries received in a collision between his car and a railway lorry. There was conflicting evidence as to the lorry's lights. The jury found for the plaintiff, the lorry having crossed the tramlines either diagonally or broadside on, and the lights being, therefore, not fully effective. The parties being agreed as to £500 damages, the jury were asked to apportion the amount, and awarded £250 to the widow, £100 to a boy child aged 12, and £150 to an infant child.

GOODLAND v. EDISON ACCUMULATORS, LTD.

IN the King's Bench Division, on Monday, Mr. and Mrs. Goodland, of Maida Vale, were awarded £695 damages against the Edison Accumulators, Ltd. The female plaintiff received serious injuries, alleged to have been due to the negligent driving of a motor lorry by the defendants' servant on April 30th. The lorry, it was stated, turned on to the footpath, knocked over a motor-cycle and side-car, and then knocked down Mrs. Goodland.

MR. THORN DRURY, K.C., for the defendants, admitted that Mrs. Goodland met with a nasty accident, but said she had made an extraordinarily good recovery. The only question was the amount of the damages.

MR. RIGBY SWIFT, K.C., for the plaintiffs, asked the jury to give compensation to the husband for the medical and other expenses he had been put to, and, far more important, to give compensation to Mrs. Goodland for the pain and suffering she had undergone in consequence of the accident.

Medical evidence was called on both sides, and MR. JUSTICE COLERIDGE having summed up, the jury awarded £95 to the husband and £600 to the wife, and judgment was entered accordingly.

MR. DRURY considered the damages excessive.

His LORDSHIP: Then you must go to the Court of Appeal.

HENDON ELECTRIC SUPPLY CO. v. BANKS.

JUSTICES A. T. LAWRENCE and Shearman, sitting as a Divisional Court, heard the appeal of the Hendon Electric Supply Co. from a decision of the County Court Judge at Barnet in the action of the company against Walter Banks, of the Hampstead Garden Suburb.

SIR E. POLLOCK, K.C., M.P., and Mr. Ball were for appellants, and Mr. Emery for respondent.

SIR E. POLLOCK stated that appellants brought an action in the County Court to recover a sum of £3 6s. 5d. in respect of electricity supplied to the defendant. The County Court Judge held that the plaintiffs were not entitled to recover, holding that the Electric Lighting Order applying to this case laid it down that the ascertainment of the amount was first to be made by an electric inspector within the meaning of the Act, and that, as that had not been done, the plaintiffs were disentitled to proceed with their claim. He, therefore, gave judgment for the defendant. The matter was of importance to the appellants, and, therefore, an appeal had been allowed by the County Court Judge. If the latter's decision stood, it fettered to a large extent the powers of the company to recover against the consumers of their electricity. In June of last year a new meter was fixed upon defendant's premises. When the meter was fixed, they forgot to take out the locking screw, the result of which was that the meter did not register. At the end of the quarter in September not much remark was made of the fact that no electricity was registered as having been consumed; but when the December quarter came, and no electricity was registered as having been consumed, the company were surprised, and on February 22nd they sent an inspector, who found that the meter was not working, and he pulled out the locking screw. Then the question arose as to how to ascertain the amount of electricity which had been consumed. The company claimed in accordance with the Act and the contract on the basis of the consumption in the corresponding quarter in the previous year.

MR. EMERY, for respondent, said there were several meters in the house, and the one in question controlled a heating apparatus which, defendant said, was not used during the periods in question, for he was using coal fires for heating.

SIR E. POLLOCK said a letter had been written since the trial at Barnet, in which it was agreed that the County Court Judge held that electricity had been used through this meter in the periods in question.

MR. EMERY dissented from that, and said the County Court Judge made no finding of fact at the trial. Upon the question of law he gave judgment for the defendant, without costs.

JUSTICE SHEARMAN: It is a point of law we are here to decide, is it not?

SIR E. POLLOCK: Yes. The defendant by contract in writing dated March 20th, 1915, agreed to take a supply of electricity upon certain conditions, under which defendant agreed to the supply being ascertained by the meters provided by the company; and, in the event of any difference as to the correctness of the meter, the dispute was to be settled in the manner provided by the Electric Lighting Acts. One of the clauses of these Acts provided for the appointment of an inspector to ascertain the amount of electricity which would have been consumed if the meter had been working, but no inspector had been appointed in this district for that purpose.

JUSTICE SHEARMAN: If an inspector were appointed, you would have to pay his salary, and that would probably be larger than the amount you would receive under his awards.

SIR E. POLLOCK pointed out that if an inspector were appointed, the consumer would have to pay the costs if he had acted unreasonably in raising a dispute before him. And in the ordinary case the inspector would have no power to give judgment; all he could say was whether the meter was right, and then the company would have to sue the consumer in the County Court.

After hearing Sir E. Pollock argue the legal point in the case, their Lordships gave judgment without calling upon Mr. Emery for respondent.

JUSTICE LAWRENCE, in his judgment, said that Clause 57 in the Schedule of the Electric Lighting Act of 1899 provided that where a difference arose between the consumer and the undertakers as

to whether any meter was not in proper order for correctly registering the value of the supply, that difference should be determined, upon the application of either party, by an electric inspector appointed by the local authority or by the Board of Trade, and that inspector should order by which of the parties the costs in the proceedings before him should be paid, and the decision of the inspector should be final, binding all the parties. A determination by the inspector was demanded by the consumer in this case, and unfortunately no electric inspector had at that time been appointed. He did not see that that entitled the County Court Judge to assess the amount of electricity consumed. He was bound to say, as he did, that the Act of Parliament had itself provided for the mode of determining such a dispute, and until it was so determined, no cause of action arose. He did not see why it could not still be determined, and then a cause of action would arise; but that point had not been argued, and therefore he did not judicially decide it.

JUSTICE SHEARMAN: I am of the same opinion, for the same reason.

The appeal, therefore, was dismissed, with costs.

BUSINESS NOTES.

The Tungsten Lamp Association.—An announcement issued by the secretary, Mr. A. Lazenby, states that as from December 1st this association has removed its offices to 46, Queen Victoria Street, London, E.C. 4. The telegraphic address and telephone number are unaltered.

Ferranti Contracts.—**MESSRS. FERRANTI, LTD.,** have received the following contracts:—

Manchester Corporation.—Annual contracts for meters and for current transformers, also a contract for three 500-k.v.a. three-phase transformers.

Kilmarnock Corporation.—One 100-k.v.a. three-phase transformer.

Birmingham Corporation.—One 100-k.v.a. three-phase transformer.

Darlington Corporation.—One 400-k.v.a. three-phase transformer.

Hal Williams & Co. (for Clayton & Shuttleworth, Ltd.).—One 375-k.v.a. three-phase transformer.

German Company for Ship Installations.—The Schiff's Installation Akt. Gesell. has been founded at Bremen (with a capital of £68,500) with the special object of manufacturing and installing apparatus for the electrical equipment of ships. The founders of the company are:—The Lloyd Dynamo Werke (Bremen), Backethal Draht u. Kabelwerke Akt. Ges. (Hanover), C. Lorenz Akt. Ges. (Berlin), Deutsche Nationalbank (Bremen), and Kommerz u. Disconto Bank (Berlin).

Dissolution.—**ELECTRICAL MEDICAL MANUFACTURING Co.,** 161, Gower Street, London.—Messrs. A. Lloyd & R. J. Wickham have dissolved partnership. Mr. Lloyd will attend to debts and continue the business.

Book Notices.—The November issue of the Tramways and Light Railways Association *Journal* contains the full report, by Col. Pringle, of the Board of Trade, on the Dover tramway accident.

"Practical Electricity." By T. Croft. London: Hill Publishing Co. 8s. 4d. net.

Catalogues.—**MESSRS. EDGAR, ALLEN & Co., LTD.,** of Imperial Steel Works, Sheffield, have issued a brochure entitled "The Making of a Tramway Point." The earlier pages contain many half-tone photographic reproductions illustrating the various stages of manufacture of a tramway point. The latter half of the book contains a reprint of a paper by Mr. F. Bland on "1883 to 1913, or Thirty Years of Tramway Practice."

LIGHTING AND POWER NOTES.

Barrow-in-Furness.—**PRICE INCREASE.**—In view of the increasing cost of coal, the T.C. has agreed to a general increase of 20 per cent. in the flat rate and demand system charges. Prepayment meters:—Flat rate, 20 to 25 per cent. increase; on the demand system the fixed weekly charges will be increased by 2d. to 3d. per week. The tender of Messrs. Siemens for sub-station switchgear, at £403, was approved, as also a proposal of the electrical engineer to ask for Government authority to order an additional turbo-alternator, and obtain tenders for same.

Blackburn.—**PRICE INCREASE.**—The Electricity Committee has decided to advance the price of electricity by 10 per cent., making 25 per cent. since the war started.

Braintree.—**PROV. ORDER.**—The Crittall Manufacturing Co. Ltd., has applied for a prov. order for electric supply within the area of the F.D.C.

Calder Valley (Yorkshire).—**WAGES BOARD.**—It is expected that a municipal wages board for the various towns and townships of the Calder Valley will shortly be established, covering Halifax, Brighouse, Elland, Todmorden, Sowerby Bridge, Hebden Bridge, Ludendenfoot and Mytholmroyd.

Cleckheaton.—A breakdown to the generating plant has necessitated an appeal to the public to restrict the use of electricity during the evening.

Colne.—The Electricity Committee has appointed a Sub-Committee to consider the question of an advance in the price of electric current, in view of the advance in the cost of coal.

Darwen.—**WAGES.**—The Corporation has declined an application for an advance of £1 per week in the wages of employes at the electricity works, put forward by the Union of Enginemen.

Deal and Walmer.—**PROV. ORDER.**—The B. of T. has prolonged the prov. order of the electricity company for a year.

Derby.—**EXTENSIONS.**—An important scheme for the development of the electricity undertaking, involving a total outlay of over £50,000, has now been decided upon. This includes the erection of a coal elevator, for which the tender of Messrs. G. Fletcher & Co., at £880, has been accepted; additions to the three-phase distributing mains, at a cost of £9,000, and additional plant at the power station costing £40,500. The latter is made up as follows:—Two new boilers, economisers, extension of elevator, and new chimney, £15,000; one 1,000-kw. turbo-alternator, £24,000; piping and brickwork for two boilers, turbine bed, and switch-gear, £1,500. Also an electric jib crane is to be purchased from Messrs. E. Morley & Sons, at £350.

Dewsbury.—**RESTRICTED LIGHTING.**—The outcome of the elaborate scheme for controlling lighting, proposed by the Chamber of Trade, has been an intimation from the Home Secretary that, after careful consideration of the scheme, he has decided that he cannot amend the existing order.

Dukinfield.—**FIRE.**—Last week a fire occurred at the sub-station of the Joint Tramways and Electricity Board; the damage is estimated at about £200, and is covered by insurance. In order to effect repairs, the current had to be cut off, and was not fully restored until next day, with a serious result upon electrically-driven mills and business premises in Dukinfield and Hyde, whilst tramway traffic between Alma Bridge and Hyde was stopped for a time.

Fort William.—At a meeting of ratepayers it was agreed to petition against the water-power scheme of the British Aluminium Co., Kinlochleven.

Guiseley.—**PROV. ORDER.**—The Electrical Distribution of Yorkshire, Ltd., has given notice of its intention to apply for a prov. order to supply electricity within the townships of Guiseley and Menston. At the request of the D.C.'s concerned, a clause is to be inserted giving the local authorities the option of purchasing the undertaking at the end of a given period.

Hebden Bridge.—**PRICE INCREASE.**—The U.D.C. has decided in Committee to advance the electric lighting charges by 8½ per cent., and power charges by 20 per cent., from January 1st.

High Wycombe.—**STREET LIGHTING.**—The T.C. has agreed to enter into a new contract for public lighting with the local electricity company for seven years as from January 1st, 1916, the date of the existing dispute, subject to the company accepting £100 for the standing charge payment for 1916 instead of £600, as demanded. If this is accepted by the company, the present action now pending in the Courts will be stayed, each party paying its own costs. The terms of the contract are:—Fixed standing charge, £100 a year; 13 300-watt lamps, £4 each; 110 100-watt lamps (all night), £2 10s. each; 62 100-watt lamps (half night) £1 10s. each.

Hull.—**PRICE INCREASE.**—The Electricity Committee has decided to increase electricity charges on January 1st by ½d. per unit on the flat rate, making 18½ per cent. increase on pre-war rates, and by a further increase of 17½ per cent. on all other units, making 32½ per cent. on pre-war rates.

Keighley.—The Electricity Committee has prepared for submission to the Council a report on the question of increasing the capacity of the boiler-house plant at the generating station, and recommends a fan installation, at an estimated cost of £1,500.

Leeds.—**RESTRICTED LIGHTING.**—The Chamber of Trade's efforts—supported by all the shopkeepers' organisations of the West Riding—to persuade the Home Office to fix definite times, covering a period of a fortnight or a month, for reduced shop lighting during the winter, instead of the daily movable times governed by the sunset, has ended in a decision of the Home Office that, after consultation with the military authorities, it cannot sanction any alteration of the present system.

Leicester.—**PLANT EXTENSION.**—The T.C. has decided to apply to the B. of T. for a prov. order authorising the acquisition of land and the construction of a new generating station. The initial instalment of the scheme comprises machinery of 6,000-kw. capacity, and this, together with buildings and land, will involve an expenditure in the aggregate of £285,000, made up as follows:—Water-tube boiler plant, £36,000; turbines, £18,000; alternators and switchgear, £10,500; surface condensers, £7,500; water piping, circulating pumps, screens, &c., £10,500; buildings, coal and ash handling plant, and foundations, £54,000; contingencies, £13,500; other constructional works and land, £135,000. Alderman Flint, the chairman of the Tramways and Electricity Committee, said this was only an approximate estimate of the cost

of the first instalment of the scheme for the purposes of the Board of Trade, and would be subject to revision when a detailed scheme was brought before the Council for adoption. It was estimated, however, that the undertaking would not cost the ratepayers anything.

London.—The South London Electricity Supply Corporation has decided to increase the charges for power by 11 per cent.

Lancaster.—PRICE INCREASE.—It has been decided to increase the price of electricity by 25 per cent.; the increase takes effect in January.

Nottingham.—WAGES.—The Committee on Production has given its award on the recent arbitration with regard to the wages demand of Corporation (gas, tramways, electricity, health, &c.) employes, by the National Union of General Workers and the National Union of Tramway and Vehicle Workers. The advances granted by the award represent about £20,000 a year.

Southport.—PRICE INCREASE.—The Finance Committee of the T.C. recommends an increase of 5 per cent. in the charge for electricity.

Stoke-on-Trent.—PRICE INCREASE.—At the last meeting of the B.C. a recommendation of the Electricity Committee was approved in favour of a further advance of $6\frac{3}{4}$ per cent., making 40 per cent. in all, upon all supply and other charges payable to the Electricity Supply Department, to be charged upon the gross total of each account from and after the next meter readings in December. Ald. Leese, the chairman, pointed out that the increased price would just save the Committee from a loss if there were no further increase next year in the cost of production. They were now paying £11,000 a year more for coal and £3,000 in war bonuses to workmen.

Sunderland.—The Electricity Committee has refused a request of the County of Durham E.P. Distribution Co. for consent to the latter supplying energy to the Egis shipyard at Pallion (in the Corporation area of supply). The Committee decided not to entertain a proposal for interchange of energy between the Corporation and Newcastle-upon-Tyne Electric Supply Co. It was further announced, in view of statements to the contrary, that the Corporation undertaking was satisfactorily meeting all demands, and was prepared to negotiate for the supply of additional energy if required.

West Ham.—PRICE INCREASE.—The Electricity Committee recommends the following prices for electricity:—Lighting, 6d. per unit; factory, 3d.; maximum demand rate cancelled. Household tariff, £10 and 1d. per unit. Power and heat, 1 $\frac{3}{4}$ d. per unit. Heating (domestic), 10s. to 6s. 8d. and 1d. per unit. Arc lamps, 3 $\frac{1}{2}$ d.—3d. per unit. Discounts over £15, 2 $\frac{1}{2}$ per cent.; over £45, 5 per cent. Minimum charge for service, £1 per annum, or special charge if necessary.

TRAMWAY AND RAILWAY NOTES.

Accrington.—Pending a final settlement on the matter, it has been decided by the Electricity and Tramways Committee to charge the Haslingden Corporation 5d. per car-mile during the present year for the tramway service provided to the latter authority.

Grimsby.—Steps are being taken to improve the tramway service, the tramway manager having attended a meeting of the Committee, and made certain proposals with this end in view. The Committee has also considered the expiration of the Council's agreement with the company in 1921, and a Sub-Committee was to be appointed to deal with this matter.

Halifax.—RAILLESS TRACTION.—The Tramways Committee proposes to purchase two railless cars from the Dundee Corporation, at a cost of £625 each.

The Tramways Committee has agreed to the request of the Amalgamated Association of Tramway and Vehicle Workers that Christmas Day be an entire holiday for the whole staff.

Hull.—A report on the question of repairs and renewals of the electrical power plant, presented to the Tramways Committee, states that unless considerable risk is incurred by the Committee, the provision of additional power should not be long delayed. A spare armature ought to be purchased at a cost of £1,310, but sanction had been refused. The provision of a third generating set, which was a preferable course, would involve an expenditure of between £10,000 and £15,000. The report is to be fully considered at a special meeting of the Tramways Committee, when also the question of obtaining power from the electricity department will be debated.

Keighley.—INCREASED FARES.—The Tramways Committee recommends an increase in fares on trolley vehicles, to take effect from December 8th.

Lancashire.—CHRISTMAS DAY SERVICES.—The Rochdale Corporation tramway employes have decided to refuse to work on Christmas Day; their application for a holiday on that day had

been previously declined by the Tramways Committee. The men's decision is subject to confirmation by the Lancashire District Council of their Association. The men were informed at their meeting that a score of undertakings were closing down for a day's holiday this Christmas. Colne T.C. has declined to grant the request for a holiday, as also have Bolton and Burnley. In the last-named town the Christmas Day passengers during the past five years have averaged about 50,000.

The Oldham T.C. has decided to suspend its service on Christmas Day; the Salford tramway employes have decided by vote not to work on that day.

Newcastle-upon-Tyne.—The Corporation Tramways Committee has agreed to grant the men's request, and close the service down on Christmas Day.

Wigan.—Owing to the recent flooding of the River Douglas, the Wallgate depot was inundated, and the services of the fire brigade were requisitioned to pump out the water.

TELEGRAPH AND TELEPHONE NOTES.

France and the United States.—A wireless station is to be erected shortly by the Government on the west coast of France, to carry on continuous communication by day and night with the United States. It will emit continuous waves of at least 15,000 m. wave-length, and will be guaranteed to transmit 10,000 useful words per day on any day in the year. It will also be able to transmit and receive continuously at the minimum speed 4,000 words an hour, transmission and reception being carried on simultaneously and independently.—*Annales des Postes, Télégraphes, et Téléphones.*

South America.—The Central and South American Telegraph Co. has received a message from its agent at Rio de Janeiro, to the effect that the Brazilian Government has finally signed the contract for the extension of its all-American cables *via* Colon to Brazil, by cable from Buenos Ayres to Santos, and another cable from Buenos Ayres to Rio de Janeiro. These extensions will be carried out as soon as war conditions will permit.—*T. and T. Age.*

Telephonic Relays.—In *Annales des Postes, Télégraphes et Téléphones* an account is given of recent tests of telephonic relays between Paris and Marseilles, over a circuit of 3·5-mm. copper wire. The apparatus—a vacuum amplifier—was installed in the office at Lyons, and its use brought up the speaking efficiency of the circuit to equality with that of the two other Paris-Marseilles circuits, which consist of 5-mm. copper wire. The copper in the former weighs about half as much as in each of the latter circuits, and the difference (150 tons), at £160 a ton, would be worth £24,000.—*Journal Télégraphique.*

Wireless Schools.—Two thousand wireless operators are needed by the Government, and the Marconi Co. is arranging with the Portsmouth Education Authority to open classes.—*Daily Chronicle.*

CONTRACTS OPEN AND CLOSED.

OPEN.

Argentina.—February 23rd, 1918. Rosario Municipality. Establishment of telephone service within the municipal radius. Conditions on application.

Bolton.—January 15th. Electricity Committee. One 7,500-kw. turbo-alternator with condensing plant. See "Official Notices" to-day.

Great and Little Usworth.—Work in connection with electric lamps belonging to the Parish Council. Mr. J. Elliott, clerk to the Council, Fern House, New Washington, Co. Durham

Manchester.—December 12th. Three fan draught cooling towers at the Stuart Street station, for the Electricity Committee. See "Official Notices," November 16th.

CLOSED.

Derby.—T.C. Coal elevator for the electricity works: P. Fletcher & Co., £880. Electric jib crane: E. Morley & Sons, £350. Electric omnibus and chassis: Edison Accumulators, Ltd., £1,923.

Faversham.—T.C. About 300 tons of coal for the electricity works: Francis Davis, 4s. per cwt.

London.—STEPNEY.—Electricity Committee. Accepted tenders: Messrs. E. Foster & Co., 2,000 tons West Cannock nutty slack, at 22s. 10d. a ton; 3,000 tons 1st stock D.S. nuts, 23s. 2d. a ton; 5,200 tons Walsall Wood Beans, 21s. 1d. a ton; 3,000 tons Hawkin's Cannock nutty slack, at 23s. 4d. a ton.

Salford.—The E.C. recommends the acceptance of the tender of Messrs. W. T. Glover & Co., Ltd., for paper-insulated lead-covered cable, required in connection with the supply of electricity to the premises of Messrs. P. R. Jackson & Co., Ltd., in Hampson Street, Salford, for £570.

Sutton.—U.D.C. Ten-line intercommunication telephone instruments: Messrs. Stuart & Moore, Ltd., £67.

Weymouth.—The T.C. has agreed to sell to Messrs. Banks, Warner & Co., a 150-kw. Diesel engine, at the electricity works, for £1,300, and to purchase from Loughborough a 350-kw. steam set for £956. This is on account of the prohibitive price of fuel oil.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, December 7th. At 8 p.m. At 39, Victoria Street, S.W. Paper on "Maintenance of Engineering Plant," by Mr. J. G. Moon.

Chief Technical Assistants' Association.—Saturday, December 8th. At 3 o'clock. At the Tavistock Hotel. Paper on "Motor Converters & Motor Generators," by Mr. Baron.

North of England Institute of Mining and Mechanical Engineers.—Saturday, December 8th. At 2 o'clock. At the Wood Memorial Hall, Newcastle-on-Tyne. General meeting.

Birmingham and District Electric Club.—Saturday, December 8th. At 7 p.m. At the Swan Hotel, New Street. Annual meeting.

Association of Engineering and Shipbuilding Draughtsmen (London Branch).—First Bohemian Concert. Saturday, December 8th. At 7 p.m. At the Caledonian Salon, Holborn Restaurant.

Royal Society of Arts. John Street, Adelphi, W.C. Monday, December 10th. At 4.30 p.m. Cantor Lecture, "Progress in the Metallurgy of Copper." (Lecture II) by Prof. H. C. H. Carpenter, F.R.S.

Wednesday, December 12th. At 4.30 p.m. Paper on "Technical Training for Disabled Soldiers and Sailors," by Lord Charnwood.

Thursday, December 14th. At 4.15 p.m. Paper on "The Trade of India with Russia, France and Italy," by Mr. D. T. Chadwick.

Association of Supervising Electricians.—Tuesday, December 11th. At 7.15 p.m. At St. Bride's Institute, E.C. Paper on "Some Notes on Transformers," by Mr. A. J. Cridge.

Faraday Society.—Wednesday, December 12th. At Burlington House, Piccadilly, W. At 7.50 p.m. Annual general meeting.

Association of Engineers-in-Charge.—Wednesday, December 12th. At 8 p.m. At St. Bride's Institute, E.C. Paper on "Some Phases of Modern Industrialism," by Mr. A. W. Wyatt.

Institution of Electrical Engineers.—Thursday, December 13th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Discussion on "The Metric System," with introductory papers by Mr. L. B. Atkinson and Mr. A. J. Stahls.

(Manchester Local Section).—Tuesday, December 11th. At 7 p.m. At the Engineers' Club. Paper on "Electrical Cooking as applied to Large Kitchens," by Mr. W. A. Gillott.

(Scottish Local Section).—Tuesday, December 11th. At 7.30 p.m. At 207, Bath Street, Glasgow. Paper on "Gas Firing Boilers," by Mr. T. M. Hunter.

(Students Section).—Tuesday, December 11th. At King's College, Strand, W.C. At 7 p.m. Discussion on "Recent Applications of Electricity."

Institution of Mechanical Engineers.—Friday, December 14th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Paper on "The Use of Soap Films in Solving Torsion Problems," by Mr. A. A. Griffith and Mr. G. I. Taylor.

Electro-Harmonic Society.—Friday, December 14th. At 8 p.m. At the Holborn Restaurant (Venetian Chamber). Smoking Concert.

Greenock Electrical Society.—Saturday, December 15th. Visit to Glasgow Central Station.

Association of Mining Electrical Engineers (West of Scotland Branch).—Saturday, December 15th. At 3 p.m. Visit to Messrs. Mavor and Coulson's Works, Glasgow. Concert at Trades House Restaurant, 89, Glassford Street.

Society of Engineers.—Monday, December 17th. At 5 p.m. At the rooms of the Geological Society, Burlington House, Piccadilly, W. Lecture by Mr. Chalmers Kearney on "High-speed Railways after the War" (postponed from December 3rd).

NOTES.

The Filiform Crystal and its Use in the Glow Lamp.

Before a recent meeting of the German Illuminating Engineering Society, reported in the *E.T.Z.* of October 28th, 1917, F. Schröter gave some particulars of the process adopted by Julius Pintsch & Co., for producing a continuous tungsten crystal which is used in place of the ordinary drawn wire for glow lamps. As is well known to investigators, metals when worked mechanically undergo certain structural alterations, the crystal grains forming the structure being displaced in certain directions. The change is accelerated by the application of heat. The return to the stable condition, when the normal crystalline structure again predominates, is known as recrystallisation.

In the case of the glow lamp we have a typical example of the "fatigue" of a metal with high temperature. A drawn tungsten wire, which in the initial cold state has a structure made up of parallel fibres and therefore possesses great elasticity, shows, when submitted to a microscopical examination after burning at a temperature of 2,300° C., the reformation of the irregularly distributed individual crystals. At the temperature of the half-watt lamp, viz., 2,700° C., recrystallisation is visible after a few minutes. When recrystallisation is complete the most valuable properties (extensibility and flexibility) which the drawing process has imparted to the tungsten wire, disappear.

The object of the new Pintsch process is to obtain glow lamps which shall have anti-vibration filaments both in the cold and hot state. Filaments were first produced by the squirted (not drawn)

process, with the addition of about 2 per cent. of thorium oxide. In certain places on the filament the wires were much more flexible than pure tungsten wire; but at irregular intervals they were brittle even when errors of manufacture were avoided. The first deciding factor in the modified process was the fact that individual crystals occur red, these crystals going to make up the filament. The problem has been solved by taking a wire, containing thorium oxide, and obtained by the squirted process, and heating as short a length as possible at 2,400° C., quickly raising this temperature to 2,600° C., and moving the wire through the heating apparatus at a velocity somewhat lower than the velocity of propagation of the crystallisation process.

Fresh sections of the wire are continually being exposed to the high temperature region, and the process is continued until the entire length of the filament is overgrown by the crystal. This "forming" process is carried out in a hydrogen atmosphere owing to the tendency of tungsten to oxidise. The wire, as it leaves the forming apparatus, is incorporated into the lamp without further treatment.

The main feature of the process is that the structure of the tungsten filament is that of one continuous crystal instead of being composed of a number of single crystals unequally distributed.

Practical tests that have been made show the superiority of the filiform tungsten crystal for the purposes for which it is intended, owing to the stability of its structure at high temperature and its mechanical properties. Its tensile strength, viz., 164 kilogrammes per square millimetre, is higher than that of steel wire, although less than that of drawn tungsten wire. The crystal filament is so malleable that it can be wound round the smallest mandrel, and it maintains this property even after burning for an extended period. Owing to the small percentage of thorium oxide included, the radiant properties of the crystal filament are pretty much the same as those for pure tungsten wire.

A Substitute for the Leclanché Cell.—In a communication in the September—October number of the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Prof. Féry describes a new type of wet primary cell that he has elaborated. The Leclanché cell, depolarised by manganese dioxide (which used to be obtained from Germany) is the most common type at the present day. Prof. Féry conceived the idea of doing without manganese dioxide and depolarising the cell with the oxygen of the air. Hitherto attempts in this direction had not met with much success owing to the zinc electrode being vertical in position, giving rise to certain disadvantages, viz.:—

1. The zinc easily oxidised—absorbs oxygen as it dissolves, which is liberated on the surface of the liquid, so that the carbon immersed in the deoxidised liquid is polarised when the circuit is closed.

2. The surface action of the aerated liquid on the zinc tends to corrode the electrode where it is immersed in the liquid.

3. The oxy-salts of zinc thus formed in the mass have a tendency to cause "creeping" of the salts.

4. The crystals of oxychloride of zinc and ammonia due to this reaction, attack the zinc and the carbon and decrease the active surface of the electrodes.

5. This continuous action of the oxygen dissolved in the liquid on the zinc electrode causes a local attack which tends to increase out of all proportion to the theoretical consumption.

To overcome these defects, and use the air as the depolariser, the author has given the zinc electrode the form of a horizontal plate placed at the bottom of the cell. The carbon electrode is vertical, being separated from the zinc by a thin sheet of felt or an ebonite cross piece.

Local action in a cell of this type is practically eliminated, and the quantity of zinc dissolved is 1.24 grammes per ampere-hour. The voltage on open circuit is 1.18.

Certain continuous tests have been made on cells of this type and the results are given in a table accompanying the original paper.

In comparative tests carried out by one of the French railway companies on four of the new cells and four Leclanché cells, after eight months of continuous operation on a resistance of 700 ohms, the manganese (Leclanché type) cells had used up two zinc rods each weighing 150 gm., while the new cells had only used one zinc sheet weighing 120 gm. A cell of the new type capable of yielding 90 ampere-hours weighs only 21 kg. (about 46 lb.). It is possible to obtain this output of 90 ampere-hours with 100 gm. of sal-ammoniac, the concentration of the solution being 12 per cent.

A brief account of this cell, with a drawing, was given in our issue of August 10th, 1917, p. 129.

German Economy in Lubrication.—It is now some time since a German committee appointed to consider the matter issued a report making numerous recommendations with a view to eliminating waste in lubrication. In recognition of the fact that it is seldom possible to get individual workpeople to add to their other duties, a live interest in and effective application of the principles of economy in lubrication, a number of German works now make one person definitely responsible for the sufficient yet economical lubrication of a certain number of machines. It is this person's duty to lubricate the machines once or more in each 21 hours as may be necessary; and he or she is trained to use as little oil as effectively as possible. The "lubricator" has also to collect oily waste and oil collected in drip pans, &c. Each machine operator is given a small emergency supply of oil and is held strictly accountable for this. It is said that these measures resulted in 40 per cent. reduction in the oil consumption of a certain works where it was thought that the consumption had already been reduced to a minimum.

National Service for Small Engineering Works.—A Conference, convened by the Aeronautical Institute, of smaller engineering firms not fully engaged on war work, and capable of undertaking work in connection with aircraft production, took place on November 29th, with Mr. A. J. Liversedge in the chair. The Conference was attended by several hundred representatives from all over the country. The Institute proposes to help the small manufacturer by instituting one or more centres where samples of any parts can be seen in different stages of manufacture; by providing newcomers with full information and technical assistance concerning the making of any parts they may undertake to do; and by putting at their disposal jigs, &c., that have in practice proved successful and accurate. The small manufacturer can produce parts at a low cost only if he be given standing repetition work for two or three parts suitable to his plant and labour; and this repetition work can be obtained only if all the smaller firms interested act together as one big concern, and each individual firm produces in quantities its quota; therefore, one or more centres should be established at which the Government could deliver in bulk, for re-distribution among the members of the proposed body by a Committee of the body itself, and one or more centres should be established to which all finished articles would be sent for inspection in bulk by Government inspectors. A resolution was carried approving of the proposals of the Institute, and appointing a Committee to carry them into effect.

Volunteer Notes.—COUNTY OF LONDON VOLUNTEER ENGINEERS (FIELD COMPANIES).—Headquarters, Balderton Street, Oxford Street, W. 1.

Orders for the week, by Lieut.-Colonel C.B. Clay, V.D., commanding:—
Officer for the Week.—Second Lieut. P. Bowden.
Drills.—Week ending Sunday, December 16th, 1917:—
 Monday.—No. 3 Company, Left Half. Recruits, signalling, 6.30.
 Tuesday.—Physical drill and bayonet training, 7.30.
 Wednesday.—No. 1 Company, 6.30.
 Thursday.—No. 2 Company, 6; signalling, ambulance, 6.30.
 Friday.—No. 3 Company, Right Half. Recruits, 6.30.
 Sunday.—Commandant's parade for instruction in camp arrangements at Esher. Parade, Waterloo Station, opposite No. 10 Platform, 8.30 a.m. Uniform.
Musketry.—Belvedere Road, Tuesday, Wednesday, and Thursday, 6 to 8.
Note.—The Medical Officer will attend for examination of recruits, &c., on Thursday, at 6.30.

(By order) MACLEOD YEARSLEY, Capt. and Adjutant.

Municipal Tramways Association and B. of T. Tramways Committee.—Several municipalities, both north and south of the Tweed, are very much concerned in regard to the powers of the new National Tramways Committee, which has been appointed by the Board of Trade to consider the needs of the various municipal and company tramway undertakings throughout the country, and, if necessary, to close down the less essential concerns. At the meeting of the Executive Council of the Municipal Tramways Association, which was called to consider the question, Mr. Dalrymple, of Glasgow, moved the following amendment, which was seconded by Alderman Flint, of Leicester, who is president of the Association:—"That this Council take no further action on the letter received from the Board of Trade on the question of the expert Committee in respect of materials and labour on tramways, but that the whole question of policy and personnel be referred to a general meeting of the Association to be called forthwith." The motion to proceed with the appointment of the representatives on the National Committee was, however, carried. Steps are being taken to put before the President of the Board of Trade the desirability of having a member on the Committee who will represent the tramway undertakings in Scotland.

The British Fire Prevention Committee.—The British Fire Prevention Committee was formed in 1897, and has now completed the twentieth year of its activities. The Committee's testing station, where the experiments and tests are carried out, and which is such an important part of its work is at North Bank Lodge, Regent's Park. The offices of the Committee are at No. 8, Waterloo Place. Generally speaking, the Committee's work has comprised extensive research work, including many tests; the initiation of questions of legislation, bye-laws, regulations, &c., with the necessary presentation of data and "evidence," and the issue of extensive literature on the subject of fire prevention and extinction, known as the Committee's "Red Books" and "Journals"; the preparation of a number of notices and circulars of a precautionary character, the collection and exchange of technical information and its dissemination from the Committee's inquiry office; the organisation of conferences and technical exhibitions, and, finally, a general propaganda through the Press and elsewhere in the interests of fire prevention.

The most competent authorities in the United States, France, and Russia have been liberal in their praise, whilst authorities in enemy countries, in pre-war days, adopted the Committee's data, and the conclusions drawn from its investigations. In the pre-war period, although the Committee's research work was carried on voluntarily and with limited funds, it was far superior to anything that obtained in Germany or Austria regardless of State aid.

It has not been the ambition of the Committee to court public notice; it has taken as its model the policy of some of the best-managed Government Departments, which is to work unostentatiously for the benefit of the public generally. It has found that by quiet and steady work useful results are more effectively obtained than by the clamour of public meetings and other ostentatious methods. The Government of the day has invariably supported the Committee's endeavours, and every Government Department has rendered the Committee such assistance to achieve its object in the public interest as was in its power.

The Committee has kept largely to facts, and avoided the expres-

sion of opinion on subjects of a controversial character, whilst the presentation of facts, as a rule, sufficed to show the reason for the Committee's endeavours.

Lastly, the work within the Committee has been of an harmonious character throughout, and this collaboration has led to the closest friendship between many individual workers. The organisation of the work allows for decentralisation and the allotment of tasks to those specifically conversant with the technical issues involved, and the amount of sustained technical effort and care given by the Committee's workers engaged upon individual problems has been remarkable; in fact, the Committee's reputation for thoroughness and exactitude has been largely based on their generous and painstaking work and voluntary service.

The past 20 years of the Committee's work have demonstrated that, regardless of the opposition of vested and other interests, considerable progress has been achieved, and that the results have been valuable to the citizen and to the State, both from the humanitarian and the economic point of view. We congratulate the Committee on its admirable record of public service, and trust that in the more enlightened future that, we hope, lies before us, its efforts will be still more fully appreciated and effectively aided by the people of this country and their Government.

Graphite in Madagascar.—In an article by Mr. John W. Shelley, of the Madagascar Service des Mines, which appeared in the *Mining Magazine*, some interesting particulars relating to the growing graphite industry in Madagascar were given. The deposits extend for a distance of 400 miles, and so far only the outcrops have been worked. The bulk of the graphite is in the form of thin flakes from $\frac{1}{4}$ in. diameter down to fine dust, the amorphous variety being rare: as dug out the ore contains 60 per cent. graphite, but only a third of this is recovered by present methods of dressing. Of this 60 per cent., containing 90-96 per cent. carbon, is suitable for crucibles and furnace linings, while the remainder (fine dust) is used for other purposes. Some deposits contain a large mixture of mica and iron, and await the development of a satisfactory separation process. The deposits are worked by native labour employing their own crude methods of hand washing, &c., and Mr. Shelley suggests that the staff, that is at present producing 25 tons of marketable graphite could with labour-saving devices secure 250 tons. The working cost at the mine averages £9 a ton, and with inland transport, shipping, taxes, &c., added, the total cost amounts to £17-£19 per ton c.i.f. London, under normal conditions.

In 1913 about 120,000 tons of graphite of all kinds represented the world's production. Ceylon produced 40,000 tons and Madagascar 8,000 tons, though the 1915 production of the latter was estimated at 12,000 tons. The graphite exports of Madagascar have risen to the latter figure from 19 tons in 1909. The production is exported to Europe, and used: 60 per cent. for crucible retorts, 15 per cent. for furnace and converter linings, 10 per cent. for paint, 10 per cent. for lubricant, and 5 per cent. for foundry moulding.

Mr. Shelley draws attention to the great possibilities awaiting the development of the graphite industry in Madagascar.

War Taxation on Electrical Energy in Russia.—The Minister of Trade and Industry has drawn up his conclusions on the proposed tax on electrical energy, and states that the project of the Ministry of Finance which has not been hitherto given effect to, comes into prominence again owing to the necessity of seeking new sources of revenue for the Government.

In the opinion of the Minister quoted there ought to be a distinction between the assessment of electrical energy used for lighting and heating, and of that for motive power. That the tax on lighting current should fall entirely on the one obtaining the corresponding advantages is, in his opinion, perfectly fair; but it is quite different with the electric current used for motive power. The encouragement to change over from the more ancient to the more modern methods of production and consumption of motive power is one of the first calls on the economic policy of the Government. The assessment of electrical energy used for as motive power is now quite inadmissible, and can only be applied on condition of the assessment of all kinds of power current generally. In conformity with these considerations the Board of Electrico-Technical Business has prepared a new project of taxation for electrical energy. All electrical current used for lighting and also used for other purposes, if obtained from lighting current mains, unless measured by special meter, is subject to taxation. Electric current used for lighting entertainment establishments, cinematographs, cafés, restaurants, clubs, and all kinds of illuminated advertisements, are to be separated into a special category and subjected to a maximum tariff. Electrical current used for Government establishments, Treasury premises, and concerns for lighting the rolling stock of private railways, and private marine and river ships will not be subject to taxation. The object of the new project is first of all to tax the consumption of electrical energy and not its production. Therefore the tax is to be paid to the Treasury by the owners of electric stations on account of the consumers. The owners of stations in settling their accounts with their subscribers may include the amount of the tax falling on them according to the quantity of useful energy delivered, whilst compensation is permitted also in cases where the payment taken for current along with the amount calculated for the tax, exceeds the selling rate fixed for electrical energy by the local town or county Governments. As the tax on electrical energy is a temporary measure, it will be suppressed when the present serious financial crisis is past. The tax may be at so much per cent. on the selling price of current, or per arc or incandescent lamp.

Institution and Lecture Notes.—Institution of Civil Engineers.—A paper was read, on December 4th, on "Recent Developments in By-Product Coking," by Mr. G. B. Walker. The author described the principal features of half a dozen of the most successful types of oven in use in this country and the recovery plants associated with them, and compared the relative value of the surplus gases used in producing steam (utilised through turbines) and in internal-combustion engines, to the advantage of the latter.

Association of Mining Electrical Engineers.—In the course of his presidential address to the East of Scotland Branch of the Association, Mr. Richard Kirkby, general mining manager of the Wemyss Collieries, stated that the total h.p. of electric plant in use in the coal mines of Great Britain in the year 1913 was 628,097. In 1914 the total h.p. had increased to 713,782, a gain of fully 13½ per cent. Owing to the war the figures for 1915-16 had not been published. In 1914 hauling used 28½ per cent. of the total plant h.p. of electricity, pumping 27 per cent., and coal-cutting 5½ per cent. He did not favour driving every machine in or about a mine by electricity; there was no doubt that thousands of horses and ponies could be replaced by small electrically-driven rope haulages, and the field for electrically-driven coal cutters was still open for competition by makers who had done very well during the last few years in the way of improving their machines.

Diesel Engine Users' Association.—At the November meeting of the Association, the President (Mr. Geoffrey Porter) reported that the Standing Committee on Insurance Against Breakdown were drafting by-laws to regulate its procedure and to deal with differences that might arise between the underwriters and policyholders in the interpretation of the Standard Policy, &c. The recent order of the Ministry of Munitions regulating supplies of tar oil for use as fuel in Diesel engines was considered and discussed. Comment was made on the condition in the schedule that acceptance of the producers' weights and measurements in selling tar oil should be compulsory on the purchaser. It was reported that the Controller of the Mineral Oil Production Department of the Ministry of Munitions was arranging for trials of mixtures of pitch and creosote to be carried out, with a view to their adoption for use as fuel for Diesel engines. The hope was expressed by the meeting that actual users of Diesel engines under normal working conditions would be given an opportunity of thoroughly testing any such fuel and reporting thereon, before any final decision was arrived at by the Controller as to its suitability. Mr. George W. F. Horner read some notes on "The Lubrication of Air Compressors." A communication from Mr. J. Veitch Wilson on the subject of "Lubrication of Air Compressors and Diesel Engines" was also read. An interesting discussion followed, and will be reported at a later date.

Institute of Marine Engineers (Inc.).—In the course of a paper on "Aids to Prevent a Ship from Sinking," read on November 13th, Mr. C. V. A. Eley advocated the provision of ample pumping capacity to clear out the water as fast as it entered a damaged compartment. This could be effected by providing sufficiently large suction pipes from the bilge to the centrifugal circulating pumps, and by fitting the electric lighting engines with centrifugal pumps. In his own system, he used direct pumping plant with central means of indicating the position and extent of the damage and of controlling the pumps. The discussion was adjourned to December 11th.

Chadwick Public Lectures, Leicester.—The third of the Chadwick Lectures on "Electricity and National Welfare" was given at the Museum, Leicester, by Prof. H. T. Davidge, on Saturday, December 1st, the special subject dealt with being "Electricity and the Hygiene of the Body." The lecturer stated that we were much in the dark as to the action of electricity upon the body, but certain purely physical and chemical results caused by the passage of a current through living beings were well established. He then dealt with electric shock, the use of X-rays for examination and curative treatment, the principles and uses of ionic medication, the brush discharge, and electric baths, and applications of electricity and magnetism to the removal of foreign bodies from wounds, and finally an elementary treatment of the properties and uses of radium for medical purposes was given.

Royal Society.—At the meeting, on Friday last, Sir Joseph J. Thomson was elected president. The treasurer and other officers were elected in accordance with the list published in our issue of November 9th.

President Wilson's Speech.—In the course of his speech delivered to the U.S. Congress, on Tuesday, President Wilson, in referring to necessary new legislative and other war measures, said:—"It is imperatively necessary that the consideration of the full use of the water power of the country, and also the consideration of the systematic, and yet economical, development of such of the natural resources of the country as are still under the control of the Federal Government, should be immediately resumed, and affirmatively and constructively dealt with at the earliest possible moment. The present need of such legislation is daily becoming more obvious. The legislation proposed at the last session with regard to regulated combinations among our exporters, in order to provide for our foreign trade a more effective organisation and method of co-operation, ought by all means to be completed at this session."

Mine Electricians' Exemptions.—Under arrangement with the Miners' Federations, all certificates of exemption issued on grounds of employment to electricians of military age employed at coal mines who entered the coal mining industry after August 14th, 1911, and were of military age at that date, have been withdrawn.

"Natural Steam" Electric Generating Plant in Italy.—In the volcanic areas of the Province of Tuscany (Italy) there are numerous hot springs from which immense columns of steam issue. In the current (September) number of *La Science et la Vie*, the electrical engineer of the company (Società Boraefera di Lardarello) which has been formed with a view to the practical utilisation of this natural steam, discusses the methods adopted for this purpose. Boreholes are made at suitably selected places in order to collect the steam, and are lined with cast-iron. The steam cannot be used direct for power raising owing to the presence of incondensable gases. Use is made of a series of evaporators, consisting of nests of tubes in a special vessel. The subterranean steam is led into this vessel, and heats the water contained in the tubes. The pressure of the natural steam is about 40 lb./sq. in., and of the steam in the tubes about 30 lb. The steam turbine, constructed for a pressure of about 24 lb./sq. in., runs at 3,000 R.P.M.; it is coupled to a three-phase, 250-kw. alternator, working at 50 cycles and 4,000 volts. The current is stepped up to 16,000 volts, and is fed to an aluminium transmission line feeding an area of about 25 miles. It supplies energy to the town of Volterra and to various factories in the vicinity. For factory purposes the pressure is stepped down to 220 volts. This plant started working in 1913, and is giving entire satisfaction.

This first installation led the promoter to consider the construction of a higher-powered plant, which was brought into use in 1916. The war naturally caused difficulties in obtaining delivery of the necessary plant, which increases to 7,500 kw. the capacity of the new station. A French firm was given the task of designing the evaporators for producing the pure steam for working the turbines. They may best be compared to a multi-tubular boiler, in which the flame surrounds the tubes. The new station comprises 16 evaporators, to be soon supplemented by six others, each capable of generating 6,000 kg. (13,500 lb.) of pure steam per hour, at an effective pressure of about 8 lb./sq. in. The natural steam arrives at a pressure of 14.7 lb./sq. in., and condenses in the chamber surrounding the tubes. It is impossible to eliminate the sulphur dioxide mixed with the steam from the "soffioni" (as the natural steam jets are called), so that the tubes in the boiler have had to be made of aluminium to prevent incrustation.

Finally the pure steam produced in the evaporators is led into the turbines after having been superheated by a further supply of natural steam.

Three turbo-generator groups have been installed, each of which has an effective output of 2,500 kw. The turbines are of the reaction type, and work at an effective pressure of 0.25 atm. (3.6 lb./sq. in.) at 3,000 R.P.M., and each consumes about 30,000 kg. (66,000 lb.) of steam per hour.

The turbine condensers are of the surface type. Pumps of 350 h.p. for each machine circulate the water for cooling the condenser tubes: they deliver 1,200 cb. metres (42,378 cb. ft.) per hour.

The turbines are coupled to three-phase, 3,000-kw., alternators, supplying current at 4,000 volts, 50 cycles. The pressure is raised to 36,000 volts for distribution.

The transformer house contains four three-phase transformers, each of 2,850 k.v.a., and two others of 4,000 k.v.a. will shortly be installed. The pressure can easily be stepped up to 40,000 volts.

The company mentioned above owns other "soffioni" (hot springs), which contain a less proportion of corrosive gases, and experiments will be made with a view to utilising the natural steam direct, thus obtaining greater efficiency.

Trade Matters Before Parliament.—In the House of Commons, on Monday, Sir Albert Stanley, President of the Board of Trade, moved the second reading of the Non-Ferrous Metal Industry Bill. The rejection of the Bill was moved and seconded. In reply to discussion, Dr. Addison showed that the Bill involved questions of national safety and the increased development of essential raw materials. He showed how for 18 months the Ministry of Munitions were trying to escape from the toils of the German monopoly. Without such powers as the Bill would give it would be practically impossible to form any competing organisation. The discussion stood adjourned.

The Import and Export Control Bill, which proposes the exercise of its powers for three years after the war, is understood to be meeting with strong objections from commercial interests in the House, and the Government may reduce the period to one year.

The *Daily Chronicle* Parliamentary Correspondent states that the final report of Lord Balfour of Burleigh's Committee on Trade Policy will be published in the course of a few days. It is understood that its principal recommendation will be the imposition of a general tariff on all imports, with the exception of food commodities. "The import duty proposed is 10 per cent. *ad val.*" This would be reduced by negotiation to those countries who gave British goods reciprocal treatment. Presumably imports from the Dominions and India would be admitted free."

Holt v. A.E.G. Electric Co., Ltd.—On Tuesday, in the Chancery Division, Mr. Arthur Holt, formerly London manager of the A.E.G. Electric Co., Ltd., claimed for a liquidated sum representing salary up to the end of November 30th, 1918, the date when he calculated the war would end. Plaintiff, who is with the Forces at the Front, claimed damages by reason of the fact that the contract for his services had been determined since the company had been ordered to be wound up by the Board of Trade. It was stated for the Board of Trade that they thought that directions should be given to the Controller to make a payment in settlement of the claim, but a decision was asked for on the point as to whether the action would lie against the company. Mr. Justice Younger said he would give a written judgment.

The I.M.E.A. and Station Engineers.—A circular letter has been sent out by the hon. secretary, Incorporated Municipal Electrical Association, drawing attention to (a) the position of electrical undertakers as regards the difficulty of retaining the services of their technical assistants; (b) the tendency in the past to underpay engineering assistants; and (c) recommending, as a first step, that the bonus awarded by the Committee on Production should be paid (where this has not already been paid) to all members of the staff, and suggesting that the general question of remuneration of the technical staff should receive the earliest possible attention.

Gas Traction Committee.—It is officially announced that the Government has appointed a Committee to consider and report on matters arising from the substitution of gas for petrol, &c., as a source of power, especially in motor vehicles. We note that Mr. Shrapnell Smith, who occupies the position, amongst others, of vice-chairman of the Electric Vehicle Committee of Great Britain, is to act as secretary for the time being.

P.O. Tube Railway.—The Board of Trade has extended by one year the time for the completion of the P.O. (London) Railway authorised by the Act of 1913.

Meter Accuracy on Arc Furnace Loads.—In electric arc furnaces used in making high-grade steel, the current wave shape is at times greatly distorted. A member of the Committee on Meters of the Technical and Hydro-Electric Section of the National Electric Light Association reports that the accuracy of an induction meter on this service was questioned because the magnetic and electrical characteristics of iron vary somewhat with the shape of the current wave. On account of the rapidly fluctuating load, indicating instruments could not be used; dynamometer type watt-hour meters without any iron in their magnetic circuits were specially compensated for inductive loads and used as standards, and the readings of the induction type watt-hour meter compared therewith. The meters were installed on the secondaries of current and voltage transformers. A large number of tests were taken under various conditions of furnace operation, and the dynamometer and induction type meters agreed to within 1 per cent. The instrument transformers were tested by the Electrical Testing Laboratories under artificially distorted wave forms, and were found to be accurate. The laboratory wave forms were not quite as irregular as the actual furnace current waves, but were severely distorted, and as they produced no appreciable effect on the transformer accuracy it was assumed that the effect of the slightly greater irregularity in the furnace wave would be negligible. It was concluded that under the conditions existing in this installation the accuracy of registration of the customer's meter was well within commercial limits, and was not seriously affected by the irregular wave form.

It is important to note that in the furnace electrode circuits considerable direct current was present, due probably to rectification in the arc, and consequently the current wave shape was unsymmetrical with respect to the zero line. The general shape of the wave was such as would be produced by superposing direct current on alternating current, and it was found that current transformers had large errors on this type of wave. If, therefore, the customer's meter had been placed in the secondary circuit of the supply transformers, instead of in the primary, serious errors in registration would probably have resulted. Pending further investigation, it is therefore recommended by this Committee that if arc furnace loads are metered on the secondary side of the supply transformers, the accuracy of the metering should be investigated. If metered on the primary side of the supply transformers errors will be avoided, as the direct current in the electrode circuits cannot reappear on the primary side, hence the primary current wave is symmetrical with respect to the zero line. Summing up the results, it appears that no serious error is produced by an irregular current wave form; but if the wave is unsymmetrical with respect to the zero line, considerable error may occur.—*Metallurgical and Chemical Engineering.*

Russian Electricity Supply.—RIGHT TO VARY AGREEMENTS.—The dearness of materials and labour, says a semi-official journal, has made it necessary to increase the price of finished products in Russia, even in cases under Government control. This applies particularly to electrical concerns that are bound by concession agreements with the towns. The normal solution of this would appear to lie in a review of the concession agreements. Experience, however, has shown that agreements cannot always be arrived at between towns and concessionaires, and in the cases of losing concerns such have been looked upon as in a condition facilitating the earliest possible transfer of such concerns to the control of the towns on an advantageous basis to the latter. On the other hand, the contractors have not always shown an inclination to review their agreements on the basis of safeguarding the interests of the towns. The fear of a disaster to the electrical industry, which threatened to leave the towns and industry without electric light and power, prompted the Ministry of Trade and Industry to inquire into the matter and to seek means for the protection of the electrical industry. The Ministry of Trade and Industry found a ready support in the Ministry of Foreign Affairs, which, being interested in the fate of foreign capital, particularly Belgian, invested in the electrical industry, brought the question to the notice of the Provisional Government. As the result of a conference a project was prepared for varying the agreements as to the delivery of current by the public electricity stations. This project embraces the following conditions:—

All stations for public use are permitted to raise the tariffs for

energy inscribed in the concession agreements, as well as tariffs according to separate agreements within the limits of the maximum fixed by decree. An explanatory notification of the increase is to be delivered to the respective towns; but if an agreement is not reached in a month the new tariff announced is to come automatically into force from the date of the delivery of the declaration; whilst the town will only have the right until the expiration of six weeks from the date of the delivery of the notification to oppose such increase at the Ministry of Trade and Industry, which, after deliberation, will decide the question finally.

If the increase in the tariffs should raise the net profits over 9 per cent., the surplus is to be divided between the Government (90 per cent.) and the town (10 per cent.), whilst the superintendence rests with the Ministry of Finance, which may inspect and revise the books and business methods of the interested concerns. The decree is to remain in force until December 31st 1918.

The project referred to will no doubt decide the question in a radical form. If it comes into existence the electrical industry will be completely freed from the possibility of any efforts of the towns to influence their activity in any way. This would be attained at too high a price; namely, by the complete destruction of the rights and contempt of the interests of the towns. Such a solution goes far further than the object immediately aimed at by the decree.

An Institution of Electrical Station Engineers.—On Wednesday evening a meeting was held at St. Bride's Institute to discuss the reconstitution of the A.E.S.E. on the new basis formulated at the Hammersmith meeting. Mr. H. W. Healy, president of the London Committee of the A.E.S.E. and hon. secretary of the Provisional Committee, occupied the chair, and opened the proceedings with an explanatory statement regarding the purpose of the reconstitution and the object of holding the meeting.

Mr. W. A. Jones, hon. secretary of the A.E.S.E., then read a report on progress to date, and Mr. G. C. Law, of Barnes, delivered an admirable address on the functions of the electricity supply engineer, the ideals at which he should aim, and the status to which he was justly entitled. The chairman then threw the matter open for discussion, and answered a number of questions which were put to him by members of the audience. There was a very large attendance, numbering perhaps 120, and some useful suggestions were put forward. Much interest was shown in the question of qualifications for membership, and it was urged that the Association should secure the support of the senior men before enrolling the juniors, instead of adopting the reverse procedure, as at present.

The Electro-Harmonic Society.—The next smoking concert will be held at the Holborn Restaurant, in the Venetian Chamber, on Friday, December 14th, commencing at 8 p.m. Mr. H. Scholey will preside. Artists: Mr. Philip Ritte, tenor; Mr. George Baker, baritone; Mr. Oily Oakley, banjo soloist; Mr. Arthur Melrose, comedian; Mr. Reginald Wishart, illusionist; Mr. Warwick Pryce, musical sketches at the piano; Mr. Bernard Flanders, A.R.A.M., solo pianoforte and accompanist.

Wages in Metropolitan Electricity Works.—The Marylebone Electricity Committee, reporting to the Council with regard to the recent conference of electrical supply companies and corporations, called to discuss the various awards which have been made from time to time by the Ministry of Labour, and which related to electricity supply employees, after quoting the resolution passed at the Conference (printed on page 521 of our last issue), states that the resolution has not yet become operative, and that the question has been referred to Sir George Askwith, with the view that he should issue an award on such lines in order that employees at all electrical power stations should be treated in a similar manner. A further meeting of the Conference is to be held.

Appointments Vacant.—Chief assistant electrical engineer, for Birmingham Corporation (£750); junior shift engineer for the Borough of Barnsley Electricity Department. See our advertisement pages to day.

Educational.—BIRMINGHAM.—Owing to the great increase in numbers of students in the Electrical Engineering Department of the Birmingham Technical School, and particularly in connection with the wireless telegraphy classes, the City Council has obtained additional temporary school accommodation at Ludgate Hill.

LEEDS.—The Secretary for Education in Leeds invites applications for the position of teachers of electricity, electrical engineering, and electric wiring work in connection with the Leeds Technical School. Applications to the Principal of the Technical School, Cookridge Street, Leeds.

Woman Electrician Wanted.—A woman electrician is urgently wanted to take charge of the lighting installation in a country house, with dynamo and accumulators. A man operates the steam engine which drives the dynamo. A knowledge of wiring, &c., is required. Wages, 35s. to 37s. a week, with lodgings. We believe this is the first instance in which a female attendant has been inquired for.

Inquiry.—A correspondent seeks information regarding engines running on sewer gas; also apparatus or processes which could be worked in conjunction with a producer gas-engine electricity works generating direct current, such as plant for briquetting anthracite dust, converting clinker into paving slabs, electric welding, &c.

REVIEWS.

Spons' Electrical Pocket Book. By W. H. MOLESWORTH. London: E. & F. N. Spon, Ltd. Price 6s. net.

There are many pocket-books for engineers in existence, but up to the present we do not remember having seen one so useful for electrical engineers as the one now before us. To a large degree the test for such works lies in the numerous occasions for reference that are always cropping up, but before reference can be made, it is necessary for one carefully to peruse the pages of the book under consideration. This procedure would appear necessary for all technical works, but in the case of a "pocket-book," the reader's glance, if any, is usually most casual, so that the actual utility of such a book is then limited through the ignorance of its owner.

In "Spons'" much of the matter will be found to be of more than passing interest, for there are many pithy articles to be found within its pages. A comprehensive index certainly assists one's search, but at the same time individual study is recommended for those who purchase this volume or similar ones.

The book opens with tables of weights and measures, with full details for metric conversion, and other useful tables, too numerous to mention, follow. The Italian graphic symbols are worthy of study and adoption by those who believe in progress, and their inclusion should do much to assist in their international propagation. The careful explanation of terms and fundamental principles will assist the student, while the tables relating to the heating of wires, &c., will meet with the needs of even an expert. Resistances and conductors are fully dealt with and exhaustive data given. Contractors and wiremen are catered for, inasmuch as there is a great deal of information which should be of use to them. Board of Trade and Home Office Regulations are fully given, and later on other standard regulations and rules are reprinted, including those of the I.E.E. The collection of such items under one cover makes the book an extremely handy work of reference. Transmission is handled in a masterly manner, as also is testing. Magnetism and electromagnetism are set forth in an understandable way, so that even a beginner could appreciate the text and diagrams relative to electrical machinery, regarding which many valuable data are set out, the particular section finishing up with the British Standardisation Rules.

Details relative to alternating current next appear, theoretical and practical considerations relating to the principles involved being given, as in the previous sections. Applications of electricity to lifts, machine tools, and electric vehicles are next treated, much of practical use being given concerning accumulators; regarding electric furnaces and electro-chemistry the information appears to be somewhat meagre, but no doubt the next edition of the work will show changes in this respect. The pages devoted to illumination could be improved without much difficulty, since it would appear that matter has been added without due respect to terms previously quoted. The "trade" is also in evidence in this section.

Practically the whole of the remainder of the book is devoted to electric traction, and we are inclined to think that much contained therein might have been cut out with advantage, as the space represents about 30 per cent. of the whole. It is true that electric traction is likely to be of the utmost importance, but there are signs that other branches are developing at an even greater rate, and we should therefore like to see such a book as this rather more general than at present. To those connected with electric railways and tramways "Spons'" will appeal most, but at the same time it is a volume which may be appreciated and utilised by all whose work demands even the slightest knowledge of electricity.

The editor is to be congratulated upon the systematic manner in which it is arranged; the diagrams are very good, and errors are rare.

Hydro-Electric Power. By LAMAR LYNDON. Vol. II. Electrical Equipment and Transmission. London: Hill Publishing Co. Price 15s. net.

In this volume generators, transformers, and switchboards are discussed in considerable detail, and a great deal of information is given on the subject of transmission lines.

The operating speed of a water-wheel is determined within a limited range by the head of water and the power. The periodicity is also limited by the wheel speed, thus at the Keokuk plant 25 periods was chosen for the 10,000-h.p. units because the low head of water gave a very low speed, namely, 57.7 R.P.M.

On the other hand, for a moderate or high head fall a higher periodicity than 25 cycles per second is desirable, because the latter would cause the generators to have a small number of poles, and the rotor to be of small diameter and great length.

Maximum rating of generators is defined as the maximum continuous load which they will deliver with a temperature rise of 50 per cent., no allowance being made for overload capacity. It is stated that up to about 13,000 volts, generators may be directly connected to the line, and that the capacity

of a generator wound for that voltage will be 30 or 40 per cent. lower than if wound for 2,300 volts, because of the extra space taken up by insulation.

In discussing the methods of driving exciters, it is pointed out that if driven by a small auxiliary water-wheel, as the size is small, the wheel is usually inefficient. By driving the exciter with a synchronous motor, the motor may be used to improve power factor. If this is done it is necessary to have, at least one other exciter driven in another way, so as to start up the plant. In some cases storage batteries are installed for use in an emergency, in case of breakdown of one or more exciters.

Transformers.—When a transformer has water cooling coils the amount of water required is dependent on the losses of the transformer, and it is usual to allow $\frac{1}{2}$ gal. per minute per kw. loss. When a transformer is air-cooled it is usual to allow about 150 cu. ft. of air per minute per kw. loss. One kw. will raise the temperature of 1,630 cu. ft. of air at atmospheric pressure 1 deg. C. per minute.

Condenser type terminals of transformers are built up of alternate layers of insulation and of thin metal. The metal layers form equipotential surfaces which distribute the potential between the terminal and the ground in direct proportion to the insulation strength of the material used, provided, of course, that the thicknesses of layers of insulation and the lengths of the layers are correctly proportioned. Each layer of insulation, with its metal layers, acts as a condenser, and thus the completed terminal consists of a number of condensers in series distributing the potential in proportion to their relative capacities.

If single-phase transformers are used, it is possible to connect in circuit two such transformers instead of three; in case one breaks down, the two will carry 58 per cent. of the load (not 67 per cent.) with the same heating as before the breakdown. The two will not parallel successfully with a three-unit bank, because the regulation is worse, and the voltage drop on one of the phases is slightly greater than on the other two.

The delta star connection is widely used for raising generator voltage to line voltage, and it is usual to ground the neutral on the high-tension either directly or by a resistance. Since 1913 the tendency has been towards using outdoor-type transformers, as this practice is more rational than having transformers inside an expensive building.

In warm climates, where the temperature in the sun may reach 135 deg. C., the ability of the transformers to radiate heat is diminished. Therefore, for such situations a shed should be built to shield them from direct rays of the sun.

Switchboards.—The chapter on switchboards is good, and includes the specification of a 5,000-kw., 2,300 to 44,000-volt switchboard, also one for 46,000-k.v.a., 6,600 to 110,000 volts. It is stated that brass and copper pipes are being used in many installations for high-tension bus-bars and connections. Particulars are given of submerged iron-wire rheostats for testing purposes, and it is stated that three tanks, each 6 ft. by 4 ft. by 2 ft. deep, will effectually cool resistance coils absorbing 2,000 kw. at 6,600 volts. A rubber hose-pipe feeding a $\frac{1}{2}$ -in. stream of water into each tank will keep the water sufficiently cool.

Transmission.—On the question of aluminium *versus* copper for transmission lines, the author favours the first-named, the advantages being: (a) Aluminium costs less than copper; (b) for a given resistance or given cost, aluminium is larger in diameter, and this tends to reduce the corona effect on high voltages; (c) the better radiation gives a lower temperature under load, thereby slightly reducing resistance; (d) the larger conductor is more mechanical; (e) the surface of aluminium oxide sheds sleet better than does copper; (f) the lighter weight lowers freight charges and cost of transporting along the line on reels.

Aluminium alone is not adapted for lines in which the spans are great and the cables small, because the metal sags so much at high temperatures. Cables may snake or whip under sudden gusts of wind, which means that all the cables on a pole may not sway together. By losing their normal separation they come too near, and may even make contact. These objections have been largely overcome by providing aluminium cables with steel cores. Formulae are given for bimetallic wires, and it is stated that one made of aluminium and steel costs nearly as much as a copper conductor for the same power.

Dwight's chart for the quick computation of transmission lines is included.

Poles.—The author prefers wood or concrete poles to steel poles for transmission lines, and, as the latter are conventional practice with many engineers, there is a complete discussion of the subject. Comparative estimates of tower lines and pole lines are given, and there are some very full specifications.

A valuable chapter of transmission calculations contains data on corona effect, surge voltages, transposition of wires, &c.—E. K. S.

Principles and Practice of Electrical Engineering. By ALEX. GRAY, Whit-Sch., M.Sc. Second Edition. London: Hill Publishing Co., Ltd. Price 12s. 6d. net.

When we reviewed the first edition of this work a few years ago we described it as bearing "the hall-mark of sound

experience, and accurate, complete knowledge of the science . . . one of the best books on electrical engineering that any kind of engineering student could wish to study from." Naturally, the new edition is no less worthy of our encomiums. It has not been greatly changed, the additions consisting mainly of a considerable number of problems relating to the contents of the respective chapters; these are all collected at the end of the book, and appear to be admirably adapted to make the student think, and to impress the leading facts upon his memory. The desirability of adding such a collection of examples was pointed out in our previous review. The treatment of armature windings has been recast, to show more clearly the transition from the Gramme to the drum type of winding; minor changes have also been made in the chapters on alternating current circuits, and in the treatment of the force acting on a conductor carrying current in a magnetic field. As a whole, however, the book is practically identical with the earlier edition, and the author is to be congratulated upon the thoroughness with which his work was accomplished in the first instance, which has left so few loopholes for improvement. We cordially recommend the work to engineering students; it is one of the few selected volumes which we always keep within arm's reach.

Laws of Physical Science. By EDWIN F. NORTHRUP, Ph.D. London: J. B. Lippincott & Co. Price 8s. 6d. net.

This is a book of much originality, being nothing less than an attempt to put under one cover a full list of the general propositions or laws of science. Every student of the sciences is, of course, familiar with the data pertaining to those sciences—they are to be found in many manuals—but this work goes much beyond that sort of thing. It gives the laws underlying the data. The author hopes that students "will not only find guidance, but will also derive inspiration by having before them under a single view the very epitome of the world's heritage of the fundamentals of its knowledge and wisdom."

Although the title of the book refers to the *laws* of physical science, the author has found it a difficult matter to say just what *are* laws. So, in order that nothing possessing any claim to the dignity of a law should be omitted, many general propositions, theorems, and mere statements of important facts have been included.

The general statements have been classified in six sections:—I, mechanics; II, hydrostatics, hydrodynamics, and capillarity; III, sound; IV, heat and physical chemistry; V, electricity and magnetism; VI, light.

The system of stating the laws, propositions, and theorems is as follows:—There are some 189 pages in the book, and on an average about three statements are given per page. Each law is plainly marked by a title in large type. Then there follows a brief explanation in words and, if necessary, in mathematical symbols. The account finishes with references to easily accessible text-books, and in some cases to original articles or papers. The method is best understood by considering an example. Taking Section I, Mechanics, and turning to page 19, we find:—

YOUNG'S MODULUS.

By "Young's Modulus" is understood the force which would be required to stretch a body of unit cross-section to double its length if such lay within the elastic limit. It is a constant for any one material.

$$\text{Thus, Young's Modulus} = M = \frac{L F}{e a}$$

where L = length of body (usually a wire),

a = area of cross-section,

F = stretching force applied,

e = total elongation produced by F .

Similar moduli hold for compression, flexure, and torsion. (Crew, *General Physics*, p.131. Also *Ganot's Physics*, art. 87. Also Thomson & Tait, *Treatise on Natural Philosophy*, Part II, arts. 686-688.)

At the end of the book there is an alphabetically-arranged bibliography of all books and journals referred to, and a very full index with duplicated references, so as to aid in the quick location of subject matter.

There can be little doubt that the idea underlying the work is a good one. Advanced students of the sciences, especially those engaged in research work—and we are likely to hear quite a lot of this kind of work in the near future—will find it useful to be able to look up any fundamental law or conception in any branch allied to their own, without the necessity of hunting through a library. And, moreover, such a work as this is welcome nowadays when none of the sciences can any longer be locked fast into a separate compartment, for one shades off into another, and no man can define the border line.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station Officials.—The Morecambe Corporation has increased the salary of its electrical engineer by £30.

The Walthamstow F.D.C. has granted the following increases of salaries to officials in the electricity department:—Mr. G. J. Hollyer, £35 per annum; Mr. T. F. Lynn, £25 per annum, without bonuses; Mr. G. W. Stubbings, £10 per annum, with bonuses; Mr. W. H. Arnold, £10 per annum.

Mr. W. J. Cox has been appointed works manager at the Derby electricity works, at a salary of £240 per annum, in place of Mr. W. C. Dinn, resigned.

Mr. F. R. HOBLEY, mains engineer to the Lowestoft Corporation electricity department for the last 10½ years, has been appointed electrical engineer to the New Van Mining Co., of Llanidloes, South Wales, and has already taken up his new duties. On leaving Lowestoft he was presented with a memento, the presentation being made by the chief engineer on behalf of the whole of the staff and employees.

General.—SIR JOHN TURNEY has retired from the chairmanship of the Nottingham Corporation Electricity Committee after occupying that position for over 25 years. He is succeeded by Mr. R. H. Swain. At the last meeting of the Committee, Mr. H. Talbot, the city electrical engineer, was presented with a silver rose bowl, the gift of Sir John Turney. Mr. Talbot has been associated with the undertaking for 25 years. Sir John has also presented a silver rose bowl to Mr. A. Brown, the city engineer, on the completion of 50 years' service.

Mr. H. R. PYKE has resigned his position with the India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd., and joined the staff of Messrs. S. G. Leach & Co., Ltd., as manager of their motor department.

The Birmingham City Council on Tuesday appointed Mr. W. BREW, M.Inst.E.E., head of the electrical engineering department of the Municipal Technical School at £400 per annum, in place of Mr. E. O. Turner, B.Sc., resigned.

Prof. F. W. BURSTALL, Professor of Mechanical Engineering at the University of Birmingham, has been appointed gas examiner, in the place of the late Mr. Crésswell, at an annual salary of £200.

Ald. SMITH has been re-elected chairman, and Col. WADHAM (at present with the Forces) vice-chairman, of the Burrow Corporation Electricity Committee.

We desire to congratulate Mr. GEORGE SUTTON upon his election to the chairmanship of the important concern with which he has for the past 36 years been so prominently associated—W. T. Henley's Telegraph Works Co., Ltd. Mr. Sydney Gedge has been a director of the company for 37 years, and for 30 of these he has acted as chairman. His genial presence at the company's meetings has always engendered great good humour, and his speech has generally formed a suitable introduction to the very practical informing remarks with which Mr. Sutton, as managing director, has acquainted the shareholders with the actual situation of the electrical industry so far as it was represented by Henley's. Mr. Gedge, owing to advanced age, has decided to relinquish his position as chairman as from January 1st, 1918, but the company will still have the benefit of his long experience on the board. Mr. Sutton will henceforth hold the position of chairman and managing director. For Henley's, as for all important electrical industrial undertakings, the coming years will bring innumerable problems, but those who remember how well the concern was piloted through the troubled period of several decades ago, and who have followed its uniform progress for a good many years past, will feel assured that with the experienced leader of the past 36 years at the helm the concern will know well how to avail itself of the very great opportunities that will present themselves for the display of progressive and successful enterprise.

Roll of Honour.—The death in action is reported of Corporal H. C. HAMMOND, of the Tank Corps. He was formerly in the service of the Lytham Tramways Co.

Private TOM SCOTT, who was formerly employed at the Leeds electric power station, has died of wounds received in action.

Second-Lieutenant ERNEST S. LEAROYD, Middlesex Regiment, who has been killed in action, aged 28 years, was with Messrs. A. Learoyd & Son, metal merchants, Clapton.

WILLIAM EDWARDS, an employé of the Barrow Corporation electricity department, has fallen in action.

Corporal G. BRADLE, formerly of the Scarborough Tramway Co.'s staff, who has been wounded, has been awarded the Military Medal.

Gunner J. O. DONOVAN, R.H.A., formerly in the staff of the Brompton & Kensington electricity station, has been killed in action.

Second-Lieutenant VINCENT H. M. M'MAHON, Mechanical Transport, A.S.C., who appears in the list of officers mentioned by Lieutenant-General Milne, Commander-in-Chief of

Patent Extension Application.—Sir James Dewar, F.R.S., LL.D., is applying for an extension of term for Patent No. 13,638/1904 for his invention "An improved method of absorbing gases and the application thereof to the production of high vacua and the separation of gases."

the British Salonica Forces, for gallant conduct and distinguished services, is the son of Mr. J. J. McMahon, electrical engineer, Manchester Corporation tramways. Previous to the war he was engaged in the rolling-stock department of that undertaking.

Private R. GEE, South Lancashire Regiment, formerly missing, and now reported killed, was prior to enlistment employed by Messrs. Charles Macintosh & Co., electric wire and cable manufacturers, Manchester.

Lance-Corporal J. B. HAMILTON, H.L.I., who has received the V.C. for most conspicuous bravery and devotion to duty, was employed in the electrical department of the Steel Co. of Scotland, Ltd., at Hallside, Cambuslang, for many years, and prior to joining the H.L.I. he was employed for six months with the Electrical Co., in Pitt Street, Glasgow.

Sergeant A. APPLETON, King's Own Yorkshire L.I., reported wounded and missing a year ago, is now officially reported killed. He was employed by Messrs. Vlasto, Clark and Watson, electrical engineers, Warrington.

Gunner J. SHAW, R.G.A., killed in action, was in the employ of the Tudor Accumulator Co., Dukinfield.

Motorman A. A. ALLEN, of the West Ham tramways, who was promoted in June, 1917, to the rank of Second-Lieutenant in the 13th Royal Fusiliers, has been granted the Military Cross for conspicuous service on October 4th, when, after all other officers of his company were put out of action, he took charge and held the position for 18 hours.

Sergeant T. BARCLAY, who was employed on the Glasgow Corporation tramways, has been awarded the Military Medal.

NEW COMPANIES REGISTERED.

Armorduct British Co., Ltd. (148,980).—Registered November 26th. Capital, £50,000 in 41 shares. To acquire by licence of the Board of Trade the undertaking of the Armorduct Manufacturing Co., Ltd., the books and documents of which are liable to inspection under Section 2 (2) of the Trading with the Enemy Act, and to carry on the business of electrical engineers, electricians, manufacturers of and dealers in internal-combustion engines, conduits, tubes, wires, cables, pottery, rubber, gutta-percha, and metals, &c. Purchase of considerations, £15,500 in cash, of which £50 is allocated to goodwill. The subscribers (each with one share) are:—H. A. Marsh, Ash Cottage, Gravelly Hill, managing director; G. C. Busgell, 76, Handsworth Wood Road, Handsworth, Birmingham, managing director; W. H. Glassey, "Overley," Station Road, Yardley, managing director; A. D. Tipper, Hamstead Hill, Handsworth, ironfounder; G. A. T. Legg, Penybryn, Sedgley, near Dudley, managing director; G. H. Fraser, 757, Royal Liver Building, Liverpool, export merchant; J. D. Burnside, 15, Lawley Street, Birmingham, secretary. Minimum cash subscription: 100 shares. The articles contain the usual provisions for excluding enemy holdings or for high control. The first directors are:—H. A. Marsh, W. H. Glassey, A. D. Tipper, G. A. T. Legg, and G. H. Fraser. Registered office: Bathurst Works, Witton, Birmingham.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Cutting Bros., Ltd.—Memorandum of satisfaction to the extent of £2,900 on September 27th, 1917, of debentures created June 20th, 1916, securing £3,450, has been filed.

Gambrell Bros., Ltd.—Land Registry Charge on leasehold laboratories and works in Southfields, S.W., dated October 30th, 1917, to secure all moneys due, or to become due, from company to National Provincial Bank of England, Putney.

James Keith & Blackman Co., Ltd.—Memorandum of satisfaction in full on November 11th, 1917, of debentures dated December 5th, 1902, securing £2,400, has been filed.

CITY NOTES.

Amazon Telegraph Co., Ltd.—Mr. C. W. PARISH presided, on November 27th, at the annual meeting, held in London. He said that, compared with the previous year, the improvement shown in the report was quite satisfactory. The rubber crop of the Amazonas district had increased slightly. During the year the highest and lowest quotations for fine hard Para rubber were 3s. 7d. and 2s. 8½d. per lb., respectively, and for the greater part of the time the price was over 3s., whereas during the previous year it fluctuated between 4s. 1d. and 2s. 1½d. The traffic receipts of the company showed an increase of £8,940, or over 19 per cent. The gross revenue showed an increase of £10,557, or over 17 per cent. The total working expenses increased by only £711, or less than 2½ per cent, which was not large considering the general rise in prices which had taken place all over the world. The result was that the net revenue showed an increase of £9,846. They had been able to add 1 per cent. to the dividend, and to carry forward about £100 more. The investments now

amounted to £51,313, an increase of £38,839. They invested a total of £50,000 in British Government securities. In the current year, the traffic receipts up to the present were nearly £3,000 higher than those for the same period last year. The prospects for this season's rubber crop were believed to be good. If their expectations materialised he thought they might confidently look forward to having at least as good a year as the one they had just passed through. A portion of the company's revenue was derived from a service of local deferred messages, which was instituted in July, 1914. These messages were subject to a delay of not less than 10 nor more than 21 hours, and up to September last year were carried at half-rate. The directors, however, were not very satisfied with the result of the experiment, as although this class of traffic at first showed signs of expanding, it ultimately fell away considerably. They decided, therefore, to make a further reduction in the rate, which came into force in October last year, and as a result there was a very satisfactory increase in the number of local deferred words transmitted, the receipts having increased by nearly £3,000 as compared with the previous year, and they hoped to see a further expansion during the current year.

Allgemeine Elektrizitäts-Gesellschaft.

The report of the directors for the year ended June 30th, 1917, states that the whole of the company's activity was devoted, as in the preceding year, to the problems raised by the war, the multiplicity and extent of which would be reserved for mention in the future period of peace. At present the company would have to limit itself to the statement that the orders received and the deliveries effected were considerably greater than in 1915-16. The superficial area covered by the workshops in full operation had risen from 203,874 square metres to 808,881 square metres, and the number of employés at the end of the financial year had advanced to 79,293.

The machine sets in construction in the turbine factory comprised those of powers rising to 50,000 kw., whilst the machinery works had carried out the largest types of transformers hitherto made, namely, of 60,000 kw. and 110,000 volts, and was continuously occupied with the production of high-tension material. In wireless telegraphy important innovations were developed, and the deliveries of the apparatus factory exceeded the figures for the previous year. It was possible for the glow-lamp branch to bring sale prices into better proportion to the costs of production. The aeroplane department, for which workshops had been erected at Hennigsdorf, and at Johannisthal on the Upper Spree, was carrying out work which afforded satisfactory prospects also for peace times.

The demand for electrical machinery and apparatus for war industries, particularly the chemical industry, was exceptionally active. Remunerative orders were also received from the coal mines, whilst the iron and steel works continued to require electrical equipment, especially large rolling train drives. The central-station department completed the Gerstein works in Westphalia with a capacity of 30,000 kw., and the power station at Zschornowitz, in the lignite district of Bitterfeld, for the Electro Works Co., and the power station at the Fortuna mine was enlarged by 8,000 kw. The Ferro-Silicon Works of Elverlingen placed an order for a complete sinking plant with a transformer output of 14,000 kw., and the Bavarian Nitrogen Works Co. and the Silesian Electricity and Gas Co. gave contracts for turbo-dynamos of large dimensions. In the case of the railway department, the activity was almost exclusively applied to the production of replacement plant for existing lines, and the work on the A.E.G. high-speed railway in Berlin was temporarily restricted. The accounts show the following figures for the past four years, 20 marks being assumed as the equivalent of £1 sterling:—

	1913-14.	1914-15.	1915-16.	1916-17.
Share capital	£7,750,000	£7,750,000	£9,200,000	£9,200,000
Gross profits	1,132,000	1,544,000	1,987,000	2,339,000
General expenses	73,000	73,000	91,000	103,000
Taxes	106,000	145,000	143,000	195,000
War allowances	—	230,000	377,000	507,000
Depreciation	44,000	44,000	45,000	55,000
Net profits	908,000	1,028,000	1,324,000	1,478,000
Net profits, including balance forward	944,000	1,064,000	1,359,000	1,518,000
Directors' fees	23,000	27,000	28,000	34,000
Bonuses to staff	60,000	75,000	100,000	100,000
Pension fund	50,000	75,000	100,000	100,000
War benevolence	—	—	75,000	75,000
Dividend	775,000	852,000	1,017,000	1,150,000
Dividend, per cent.	10	11	12	12½
Carried forward	26,000	35,000	39,000	59,000

The share capital now stands at £10,000,000, the difference between this amount and £9,200,000 given in the table only ranking for dividend from July 1st, 1917. In addition, the loan debt reaches £5,271,000, and the mortgage debt £135,000. The credit at the company's bankers is stated to be £5,575,000, as compared with £6,680,000 in 1915-16, and £4,531,000 in 1914-15, whilst the advances made to the Berlin Electricity Works Co., the A.E.G. High-speed Railway Co., and other undertakings raise the total outstanding credits to £10,710,000, as against £10,010,000 in the preceding year. It is further mentioned that all new machinery, plant, patterns, &c., have been entirely written off, as in previous years. In conclusion, the report gives particulars of the company's investments, and refers to the transfer to the State of the interests held in the Electro Works Co.

French Companies.

The *Société l'Eclairage Electrique* reports net profits of £194,000 for the year ended on June 30th, 1917, as against £146,000 in the previous year. It is proposed to distribute 12s. per share, as in 1915-16.

The *Compagnie Parisienne de l'Air Comprimé* reports net profits of £37,000 for 1916-17, as contrasted with £63,000 in the previous 12 months. As the compressed-air business resulted in a deficit, no profits would have been realised had it not been for the return received from the settlement of accounts with the Union des Secteurs and from investments. The dividend in 1915-16 was at the rate of £1 4s. per share, and it is assumed that the rate for the past year will be 14s. 5d. per share.

The directors of the *Société Industrielle des Téléphones* report gross profits amounting to £373,000 for the year ended on June 30th, 1917, as compared with £260,000 in the preceding year. After deducting general expenses, interest on loans, and setting aside £100,000 for depreciation, as against £60,000 in 1915-16, the balance permits of the payment of a dividend of £1 12s. per share, as contrasted with £1 4s. and 12s. per share in the two previous years respectively. The sum of £64,000 has been placed to the contingency fund, and £30,000 to the legal reserve fund.

The report of the *Société d'Electro-Metallurgie de Dives* for 1916-17 states that new workshops were erected for Army purposes, and, apart from these installations, the greatest work undertaken related to the diversion of the sources of the Val au Loup and of the Caudemuche. As net profits the accounts show the sum of £223,000, as compared with £231,000 in the preceding year, and a dividend of £2 8s. per share has been declared for 1916-17. The reserve fund has received an addition of £104,000, thus raising it to £210,000.

The *Société Anonyme Electro-Metallurgique (Procédés Paul Girod)* reports that the works were actively engaged in 1916 not only in the distribution of energy for the Acieries Paul Girod as well as in the district of Lyons served by the Société Hydro-Electrique de Lyon, but also in the production of special alloys. After providing for depreciation, the accounts show net profits amounting to £281,000, as compared with £59,000 in 1915. The tax on war profits absorbs £172,000, and the balance permits of the payment of a dividend of £2 per share. At the recent meeting a proposal was confirmed for amalgamating the company with its subsidiary—the *Compagnie des Forges et Acieries Electriques Paul Girod*. The transaction is to take place this year, after the latter's capital has been increased for the purpose of effecting an interchange of shares.

Fraser & Chalmers, Ltd.—For the year ended June 30th last the profit, after providing for all expenses and depreciation, and after making provision for special taxation, was £36,174, as compared with £21,669 in the previous year. The works have been fully employed, and an increased output has been obtained. The results show improvement, notwithstanding the heavy increases in the cost of material and labour, and the difficulty of obtaining sufficient supplies. The merchandise business in South Africa has also been on a larger scale, in spite of freighting difficulties, and the results of the trading there and at the other branches of the company have been satisfactory. The directors recommend a dividend of 5 per cent., less tax, on the ordinary shares, and after transferring £20,000 to the reserve account (increasing it to £100,000) to carry forward the balance of £16,773.—*Financial Times*.

Tata Hydro-Electric Power Supply Co., Ltd.—The great success with which the introduction of electric power from the generating station on the Ghats is being developed in Bombay is revealed by the report of this company for the half-year ending June 30th. The company paid dividends of 7 per cent. per annum, both preference and ordinary shares, for the second half of last year. For the half-year just ended the directors recommend a further 7 per cent. per annum for preference shareholders, and a further 8 per cent. per annum on ordinary shares. The current now being supplied to motors in Bombay amounts to 48,000 h.p. The whole undertaking has been working most satisfactorily. Thirty-six mills are receiving power, and only the difficulties arising from the war prevent development being more rapid. Good progress has been made with the preparation of the new lake at Shirawata above the Ghats for the supply of additional water to the generators, and two-thirds of the new dam there has been completed.—*Indian Engineering*.

Companies Struck Off the Register.—The following companies have been struck off the Register, and are accordingly dissolved:—

Advisory Engineers' Corporation.	Midland Magneto Co.
All-British Electrical Co.	Fletcher's Electric Fittings.
Alphons Custodis Chimney Construction Co.	Krupka & Jacoby, Ltd.
Anti-German League.	Magneta Time Co.

Brazilian Traction, Light & Power Co.—Quarterly dividend of 1½ per cent. on the fully-paid cumulative preference shares.

Western Telegraph Co., Ltd.—First quarterly dividend, 3s. per share, free of tax, for the year ending June, 1918, being at the rate of 6 per cent. per annum.

United Wire Works, Ltd.—For the year ended September 30th, after providing for depreciation, bad debts, and excess profits duty, the credit balance is £14,036. Dividend, 7½ per cent. on ordinary shares, free of income-tax, £1,500 to general reserve, leaving £3,536 to carry forward.

Adelaide Electric Supply Co., Ltd.—A final dividend on the ordinary shares of 7 per cent., tax free, is announced, making 12 per cent., tax free, for the year.

Melbourne Electric Supply Co., Ltd.—Final dividend on the consolidated ordinary stock of 5 per cent., tax free, making 10 per cent., tax free.

Pollock & Macnab, Ltd.—A petition for confirming the reduction of capital from £60,000 to £50,000 has been presented.

Globe Telegraph & Trust Co., Ltd.—Quarterly dividend, 2s. per share on the ordinary shares, free of tax.

Provincial Tramways Co., Ltd.—With the final dividend and bonus now announced, the total distribution on the ordinary shares for the year is 10 per cent.

Cape Electric Tramways, Ltd.—Dividend, 5 per cent., less tax.

*** STOCKS AND SHARES.**

TUESDAY EVENING.

HAD these been ordinary times, the quietude such as the Stock Exchange markets are experiencing would have been attributed to the advent of Christmas, but as this is scarcely a reason which can be advanced in war-time, members of the House put down the somewhat lifeless condition of markets to the Russian developments, to the War Bonds campaign, and to the news of a slight set-back on the Western Front. Prices keep steady in most departments, and, having regard to the paucity of business, to say nothing of the claims of the Government borrowings, it is a little surprising that the general strength should be so well held. There is less gambling going on, which is a good thing, but it has the effect of causing markets to appear dry and inanimate.

The home railway position has not been improved by the settlement of the latest strike. Prices gave way on the trouble which appeared imminent, and they have not recovered from the loss which they then sustained, notwithstanding the compromise arrived at between employers and employed. It is assumed that the greater part of the increased wages bills will have to be footed by the Government, i.e., the country, and that the companies themselves will bear but a small proportion of the extra burden laid upon the industry by the latest all-round rise in wages. People, however, look ahead, and are disposed to wonder what will be the position at the end of the war, when the companies will presumably re-assume control of their own affairs, and when there will be no Government subsidy to help meet the increased costs of working. It is held accordingly that every rise in costs stores up future difficulty for the railway companies, and adds to the reasons why investors should seek fields other than home railway stocks for the employment of their money. Undergrounds are concerned indirectly by the broad considerations which govern British railway working, and the stocks are heavy with the rest.

The most active feature of the markets with which we deal is furnished by another jump in American Marconis. The price has strengthened 26s. 3d., and has been steadily rising from a level nearly 10s. lower down. As we have already indicated, the buying comes principally from the North of England, where rumour credits inside information with news of an important contract just concluded by the American Marconi Co., and optimists look for the price to go well over 30s. It may be well to lay accent on the word optimists. The parent shares are practically unchanged, though the strength of Americans reflects a little brightness to Canadians, these hardening to 11s. 9d. Marines are also a good spot at 52s.; and this section of the industrial market is one of the few strong spots.

Anglo-American Telegraph Preferred weakened a trifle, but the cable list as a whole is strong, and the monotonous complaint is reiterated that it is easier to sell than it is to buy. Some people are talking of the possibility of another increase in the dividends of the Western and Eastern groups, with its corollary of a rise in the Globe dividend. Speaking without intimate knowledge, this seems to be looking rather far ahead, because, with the possibility which has to be faced of further taxation, it can hardly be expected that such conservative boards as these which control the affairs of the cable companies would increase dividends, save in very exceptional circumstances, and, moreover, rates have already been advanced once since the outbreak of the war.

Western Telegraphs are ½ better, and so are China shares. The usual quarterly dividends on Globe ordinary and preference are just declared. Great Northerns are flat, a drop of 50s. occurring on a little pressure to sell. Cuba Submarines are good, with a 5s. rise. Oriental Telephones have reacted. Automatic Telephone ordinary are better at 21s. 3d.

City of London Electric ordinary rose ½ to 13½, and the remainder of the list keeps very hard. Manufacturing issues are somewhat irregular. General Electric ordinary are 20s. up at 20½. India-Rubbers gained ½ at 14½. Electric Construc-

tions have recovered their dividend deduction. Brush ordinary improved to 28½. British Aluminium show a small rise at 32s. 6d. On the other hand, Westinghouse preference have receded to 56s. 3d.; Balcocks are the turn easier at 61s. 6d. Edison Swan keep steady at 26s.

The Adelaide Electric Supply Co. declares a final dividend of 7 per cent., making 12 per cent., free of tax, for the sixth successive year, and the Melbourne Co. is to pay 5 per cent., making 10 per cent. (also tax-free) for five years running. In spite of these excellent results, Melbourne ordinary has fallen 3 points to 170. Adelaide ordinary are not quoted on this side. The 6 per cent. preference stand at 4½. Anglo-Argentine First preference weakened to 2 15/16 on the incessant labour alarms in the Republic. Mexican issues are flat. The Second Mortgage bonds of the Light & Power Co. have dropped to 26½. Rio Seconds are easier at 76. Georgias fell ½ to 13. British Columbia 4½ per cent. debenture at 58 is 2½ up, though the preference is 2 points lower at 42½.

The rubber market remains lifeless, and the fall in the price of the material to a little below half-a-crown per lb. led to a fresh bout of profit-taking. Rubber is out of favour for the time being. There is no speculation going on, and the buyers of the earlier part of the year are now devoting their financial energies to shares which offer more scope for immediate profit. The base-metal markets are better, more especially that for tin shares, where a further record attained by the metal itself has had the effect of bringing in buyers for West Africans, although the home products of Cornwall are still neglected. The armament group has given way, and there is not so much going on in iron and steel shares generally, the decline in activity spelling, as usual, a slight reaction in quotations.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.						
	Dividend		Price			
	1915.	1916.	Dec. 4, 1917.	Rise or fall this week.	Yield p.c.	
Brompton Ordinary	10	9	6½	—	£6 18 6	
Charing Cross Ordinary ..	5	5	4½	—	5 17 8	
do. do. 4½ Pref.	4½	4½	8½	—	6 13 4	
Chelsea	4	8	2½	—	5 9 1	
City of London	8	8	19½	+ ½	6 0 9	
do. do. 6 per cent. Pref. ..	6	8	10½	—	5 18 6	
County of London	7	7	11	—	6 7 8	
do. do. 6 per cent. Pref. ..	6	6	10½	—	5 18 5	
Kensington Ordinary	7	6	5½	—	6 11 7	
London Electric	8	8	1	—	Nil	
do. do. 6 per cent. Pref. ..	6	4	8½	—	6 6 8	
Metropolitan	6	8	8½	—	4 12 4	
do. 4½ per cent. Pref. ..	4½	4½	8½	—	7 4 0	
St. James' and Pall Mall ..	8	8	7	—	5 14 6	
South London	6	5	3	—	6 13 4	
South Metropolitan Pref. ..	7	7	21½	—	8 10 6	
Westminster Ordinary	7	7	6½	—	5 5 8	
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	8	6	96½	— ½	6 4 8	
do. Def.	83½	1½	98½	+ ½	8 8 4	
Chile Telephone	8	8	7½	—	5 11 4	
Cuba Sub. Ord.	6	7	9½	+ ½	*7 11 4	
Eastern Extension	8	8	14½	+ ½	*6 7 7	
Eastern Tel. Ord.	8	8	149½	—	*6 7 0	
Globe Tel. and T. Ord. ..	7	7	19½	—	*6 1 10	
do. Pref.	6	6	10½	—	5 17 1	
Great Northern Tel.	22	24	36½	—2½	6 11 8	
Indo-European	18	13	62½	—	6 9 10	
Marconi	10	16	8½	—	4 12 4	
Oriental Telephone Ord. ..	10	10	8½	— ½	3 4 0	
United R. Plate Tel.	8	8	6½	—	*6 18 6	
West India and Pan.	6d.	6d.	1½	—	*3 9 6	
Western Telegraph	7	6	15½	+ ½	*6 5 10	
HOME RAILS.						
Central London, Ord. Assented	4	4	60½	—	6 12	
Metropolitan	1	1	22½	— ½	4 9 0	
do. District	Nil	Nil	15½	—	Nil	
Underground Electric Ordinary	Nil	Nil	13	—	Nil	
do. do. "A"	Nil	Nil	8½	—	Nil	
do. do. Income	6	4	81½	— ½	*4 18 2	
FOREIGN TRAMS, &c.						
	Dividend					
	1915.	1916.				
Adelaide Sup. 8 per cent. Pref.	6	6	4½	—	8 3 1	
Anglo-Arg. Trams, First Pref. ..	5½	6½	21½	— ½	9 7 4	
do. do. 2nd Pref.	6½	—	2½	—	—	
do. do. 5 Deb.	5	5	67½	—	7 9 3	
Brazil Traction	4	4	45	—	—	
Bombay Electric Pref.	6	6	9½	—	8 3 1	
British Columbia Elec. Rly. Pfce. ..	5	5	42½	—2	11 15 4	
do. do. Preferred Nil	Nil	Nil	80	—	Nil	
do. do. Deferred Nil	Nil	Nil	28	—	Nil	
do. do. Deb.	4½	4½	59	+2½	7 6 7	
Mexico Trams 6 per cent. Bonds ..	Nil	Nil	42	—	Nil	
do. do. 8 per cent. Bonds	Nil	Nil	85	—1	Nil	
Mexican Light Common	Nil	Nil	22½	—	Nil	
do. do. Pref.	Nil	Nil	81	—	Nil	
do. do. 1st Bonds	Nil	Nil	40½	—	—	
MANUFACTURING COMPANIES.						
Babcock & Wilcox	15	15	8½	— ½	4 11 8	
British Aluminium Ord.	7	10	12	+ ½	6 8 1	
British Insulated Ord.	17½	20	8	—	6 13 4	
British Westinghouse Pref. ..	7½	7½	21½	— ½	5 6 4	
Callenders	20	20	14½	—	6 18 0	
do. 5 Pref.	5	5	4½	—	6 1 3	
Castner-Kellner	22	20	9½	—	5 16 3	
Edison Swan, fully paid	—	—	2½	—	Nil	
do. do. 4 per cent. Deb.	4	4	74½	—	5 7 5	
Electric Construction	7½	7½	1½	+ ½	6 8 4	
Gen. Elec. Pref.	8	8	10½	—	5 13 0	
do. do. Ord.	10	10	20½	+1	4 18 2	
Henley	25	25	16½	—	7 18 2	
do. 4½ Pref.	4½	4½	4	—	5 12 2	
India Rubber	10	10	14½	— ½	*8 18 0	
Telegraph Coa.	20	20	41½	—	*6 15 7	

* dividends paid free of income tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, December 5th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/6	..
a Ammoniac Sal	per ton	£75	..
a Ammonia, Mariate (large crystal) ..	"	£58	..
a Bisulphide of Carbon	"	£23	..
a Borax	"	£28	..
a Copper Sulphate	"	£66	..
a Potash, Chlorate	per lb.	2/6	..
a " Perchlorate	"	2/-	..
a Shellac	per cwt.	£17 10	£4 inc.
a Sulphate of Magnesia	per ton	£16	..
a Sulphur, Sublimed Flowers	"	£35	..
a " Lump	"	£25	..
a Soda, Chlorate	per lb.	10d.	..
a " Crystals	per ton	120/-	..
a Sodium Bichromate, casks	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 3" to 12" basis) ..	per lb.	..	..
c " Tubes (solid drawn) .. ..	"	..	..
c " Wire, basis .. ..	"	..	..
c Copper Tubes (solid drawn)	"	1/6½ to 1/7	..
g " Bars (best selected)	per ton	£147	£9 dec.
g " Sheet	"	£147	£9 dec.
g " Rod	"	£147	£8 dec.
g " (Electrolytic) Bars	"	£125	..
d " " Sheets	"	£152	..
d " " Wire Rods	"	£133	..
d " " H.C. Wire	per lb.	1/3½	..
f Ebonite Rod	"	9/-	..
f " Sheet	"	2/6	..
n German Silver Wire	"	2/3	..
h Gutta-percha, fine	"	6/10	..
h India-rubber, Para fine	"	2/5½	1/- dec.
i Iron Pig (Cleveland warrants)	per ton	Nom.	..
l " Wire, galv. No. 8, P.O. qual. ..	"	£42	..
g Lead, English Pig .. ..	"	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small	per lb.	5d. to 8/-	..
e " " medium	"	8/6 to 6/-	..
e " " large	"	7/6 to 14/- & up.	..
d Silicon Bronze Wire	per lb.	1/8½	..
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English) .. ..	"	..	..
n " Wire, Nos. 1 to 16	per lb.	8/10	1d. inc.

Quotations supplied by—

a G. Boor & Co.	g James & Shakespeare.
c Thos. Bolton & Sons, Ltd.	h Edward Tilt & Co.
d Frederick Smith & Co.	i Bolling & Lowe.
e F. Wiggins & Sons.	l Richard Johnson & Nephew, Ltd.
f India-Rubber, Gutta-Percha and	n P. Ormiston & Sons.
Telegraph Works Co., Ltd.	r W. F. Dennis & Co.

Electric Traction in Coal Mines.—In the United States to-day storage battery locomotives are being used in mines both for gathering service and for main haulage. As one of these "electrics" will do the work of three to eight mules, it displaces a large number of drivers, who can be more profitably employed at the coal face. The cost of hauling coal and ore with storage-battery locomotives is only about one-half what it costs to haul with mules or horses, and the mine output can be materially increased and the sanitary conditions improved by the use of the electric vehicle. The Electric Vehicle Section of the National Electric Light Association has collected some interesting data showing the actual savings of the miniature electric locomotives over mule haulage in mines. The Madison Coal Corporation, one of the largest coal-mining corporations of the middle West, which strongly advocates the use of the electric locomotive in coal mines, based on actual operating experience, states that in addition to the money saving in ton haulage there is a remarkable financial economy in the prevention of injuries, for while mule drivers form only 5 per cent. of the entire working forces, their accidents amount to 26 per cent. of the whole number, and the cost in connection with them amounts to 34 per cent. of the total liability cost. It is found that the total monthly cost of maintaining four mules with drivers is \$342.80; the tonnage gathered is 8,368 tons, and the cost, altogether with mules and drivers, per ton, is \$0.04096. The cost of maintaining a storage-battery locomotive one month is \$175.70; the tonnage gathered is 8,900 tons, and the total cost including \$0.00125 for energy per ton is \$0.02099, showing a difference in favour of the locomotive of \$0.01997 per ton.

The Pocahontas Smokeless Coal Co., of West Virginia, is also successfully operating storage-battery locomotives. At this mine four cars each weighing 1,300 lb. empty, and 4,100 lb. loaded are hauled on each trip by one electric locomotive, on main entry, a distance of about 2,500 ft., including 1,200 ft. against 3 per cent. grade, 400 ft. against 2½ per cent. grade, and short grades of 5 and 7 per cent., all against the loads. To get out the 400 tons a day that this mine should produce, the mule haulage would cost \$735 a month and battery haulage \$306 a month, making the very substantial saving of \$129 a month in favour of the "electrics." Furthermore, the maximum number of mules and cars allowed by the track conditions could not handle 400 tons a day. The upkeep on ties and track was quite considerable with the mule haulage, and is greatly reduced with the locomotives. It is estimated that in one year the "electrics" will save the cost of the whole installation, and at the same time increase the coal output by two-thirds.

DIESEL ENGINES AND THE WAR.

By "PULVERISER."

THOSE central-station engineers who have Diesel engines under their control are, at the present time, working under serious disabilities. Not only have they difficulty in obtaining the specially trained staff required, and in replacing defective and worn parts, but a serious situation has arisen with regard to fuel supply. There is undoubtedly a feeling that their efforts to do the best, or the seeming best, in the country's interest, are thwarted by authority.

Diesel engines were worked in this country until 1915 almost entirely on imported petroleum residue fuel oil. About two years ago it was considered to be desirable that a home-produced substitute should be found in order to reduce purchases abroad.

Experiments were commenced in order to test the practicability of using tar oils, which are by-products of gas manufacture. The Diesel Engine Users' Association encouraged these efforts, and inquired as to sources of supply. Several papers were read by experimenters and others who could assist.

About 12 months ago matters had progressed so far that certain suitable grades of tar oil were obtainable at reasonable prices. They could, however, only be used in engines having rather costly pilot ignition. Other engines could only use tar oils when running near full load. Invention was further stimulated, and six months ago comparatively simple alterations to pulverisers were developed, so that any Diesel engine could be commercially used on tar oil when running at from half to full load. The technical problem was solved, the supply of fuel was forthcoming, and alterations proceeded apace.

It appears, however, that the proposed increased use of tar oil attracted the attention of a Controller, and restrictions were imposed. Engine users could, however, in most cases show that the work was "war work," and there was no serious difficulty in obtaining licences. Lately, however, an alarming position has developed. The Controller recently allocated a fixed and inadequate annual allowance of tar oil for engine users, but *there is no restriction on the use of petroleum fuel*. In effect, Diesel engine users are told: "Use as much petroleum as you like; use shipping to bring it over, pay your money abroad, but do not use tar oil."

This has been followed up by a somewhat tantalising price control, fixing tar oil at about £4 10s. per ton, while petroleum has rushed up to £16 per ton. It would appear that only a very pressing national need for tar oil, for more important purposes than the supply of power for munitions factories, could justify this state of affairs, which is obviously very much in favour of the importer and against the home producer and user. If allowed to continue, it must result in heavy increases in charges for power to consumers.

This has evidently been dimly realised by the Controller, as a circular has been addressed to central-station engineers asking for a return of tar oil used in the first half of 1917, an estimate for the same period of 1918, and for details of stand-by steam plant. It is a characteristic feature of this circular that no figures are desired for petroleum fuel oil. The proposal underlying this last request is that Diesel engine users will be compelled by high prices of petroleum fuel and by the restriction on tar oil to shut down their Diesels and run their antiquated steam sets, so that the Controller will be able to point to reduced consumption of his particular commodity, which is apparently the one aim and object of a Controller. From the point of view, however, of national interest, the Diesel engine user is unable to understand the position. Tar oil can usually be obtained locally, or with a short railway journey. Fuel oil of all kinds has a producing value of from four to five times that of an equal weight of coal. The man power required for loading and unloading is much less than with coal. Diesel engines have for these reasons shown increasingly favourable results as the distance from sources of coal supply increases. In the South of England, where Diesels are plentiful, coal must come along the munition-congested routes and in the same direction, *i.e.*, North or West to South, causing further congestion. The Coal Controller and the railway

authorities are unable to deal satisfactorily with the present traffic, yet Diesel users are asked to replace 1 ton of fuel oil by 5 tons of coal, and 10 to 20-mile journeys by 50 to 100-mile trips. It would be necessary to engage more stokers, coal trimmers, carters (for coal and ashes), use more water, and, in many cases, raise prices of electricity if the use of old steam plant in place of Diesel engines were brought about.

At present the general opinion is that the effect of the policy being carried out is directly contrary to the ideals we have been asked to keep in mind—reduction of overseas traffic, of transport and of labour, and economy in use of coal—and that the restriction on the use of tar oil is a direct encouragement to profiteering in petroleum.

It is felt that a short-sighted Controller has got to work on his own watertight compartment without consulting his *conféres* who control shipping, railways, coal, and man power. If these latter officials have been consulted, and if they state that, notwithstanding the obviously bad effects from the point of view of their departments, it is desirable to persist in encouraging the use of any and every form of fuel in preference to tar oil, there will be a cessation of opposition from Diesel engine users, and they will, no doubt, assist in every way in making the change.

GAS FIRING BOILERS.

By T. M. HUNTER, M.A., B.Sc.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS.)

(Continued from page 510.)

Drying and Cleaning Gas.—It is very important that the gas should be dry when burned. At any temperature from 0 deg. to 100 deg. C. gas will take up a known amount of water as vapour, and this amount can be found in an air-saturation table. If the gas has been cooled or washed in water, it is reasonable to assume that it is saturated with water to the amount corresponding to the lowest temperature to which the gas has been brought. As an example of the amount of water carried in this way, the author had recently to use, at 15 deg. C. and 55 deg. C. respectively, the two producer gases described in the foregoing table. The former gas carried under 2 per cent. by volume of water vapour, and the latter carried 15½ per cent. This vapour must all be heated when the gas is burned, and it not only lowers the flame temperature, but also is responsible for carrying to the chimney a large quantity of sensible heat.

To show the actual loss from this cause, let us assume that we have cleaned blast-furnace gas from the same furnace, in one instance at atmospheric temperature with 12 to 15 grammes per cu. metre of water vapour, and in the other instance gas saturated at 70 deg. C., carrying about 362 grammes per cu. metre. In both cases the gas is to be burnt under boilers with an excess of air of 25 per cent.

In the first case the combustion temperature of this gas when burnt with an excess of air of 25 per cent. is 1,294 deg. C., found by using the Le Chatelier formula.

Now take the gas at 70 deg. C. The combustion temperature is found to be 1,010 deg. C.

There is a drop of 284 deg. C. in the combustion temperature, which, of course, is a very serious matter. It is much more difficult to obtain complete combustion of this mixture of aqueous vapour and gas with an excess of air of 25 per cent. than if gas alone is dealt with. It is also a well-known fact that the efficiency of a boiler depends in the first instance on the initial temperature of combustion, and if the latter is lower the efficiency of the boiler is certain to decrease. The evaporation per sq. ft. of heating surface is certain to be considerably smaller if wet gas is used than with dry gas.

We have next to consider the effect of the water vapour on the efficiency of the boiler. The loss through waste heat for dry gas would be 21 per cent. of the total value of the gas, and for wet gas 29.8 per cent. In other words, the presence of the water in the gas will cause an unavoidable and irredeemable loss of 8.8 per cent., in addition to the loss by the reduced flame temperature. Assuming in both cases 5 per cent. loss through radiation and conduction, the actual efficiency for dry gas would be 71 per cent., and for the wet gas 65.2 per cent., which is equivalent to a drop in the output obtainable from the same quantity of gas amounting to 12 per cent.

So far as regards the efficiency, but it will also be worth while to consider the evaporation obtainable in both cases, assuming that the boiler is working on its maximum load, that is to say that the boiler flues pass the maximum quantities of gas and air which the chimney draught can convey

at the most favourable position of the damper. In the case of a 30 ft. \times 8 ft. Lancashire boiler, with a dry gas under the above described circumstances the highest possible evaporation is 6,000 lb. of water from and at 212 deg. F. At 70 deg. C. each cubic foot of gas carries 0.0228 lb. of water, and at maximum load the evaporation works out at 4,725 lb. from and at 212 deg. F.

The simple presence of water in the gas can, under otherwise absolutely equal conditions, result in:—

1. A drop of efficiency of nearly 9 per cent.
2. A drop in evaporation of more than 21 per cent.
3. The loss due to lower flame temperature, which the author has not attempted to calculate.

It is evident that an engineer who has to specify a producer plant, or a gas-cleaning plant, where washing of the gas is part of the process, should take care to specify the maximum amount of water vapour allowable in the gas supplied.

Contrary to a frequently expressed opinion, the author does not believe that the dust in itself impairs seriously the heating value of blast-furnace gas; and the uncleaned gas has the advantage that it contains the sensible heat. The dust, however, may seriously affect the efficiency of the boiler. If two Lancashire boilers are run side by side, the one on cleaned and the other on uncleaned blast-furnace gas, it will be found that at first the results as regards both evaporation and efficiency are about the same. Soon dust will start to accumulate in the boiler flues, and as this dust is an insulating agent it will impair both the evaporation and the efficiency. After four or six weeks the dust accumulates in such large quantities that the evaporation falls and combustion may even take place partly in the stack instead of under the boiler. Where Lancashire boilers are to be fired, it will therefore generally pay to install a gas-cleaning plant, even at the expense of the sensible heat which is lost in the cleaning process.

Conditions are much more favourable with water-tube boilers, as with these it is often possible to clean the tubes without stopping the boiler. If liberal use is made of the steam lance, the proposition to put in a cleaning plant will certainly not be such a favourable one as in the case of Lancashire boilers.

The cheapest plant is not worth having, unless it fulfils the following conditions:—

1. The gas must be clean.
2. It must be dry, and this is even more important than the cleanness.

In some cases where the gas can be cooled to a temperature of 80 deg. C. without water injection, and where the ores contain only a small percentage of moisture, it is possible with a dry cleaning plant to obtain a dry, hot gas; whereas, where wet cleaning processes are used, or where water is injected for the purpose of cooling the gas, the gas is saturated and this water has to be eliminated.

So far as the author can discover, the cost of cleaning gas, inclusive of all charges, is about 2d. per 35,000 cu. ft., and is practically the same whether the wet or the dry process is used.

The sensible heat in blast-furnace gas per cubic foot is approximately as follows:—

Temperature of gas, deg. C.	200	250	300	350	400
Sensible heat, therms per cu. ft.	7	9	11	13	15

As cold blast-furnace gas varies from about 90 to 110 therms per cu. ft., this sensible heat is a large percentage of the total heat of the gas. Firing water-tube boilers with properly designed burners, and using the steam lance, say, twice a day to clean the tubes, the efficiency with uncleaned gas is certainly within 10 per cent. of the efficiency with cleaned gas—probably within 6 per cent. On the other hand, with Lancashire boilers the average efficiency over four or six weeks with uncleaned gas is very considerably lower than with cleaned gas.

The decision as to whether it will pay to clean gas must therefore be made for each case separately, and depends on the peculiarities of the gas and of the dust, as well as on the kind of boilers used.

Heat Transfer.—Gaseous fuel as usually burned does not give the intense local heat and the heat-radiating surface of the coal fire. Rather, the problem is that of a very hot gas which is cooled gradually as it travels through the boiler. It is like the problem of a coal-fired boiler with the fire-grate entirely outside.

The transfer of heat through a steel wall from hot gases to water consists of three parts: transfer of heat from gas to metal, transfer of heat through metal, transfer of heat from metal to water. The resistance to the transfer of heat in the second and third parts is exceedingly small when compared with the resistance to the transfer of heat from gases to metal. It is calculated for one case that the resistance to transfer of heat from gas to metal was 622 times the resistance to heat passing through the steel. This shows that the advantage to be gained by fitting, say, copper tubes instead of steel would be very small indeed. Again, the transfer from metal to water, if the metal has a clean surface, is also negligible compared with the gas-metal transfer. If, however, the metal carries scale on its surface the case is very different. Scale $\frac{1}{8}$ in. thick, assuming the scale to have the same conductivity as plaster of Paris, of which the specific resistance to the conduction of heat is 108 times that of iron, would add resistance

to heat transfer equal to 18 per cent. of the resistance of transfer from gases to steel.

The problem of finding the most satisfactory boiler for gas firing is to be solved by the boiler which abstracts the heat most successfully from the hot gases passing. There are several lines along which improvements can be made.

The first is to increase the surface exposed to the hot gases by fixing projecting pieces inside the fire tubes, to increase the heated surface.

The second method depends on the fact that a square foot of heating surface at right angles to the gas flow is about eight times more effective than a similar area parallel to the gas flow—at ordinary velocities of gas. Deflectors or retarders are put into the boiler so as to cause the gases after they have been fully burned to impinge on the tubes as directly as possible.

A third method, and probably the one most commonly used, is to put surfaces of brick or other refractory material in the boiler in such a way that the flames play upon them. These surfaces are raised to a high temperature and transfer the heat by radiation to the boiler tubes. Such surfaces, in order to give the greatest effect, must face the boiler tubes squarely, and must be as near as possible to these tubes.

The transfer of heat by radiation becomes much more rapid in proportion as the difference between the temperatures of the two bodies concerned increases. This shows the necessity of raising our radiating surface to the highest possible temperature; and this again points to the use of the highest possible gas or air pressure in our burners in order to shorten the flame and make it more intense.

A fourth method depends on the theory that the difficulty of heat transfer from gas to metal is caused by a thin layer of cooled gas, which adheres to the surface of the metal and acts as a non-conductor. The stream of hot gases is made to scour very rapidly the surface of the tubes, and in this way the cooled gas is swept away and fresh hot gas is constantly applied. Very rapid heat transfer has been obtained by this means.

The author has had no experience with the Bonecourt boiler, but it is claimed by the makers that the heat is taken out of the gas by means of surface combustion on blocks of refractory material in the tubes, and that the heat is transferred by means of radiation from this material. Whether or not there is any surface combustion in the process as carried on in their latest boilers, the author thinks it likely that the high velocity of the gases through the tubes, in close contact with the walls and heating the refractory blocks, may be sufficient to account for the evaporation per square foot claimed. The suction required—16 in. water-gauge for the larger evaporations, equivalent to a velocity of about 250 ft. per second—would seem to bear this out. Unfortunately, it is a costly matter to get these high suction for the very large volumes of hot gas with which we have to deal in boiler firing.

Each of these methods involves either the use of power or the insertion of some obstruction in the boiler. Boiler users object to have any kind of brick erection inside a flue, as it may burn away and require renewal, and it must be removed to clean and inspect the flue. The author considers that for existing boilers the method of increasing the heating surface by the use of some kind of metal fitting in the flues is the one least open to objection. Power for forced draught or suction is a charge against the boiler, and its cost must be deducted from the efficiency of the boiler. To put the gas—or air—under 2 in. pressure, in the case of blast-furnace or producer gas, requires power which would only reduce the boiler efficiency by $\frac{1}{3}$ to 2 per cent., whereas the additional efficiency attained may be from 10 to 20 per cent.

Types of Boilers.—Lancashire boilers are used very largely, and have to be utilised in the best way possible for gas firing. It is a pity that three-flue and five-flue boilers are not more often used, as they not only give a larger heating surface, but also allow of smaller volumes of gas being burned in each flue. With smaller volumes of gas it is easier to burn the gas with a small excess of air. A disadvantage of the Lancashire boiler when gas-fired in any of the usual ways is that the fall of temperature in the gases from one end of the flues to the other is not sufficient to set up good circulation of the water, as is done by the intense local heat of the fire when the boiler is hand fired. In spite of all that is said against gas-fired Lancashire boilers, they will continue to be successfully and economically used. The author has experience of regular evaporations of over 9,000 lb. per hour from and at 212 deg. F. from ordinary 30 ft. \times 8 ft. boilers, both with producer gas and with blast-furnace gas, which is far higher than what we should expect from a water-tube boiler.

The author's idea is to have a boiler with a considerable number of smaller tubes, forcing the gas to burn at the highest possible temperature in each, and to have no obstructions in the tubes, and no mechanical suction. Such a boiler, properly insulated, would give at least as good results as the best water-tube boiler.

Wherever high-pressure boilers are to be installed, there is little doubt that water-tube boilers will be chosen if the available feed-water is soft enough and can be suitably treated. It is important that sufficient combustion space should be provided for the huge volumes of gas, so that the gas may be fully burned before passing through the tubes. External combustion chambers should be avoided as causing unnecessary

losses by radiation and conduction of heat, and because the highest temperature is not attained in the immediate vicinity of the tubes.

A good boiler should evaporate about 80 per cent. of its load in the first bank of tubes, 15 per cent. in the second, and 5 per cent. in the third. The third bank is thus practically an economiser, and this accounts for the fact that the maximum evaporation of water-tube gas-fired boilers per square foot of heating surface is usually only $5\frac{1}{2}$ to 6 lb. per hour. In a large Stirling boiler fired with coke-oven gas and evaporating $5\frac{1}{2}$ lb. per square foot of heating surface, the temperature of the steam was 290 deg. C., the temperature of the gases leaving the boiler was only 238 deg. C., and the temperature of the feed water was 55 deg. C.

When judging a boiler, it will be safe to take the results obtained from coal-firing, as we can be certain that if the same boiler is fitted with good furnaces and arranged for gas-firing it will do somewhat better. In any case, where gas-firing is concerned the choice of the right combustion arrangement is much more important than the choice of the best boiler. Up-to-date boilers do not differ in their results when coal-fired, and, when the same stokers are chosen, by more than 5 per cent. at the outside; whereas, when it comes to gas-firing, one combustion arrangement can easily do 50 per cent. better than another.

Another important question is the arrangement of superheaters in gas-fired boilers. When gas-fired boilers are arranged for hand-firing and gas-firing, the nozzles of the burners are, as a rule, too near the superheaters, so that in a good many cases the superheat imparted to the steam is too large. Superheated steam pays as long as the superheat is not more than 85 deg. C. The heat added to the steam over and above that is practically lost, unless the steam is carried a very long way and loses part of the superheat in transit. It is, therefore, essential that the distance between the superheaters and the nozzles of the burners should be if possible more than 10 ft., so as to ensure that the superheater does not come into contact with the burning gas.

The ideal boiler for gas-firing has not yet been developed. There is no doubt that a water-tube boiler which is arranged so that the gas can be fully burned before passing through the tubes, and where the gas stream is kept at right angles to the line of the tubes by careful baffling, is the best boiler we have so far. To get higher outputs from such a boiler per square foot of heating surface is a matter calling for more rapid combustion of the gas, with more intense flame temperature, and this can easily be arranged where required.

The author has never come across a water-tube boiler with small diameter tubes, such as, for example, the Yarrow boiler, gas fired. It seems probable from the theoretical point of view that the Yarrow boiler would give excellent results. As the tubes are only about 1 in. diameter, the proportion of heating surface touched by the gases, to the wetted surface of the tubes, is much larger than in the usual forms of water-tube boilers. As also the tubes are only about $\frac{1}{2}$ in. apart, the waste gases must pass between them at a high velocity. For these reasons the author would expect to get a high output and economical results with this type of boiler.

(To be concluded.)

DISCUSSION IN LONDON.

The discussion was opened by Mr. C. P. SPARKS, who welcomed a paper on what was a new subject to them. The author dealt with gas and how to handle it; he wished that it had dealt rather with the sources of gas, which was the first matter of importance to the electrical industry. In burning solid fuel for steam generation, all the volatiles were lost, and it was recognised that the method must be altered; the chemical industry was dependent on coal by-products. Considering coal distillation, in coke production gas was a by-product, and in gas production, coke was the by-product; there was also low-temperature distillation, in which gas and other by-products were obtained. He asked were they to put their stations at the coke ovens or at the gas works, or wait the development of further processes. Their problem must be considered from the power engineer's point of view, which was that of securing heat units; it must be approached from a new standpoint. The Fuel Research Committee were considering how best to use fuel so as to meet all the objects in view, and the matter was also being investigated by important commercial undertakings. The question for electrical men was how they were going to get the gas. Coke manufacture took place primarily at the pits, and in most cases water was not abundant there, so that this crippled the use of steam turbines in such a locality; in addition, the question of transmission was involved. To utilise products of existing gas works would decentralise power production, instead of concentrating it, as desired.

Mr. W. B. WOODHOUSE emphasised the importance of a steady gas pressure for successful gas firing. The point in gross and net calorific values was to know which was being used. He thought the author was optimistic in his estimate of 6,000 cu. ft. of gas per ton of coal for coke ovens, while the figures for blast-furnace gas were extremely high. The important question was how much gas was surplus after completing all processes (including blowing), and he estimated

this as worth 1s. 6d. per ton of pig produced; in this country very few blast-furnaces had any surplus, and it was difficult to get successful firing with a gas containing so much inert matter. If it were necessary specially to dry gas, it was a question whether it would pay.

Mr. E. W. L. NUNOT said he felt that gas was too good for boiler firing, and the pressing need was the development of a furnace for burning coke on a large scale. As regards waste heat, with present practice gas-works coke was drawn from the retorts at 1,800 deg. F., and contained 43 per cent. of the heat used in making it; it was usually quenched in water, but there was no reason why it should not instead be dumped into a furnace, and the heat utilised at the gas works. The problem of conveying gas to a station of, say, 100,000 kw., was a huge one, some 23 million cu. ft. of 150-in. dia. producer gas per hour would be required; and ordinary coal gas was out of the question.

Mr. H. W. KOLLE remarked that the use of blast-furnace gas was more difficult than would appear from the paper. Pressure variation was a serious question, also there was the difficulty of adjusting air supply to gas supply. The author's figure of 25 per cent. excess air with blast-furnace gas was too low; in practice it was usually 100 per cent. Where there was pressure variation in the main, the air was adjusted for the maximum pressure. It was not so easy to carry out a test on gas-fired plant using dirty gas, and he did not know of any case where means was provided for controlling pressure. He thought there was not much in cleaning gas, and felt that the whole matter required much further consideration. With producer and coke-oven gas, the pressure could be regulated, but he thought the author had given a wrong impression as to blast-furnace gas firing.

Mr. J. D. PATON urged electrical engineers to study the question of combustion; they must appreciate flame colour and make the utmost use of the CO gas, which was the heat giver. Some 25 million tons of coal were wasted annually, in the heap, lost in mains or in the mine, and our fuel authorities had not attempted to deal with this matter. A large part of this fuel was only suitable for distillation, and the coke would contain so much ash that it could only be used in a producer for gas making.

Mr. W. R. COOPER said the paper was valuable as an analytical one, and as, no doubt, gas-firing would come they must be prepared to use it. It was difficult to find the quantity of gas used in industrial processes, but if used for industrial firing they must know its quantity and heat value. He thought that in the future attempts would be made to make more use of radiant heat in gas firing; in the producer the efficiency would be improved by reducing the steam used. But the commercial future of gas-firing depended very much on the realisation of the value of by-products. Low-temperature coke could be best used in producers, and for this reason the low-temperature carbonisation processes were worth considering.

Mr. W. H. PATCHELL criticised the variation from practice of some of the author's figures. The question was whether coal could be more economically turned into electricity, and, with gas firing, it turned largely on the by-products. Coke was a difficult by-product to burn, and involved extra transport, and it would be advantageous to use it in producers for gas making.

Mr. J. H. HIGHFIELD said the discussion revealed the fact that there were numerous sources of waste heat, and it was clear that the latter must be used in the form of electricity, but this still left the problem of producing the major part of the energy which would be required, and of using some form of gaseous fuel in its production. It was difficult to get any figures to go upon; in a fair-sized steam plant one might get 900 units per ton of coal costing 20s. To obtain this by gas-firing would require 14 tons, costing on the same basis 25s., and if it were assumed that sulphate of ammonia and some tar were obtained as by-products valued at 10s., then the net fuel cost would be 15s., leaving 5s., which would about meet the extra financial charges. In the case of a gas engine of, say, 1,000 h.p., 900 units could be generated on 6 ton of coal, costing 12s.; by-products might fetch 5s., leaving 7s. as the net coal cost.

Mr. A. H. DYKES said we must utilise all waste heat in the future; we were now doing so in part. Then we had to consider the capital question of large stations. With gas firing this would involve the chemical and metallurgical industries, and therefore the form of gas would no doubt be decided for the electrical engineers, and they must therefore consider how to use any probable form of gas available. Figures were required; there was too much mystery attaching to the results now obtained. Special types of boiler would have to be designed to meet the conditions, and a subsidiary advantage would be the labour saving.

Mr. C. P. TAYLOR said the author showed 30 per cent. of the heat value thrown away in producer work, the only justification for which was the by-products obtained. High fuel costs would upset all calculations unless the price of sulphate of ammonia also went up. It was questionable whether it would be profitable in a small scheme to transmit electricity rather than gas.

Mr. L. B. ATKINSON urged that too much stress must not be laid on the by-product value of sulphate of ammonia; they must look to oils and other chemical by-products. No one would use sulphate of ammonia if he could get nitrates (which

would be produced electrically), and would be available at a lower price per ton in more suitable form for agricultural purposes.

Mr. H. M. SWALES asked if any attempt had been made to clean gas by centrifugal methods?

The AUTHOR, in his reply, said he had not dealt with the manufacture of gas. Dry gas meant gas in which the moisture had been extracted by ordinary methods. The tendency was to put in cleaning plants for blast-furnace gas, which flattened out pressure variation, giving reasonable uniformity; some classes of gas must be cleaned or solidification of the dust would occur. With clean gas, economisers could be used without scrapers. It was difficult to substantiate figures for efficiency, but with a good boiler and economiser he would hope to secure an efficiency of 85 per cent. with coke-oven gas, and about 80 per cent. with clean blast-furnace gas. The efficiency of the Bonecourt boiler was probably due to gas velocity and radiation.

PARLIAMENTARY.

(Concluded from page 526.)

The following applications for powers are set out fully in notices published in the *London Gazette* for November 27th:—

Canvey Deep-Water Wharf and Railway.—New company to construct wharf, railway, dock, and other works; electric generating stations; working railway by steam or electricity; supply of electrical energy.

Yorkshire Electric Power Co.—New and further powers, as to supply; obligations upon local authorities, companies, and others obtaining powers in future to take supply of energy in bulk from the company; provisions as to Joint Boards or Committees, &c.

Sheffield Corporation (Consolidation).—Various powers respecting tramways, trolley vehicles, and electric supply.

Shropshire, Worcestershire & Staffordshire Electric Power Co.—Various additional powers, extensions of existing powers, &c.

Doncaster Rural District.—Electrical Distribution of Yorkshire, Ltd., seeks a Provisional Order for supply in a number of parishes and townships in the rural district of Doncaster.

Gildersome.—Electrical Distribution of Yorkshire, Ltd., seeks a Provisional Order for electricity supply.

Luddenden Foot and Mythelmroyd.—Ditto.

Rotherham Rural District.—Ditto.

Hoyland Nether U.D.C.—Amendment of E.L. Order, 1912, extension of time.

Werkington Corporation.—Provisional Order for electricity supply.

Sheffield Corporation.—Electric supply extension powers for urban districts of Handsworth and Dronfield and a number of parishes in other districts.

Clayton and Queensbury.—Electrical Distribution of Yorkshire, Ltd.—Provisional Order for supply in Clayton and Queensbury urban districts.

Thorne.—Electrical Distribution of Yorkshire, Ltd.—Provisional Order for supply in Thorne Rural District.

Guiseley and Menston.—Electrical Distribution of Yorkshire, Ltd.—Provisional Order for Guiseley U.D. and Menston parish.

The following notices appear in the *London Gazette* for November 30th:—

Gainsborough.—Application by J. Marshall, Gainsborough, for Electric Lighting Provisional Order.

Knottingley U.D.C.—Alteration, &c., of 1911 E.L. Order.

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED.)

Compiles, especially for this journal by Messrs. W. P. THOMPSON & CO., Electrical Patent Agents, 284, High Holborn, London, W.C., and at Liverpool and Bradford.

17,005. "Electromagnetic force therapeutic generators." C. GRAHAM. November 19th.

17,011. "Electric signalling apparatus." F. S. S. WATTS. November 19th.

17,013. "Device for electric flame ignition, cut-off apparatus for lubrication of engine." A. J. HILL. November 19th.

17,014. "Electric generators, &c." See AXON'S DES. ETABLISSEMENTS L. B. 111. November 19th. (France, November 20th, 1916.)

17,017. "Centrifugal pump device for magnetic ignition." G. A. CHAMBERLY. November 19th. (France, June 30th.)

17,018. "High tension ignition magnets." G. A. CHAMBERLY. November 19th. (France, June 30th.)

17,019. "Oil cooled electrical transformers." T. R. RENFREW. November 19th.

17,024. "Permanent magnetic motor devices." LANDIS & GYE ART. GES. November 19th. (Switzerland, December 2nd, 1916.)

17,025. "Method of working electrolytic metals." WESTINGHOUSE METAL PROCESSING CO. November 19th.

17,030. "Lighting systems for motor vehicles." BENJAMIN ELECTRIC, LTD. November 20th. (U.S.A., November 27th, 1916.)

17,091. "Induction coils." M. A. CODD. November 20th.

17,111. "Arc lamps." P. W. BIDMEAD. November 20th.

17,136. "Means of adjustably connecting a magneto and gear-box to motor-cycle bracket." S. C. POOLE & F. W. A. SMITH. November 21st.

17,162. "Telephone instruments." H. WILSON. November 21st.

17,172. "Alternating electric current protective devices adapted to operate on reversal of current." BRITISH THOMSON-HOUSTON CO. & E. B. WEDMORE. November 21st.

17,173. "Dynamo-electric machine." BRITISH THOMSON-HOUSTON CO. & A. A. POLLOCK. November 21st.

17,187. "Electric glow lamps." C. O. BASTIAN. November 21st.

17,211. "Electric incandescent lamps." SIEMENS & HALSKE ART. GES. November 22nd. (Germany, December 20th, 1916.)

17,218. "Electrical control systems." BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO. November 22nd. (U.S.A., November 22nd, 1916.)

17,221. "Sound-producers applicable to submarine signalling, &c." J. M. KINGQUIST. November 22nd.

17,224. "Dynamo-electric machine." C. L. BREEDEN, H. L. CAPE & H. LUCY. November 22nd.

17,258. "Magneto compasses." C. F. RYLAND. November 23rd.

17,277. "Rotary rectifier of alternating current." A. D. MACROPOULOS AND C. D. MACROPOULOS. November 23rd.

17,292. "Electric batteries." A. A. PRICE. November 23rd.

17,296. "Test shunt joint for electric cable." C. J. BEAVER, E. A. CLAREMONT & A. F. W. RICHARDS. November 23rd.

17,300 & 17,301. "Carbon brushes for dynamo-electric machines." C. Y. KNIGHT, MORGAN CRUCIBLE CO. & W. N. WILSON. November 23rd.

17,311. "Electric switches." E. L. RANKIN. November 23rd.

17,320. "Deflectors for electric arc lamps, searchlights, &c." J. P. YORKE. November 23rd.

17,335. "Electric signalling systems." F. G. BELL, W. C. DAVEY AND STERLING TELEPHONE & ELECTRIC CO. November 24th.

17,339. "Electromedical apparatus." E. E. GREVILLE. November 24th.

17,342. "Method of operating valves of internal-combustion engines by electrical energy." M. TATE. November 24th.

17,374. "Long-arm for overhead system electric tramcars." A. SENIOR. November 24th.

17,377. "Storage batteries." R. L. SMITH. November 24th. (U.S.A., May 17th.)

17,379. "Ignition magnets." E. MARFELI & CO. November 24th. (Italy September 28th, 1916.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

7,062. MAGNETO-ELECTRIC MACHINES. H. Robinson. November 16th, 1916. (110,760.)

8,584. METHOD OF AND APPARATUS FOR ELECTRIC DISTRIBUTION FOR USE WITH IGNITION SYSTEMS. C. T. MASON. June 19th, 1915. (100,742.)

10,938. ELECTRIC SWITCH CONTROLS. G. A. FRITSCH. August 2nd, 1916. (110,768.)

15,177. PORTABLE ELECTRIC SIGNALLING LAMPS. W. T. COULSON. (Cognate application, 5,394/17.) (110,592.)

15,187. ELECTRIC TRANSFORMERS. British Electric Transformer Co. & T. R. Renfrew. October 25th, 1916. (110,594.)

15,310. ELECTRIC FLASHLAMPS. E. NUTTAL. October 27th, 1916. (110,611.)

15,351. INTERRUPTERS FOR IGNITION SYSTEMS. C. T. MASON. June 30th, 1915. (101,980.)

15,357. ELECTROLYTIC GAS GENERATORS. I. H. LEVIN. December 20th, 1915. (102,933.)

15,365. TROLLEY HEADS FOR ELECTRIC TRAMCARS. C. SYMONBO. October 27th, 1916. (110,612.)

15,398. IGNITION DEVICES FOR INTERNAL-COMBUSTION ENGINES. R. G. L. MARKHAM. October 28th, 1916. (110,613.)

15,464. IGNITORS FOR INTERNAL-COMBUSTION ENGINES. J. F. ALVORD & W. B. THOMPSON. October 28th, 1915. (102,058.)

15,623. MEANS FOR ATTACHING IGNITION WIRES TO SPARKING PLUGS OF ROTARY AEROPLANE ENGINES. Gwynnes, Ltd., & H. Humphreys. November 22nd, 1916. (110,796.)

15,888. STAGE LIGHTING. E. BOOTH & N. R. BOOTH. November 7th, 1916. (110,627.)

16,090. ELECTRICALLY-OPERATED STRIKING DEVICE FOR CLOCKS. M. E. PUGH. November 9th, 1916. (110,629.)

16,155. IGNITION MAGNETS FOR INTERNAL-COMBUSTION ENGINES. A. H. BOUTON & J. H. BOUTON. November 10th, 1916. (110,630.)

16,382. ELECTRIC SWITCHGEAR. H. W. CLOTHIER AND A. REYROLLE & CO. November 15th, 1916. (110,808.)

16,452. MERCURY BREAKS OR ELECTRIC INTERRUPTERS. F. R. BUTT & CO., H. F. BIGGE & F. R. BUTT. November 16th, 1916. (110,635.)

16,513. IGNITION DYNAMOS. C. T. MASON. June 19th, 1915. (102,966.)

16,892. TELEPHONE INSTRUMENTS. International Electric Co. & H. E. R. ROOSE. November 24th, 1916. (110,640.)

17,003. HIGH-FREQUENCY SIGNALLING, PARTICULARLY APPLICABLE TO WIRELESS TELEPHONY. Western Electric Co. November 29th, 1915. (102,500.)

17,098. ELECTRIC BATTERIES. J. M. FLANNERY. December 14th, 1916. (110,652.)

17,099. ELECTRIC BATTERIES. J. M. FLANNERY. December 14th, 1916. (110,653.)

18,691. CONTROL GEAR FOR ALTERNATING CURRENT ELECTRIC MOTORS. J. A. STOVEN & R. J. GOTTERTSON. December 30th, 1916. (110,836.)

1917.

220. APPARATUS FOR ELECTRIC WELDING. T. E. MURRAY. January 12th, 1916. (103,293.)

1,017. SUSPENSION FOR ELECTRIC CABLES AND THE LIKE. W. T. HENLEY'S Telegraph Works Co. & R. POVEY. January 20th, 1917. (110,848.)

1,490. LOW ELECTRIC MOTOR. A. C. GILBERT CO. April 18th, 1916. (105,742.)

2,093. WIRELESS TELEGRAPH APPARATUS. R. J. THOMPSON & J. THOMPSON. February 12th, 1917. (110,685.)

2,109. MEANS FOR SECURING AN INSULATOR TO A RISE PLATE. Maschinenfabrik Oerlikon. February 12th, 1916. (101,177.)

2,701. ELECTRO-DEPOSITION OF COPPER AND NICKEL FROM SOLUTIONS OBTAINED FROM ORES. M. V. GRIN. February 29th, 1916. (101,678.)

2,900. ELECTRIC CABLE CONNECTORS. Chloride Electrical Storage Co. & H. DAVIS. February 27th, 1917. (110,858.)

3,236. ELECTRIC CONTROLS AND THE LIKE. G. ELLISON & J. ANDERSON. March 30th, 1917. (110,862.)

3,464. MAGNETO-ELECTRIC MACHINES FOR IGNITION IN INTERNAL-COMBUSTION ENGINES. M. S. COOPER. March 9th, 1917. (110,864.)

3,802. GENERAL AND ELECTRICAL JOINTS. C. J. BEAVER & E. A. CLAREMONT. March 15th, 1917. (110,868.)

4,142. ELECTRIC IMITATION CANDLES. C. AMMENTORP. May 20th, 1916. (106,609.)

6,281. ELECTRIC FLASHLIGHTS. M. H. SPIELMAN & J. CORCOS. May 3rd, 1917. (110,702.)

6,081. ELECTRIC TORCHES. R. FALLOWS. April 30th, 1917. (110,700.)

8,718. ELECTRIC CONTACT BREAKERS. F. H. ROYCE & ROLLS-ROYCE, LTD. June 18th, 1917. (110,891.)

9,182. MAGNETO CONTROLLING DEVICE ENABLING INTERNAL-COMBUSTION MOTORS TO BE STARTED BY HAND. July 1st, 1916. (107,761.)

THE ELECTRICAL REVIEW.

VOL. LXXXI.

DECEMBER 14, 1917.

No. 2,090.

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MACHINERY FOR THE WORK OF RECONSTRUCTION.

THE reports of the removal by the common enemy of all kinds of machinery and plant from Belgium and the occupied districts of France have been so frequent during the past two years that it is impossible to disbelieve them, and it may therefore be assumed that almost everything which can be utilised by the enemy has been, or will be, seized or destroyed in order to prevent the return to the rightful owners of property which could be advantageously used by the Allies, and also in connection with the gradual military advance. On the other hand, some machinery and plant may have been destroyed or greatly damaged by inadvertence through the gun-fire of the Allies in the promotion of the forward movements, as it is not possible absolutely to prevent incidents of this kind. In any case, the devastation caused to property by the war has been enormous, and will necessitate a stupendous expenditure for the work of restoration after the conclusion of peace. What this outlay may approximately amount to it would be exceedingly difficult for us to determine, but the leading iron and steel interests in the United States have not been deterred from making an inquiry into the situation, or from the formulation of estimates which are based upon an investigation made by a committee which paid a visit to Europe in the autumn of last year.

The report prepared by the committee was presented at a meeting held at Pittsburg. It shows that, in the opinion of the committee, the reconstruction requirements owing to the destruction of public and private property would represent an aggregate of £1,200,000,000 in the case both of the western and eastern fronts, £750,000,000 applying to the former and £450,000,000 to the latter. Apart from buildings, raw materials, and manufactures, the report calculates that it would be necessary to expend a total of £270,000,000 on industrial machinery in Belgium and France, £12,000,000 on agricultural machinery and implements, and £85,000,000 on railways, bridges, and tramways. If the figures for the two countries are considered in detail, the restoration of the coal and iron ore industries would involve an expenditure of £60,000,000, the iron and steel and metal industries one of £75,000,000, the chemical industry £8,000,000, and the electrical industry £36,000,000, apart from the separate outlay for the textile, paper, wood, and furniture branches. It is assumed that Belgium alone will have to import industrial machinery to the value of from £20,000,000 to £24,000,000, or six times more than corresponding imports in peace times, whilst France herself will probably be able to produce three-fourths of her own requirements in machinery, leaving one-fourth, or the value of £12,000,000, to be procured from abroad in the first year of peace. In the case of Germany, it is computed that the country will be under the necessity of importing machinery worth £6,000,000 per annum in the first years of peace; Galicia is put at £4,000,000, and Poland at £49,000,000 for works and machinery.

The foregoing estimates, as previously mentioned, only apply to the autumn of 1916. Since

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE 1-4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B O.

Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 6d.; Canada, £1 3s. 10d. (\$5.80). To all other countries, £1 10s.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.

AUCKLAND N.Z.: Gordon & Gotch, Albert Street; The Mining and Engineering Review, 31A, Strand Arcade, Queen Street.

BRISBANE: Gordon & Gotch, Queen St.

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DUNEDIN, N.Z.: Gordon & Gotch, Princes Street.

JOHANNESBURG, CAPE TOWN, BLOEMFONTEIN, DURBAN, PORT ELIZABETH, &c.: Central News Agency, Ltd.

LAUNCESTON: Gordon & Gotch, Cimitiere Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

MELBOURNE: The Mining & Engineering Review, 90, William Street; Gordon & Gotch, Queen Street.

MILAN: Fratelli Treves.

NEW YORK: D. Van Nostrand, 25, Park Place.

PARIS: Boyveau & Chevillet, 22, Rue de la Banque.

PERTH, W.A.: Gordon & Gotch, William Street.

ROME: Loescher & Co., Corso Umberto I° 307.

SYDNEY: The Mining & Engineering Review, 273, George Street; Gordon and Gotch, Pitt Street.

TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.

WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

THE "ELECTRICAL REVIEW'S"

ELECTRICAL & ALLIED TRADES DIRECTORY

(THE RED BOOK),

1917 EDITION.

H. ALABASTER, GATEHOUSE & KEMPE,
4, Ludgate Hill, London, E.C. 4.

then, however, the further havoc which has been made would naturally imply a formidable addition to the aggregate figures. Apparently on the assumption that the machinery and plant would be obtained exclusively from the United States, the American interests calculate on the flotation there of a great reconstruction loan by means of which gold shipments would be avoided, and the rates of exchange in Europe be but slightly influenced. On the other hand, a Zurich newspaper, which is published in German, states that it is an open question whether the reconstruction of the destroyed districts will proceed quite according to the American programme. With the entrance of the United States into the war that country also assumed enormous war burdens, and changed over her industries to war work to a far greater extent than previously. As a consequence, the Swiss-German newspaper submits that the United States will in no respect be able so promptly to compete after the conclusion of peace as was assumed by the committee, and that it remains to be seen whether the Americans will be able to offer machinery in countries of the European Allies at prices which would secure the business. On the other hand, the newspaper expresses the hope that Swiss engineering firms, particularly the electrical industry, will find specially favourable prospects open to them for the export of machinery and plant.

It is quite obvious that any estimates concerning the reconstruction of the devastated countries are of no practical value at the present moment. At the same time, it has to be borne in mind that the American computations were made prior to that country's participation in the war, and that, therefore, some prospect previously existed that American firms would secure a very considerable amount of the business which will result from the work of restoration. This assumption, however, has been greatly modified by the association of the United States with the common struggle for justice and freedom from the military domination of enemy countries, and under existing circumstances American firms cannot expect to obtain more than their due proportion of the machinery contracts which will come forward on the conclusion of peace, provided that the requisite shipping facilities are available for transport from the United States to Europe.

Literary Style.

AMONGST the "Random Reflections" of our valued contemporary, *The Engineer*, last week, we noted with especial interest an essay on a subject which appeals to us, but seldom figures in the technical Press—namely, the use and abuse of the English language. We wonder whether the average engineer fully appreciates the importance to him of the study of English and the cultivation of a good literary style. Often a practical man whose conversation on technical subjects derives from his expert knowledge a peculiar fascination will tell us that he cannot write an article—all unaware that he has already composed it, and that nothing is lacking but the written record of his observations. Such a man might with advantage try the experiment of engaging a stenographer to set down his remarks addressed to a real or imaginary brother engineer whose experience has run along different lines; he would probably be surprised and pleased to find himself the author of a very readable and informative article—which, moreover, would possess a cash value far in excess of the stenographer's fee.

Our confrère attributes the worst faults of composition to two causes: on the one hand an attempt to write too well, and on the other an absolute indifference to the graces of style. The former leads to the introduction, usually misplaced, of flowers of

speech, and hackneyed literary clichés or stock phrases, with disastrous effect upon the reader; a plain tale, told in simple Anglo-Saxon, is the best from every point of view, and every superfluous word is a defect. Of the two classes, we prefer the latter; it may be largely due, as our contemporary holds, to the practice of dictation to a shorthand writer (which is not the same thing as the process which we have suggested above, in which the speaker should forget the existence of the stenographer)—but in many cases we think it arises from an impression that it gives a practical and technical air to the work, whereas it is merely slovenly and affected.

Prominent amongst the defects in the latter category are the omission of the definite article, and the use of the expression "the same" (or the barbarity "same," a heinous crime) in place of "it" or "them," as in the sentence, "Take cloth off table and put instrument on same." These offences against good taste and good English are unspeakably horrible, but they are, unfortunately, very commonly committed. That trap for the unwary or inexperienced, the collective noun, to which our contemporary draws attention, is the source of innumerable errors in the daily Press; we also have made it our practice to treat all such nouns as singular, and find that this course almost invariably meets the case, whereas if the plural is used endless difficulties are encountered. Thus, "This committee has commenced its work" is inoffensive; but to say "This committee have," &c., would mean torture to the reader, and "A committee are sitting" is equally unpleasant. The limitations of our space forbid us to refer to the many other literary solecisms which are constantly being met with, and we must conclude by emphasising again the importance of good English to the engineer, as to every other professional man.

The Kinema and Industry.

WE were interested recently in an effort that was being made in the States to utilise the cinematograph as a means of popularising industrial, commercial, and other information respecting manufacturing operations—showing how things in common use are made, and under what conditions. Two lecturers of the Bureau of Economics (Washington) were recently lecturing in the U.S.A., with the aid of kinema films, on various Canadian topics, and one of the outcomes expected is the attraction of emigration and capital to Canada. There is a charm or fascination about such a procedure which renders the cinematograph a far more useful popularising medium than mere lecturing or ordinary pictures. The kinema film has proved its applicability to boosting "electrical development" schemes among the general populace in the States. Life and movement have an irresistible effect. How far would it be possible similarly to demonstrate our more prosaic industrial activities in works in the United Kingdom to the great markets of the world where too little is known about our abilities? We have seen electrical factory operations and processes admirably represented by kinema film in London. How far is the idea adaptable or applicable in helping us to inform the world and expand our trade abroad where, at times, quite wrong notions as to our capacity have been held? We attach great importance to the placing of actual British-made machines and apparatus in colleges abroad, where students will in daily operations become familiarised with them, and to the circulation of brochures containing excellent pictures of our manufactories. Is it worth considering whether, where we cannot send permanent exhibits, we can provide a peripatetic film for the edification of students, institutions, chambers of commerce, and so forth, in the great purchasing centres of the world?

THE EDUCATION AND TRAINING OF ENGINEERS.

By "RADIX."

(Concluded from page 533.)

One of the most careful thinkers of the last century has told us that "false ideas can be refuted by argument, but by true ideas alone can they be expelled." Whence are "true ideas" to come, and how are they to be inculcated? Surely not by the exercise of the rational faculty alone. What is termed "reason" varies in different individuals, in different races, and in members of the same race in different parts of the world, and under different conditions of life.

Reason—as understood by most of us who do not indulge in philosophical analysis—may perhaps be described as a co-ordination of facts of experience and of inferences and deductions therefrom. To some people "reason" and "common sense" are synonymous terms. At any rate, the "reason" upon which this non-religious age would have us base our ethical ideas is a state of knowledge arising out of experience or the accumulated results of experience. But, clearly, knowledge based upon experience is necessarily subject to modification as experience becomes wider and fuller. How can morality find any permanent basis in reason alone? All attempts to formulate a code of morals upon reason alone have failed, and *must* fail, since the basis is a variable, and not a constant, one.

Bishop Butler seems to have given us about as good a definition as is possible of the fundamentals of morality in the following words:—"For, as much as it has been disputed wherein virtue consists, or whatever ground for doubt there may be about particulars; yet, in general, there is in reality an universally acknowledged standard of it. It is that which all ages and all countries have made profession of in public; it is that which the primary and fundamental laws of all civil constitutions over the face of the earth make it their business and endeavour to enforce the practice of upon mankind: namely, justice, veracity, and regard to common good."

Whence arise the ideas of "justice, veracity, and regard to the common good"? Not from the exercise of reason alone. It is all very well for materialists and other "ists" to say that ages of experience have shown that without due regard to these ideas a community does not prosper. Grant that this be so (although this does not account for the *origin* of these ideas); grant that reason forces one to give an intellectual assent to the truth of this contention; we all know that "there is a wide difference between the formal assent given to a proposition that cannot be denied, and the efficient belief which produces active conformity with it." In the absence of that "efficient belief," what becomes of the intellectual assent? Is it not common experience that the first question a business man (and, for the matter of that, pretty nearly every man) asks himself in regard to any proposition, business or otherwise, is "What am I going to get out of it?" and if he concern himself at all with what the other chap gets out of it, it is only to enable him to see to it that the other fellow gets as little as possible. Justice and the common good, to say nothing of veracity, become quite secondary considerations.

Herbert Spencer—who certainly did not *profess* to be a religious man—acknowledges that "Were it possible forthwith to replace a traditionally-established system of rules, supposed to be supernaturally warranted, by a system of rules rationally elaborated, no such rationally-elaborated system of rules would be adequately operative. To think that

it would, implies the thought that men's actions and beliefs are throughout determined by intellect; whereas they are in much larger degrees determined by feeling."

Herbert Spencer seems to imply that the antithesis is a "consummation devoutly to be hoped," but he is wrong, as is also Tennyson when he sings "We have *but* faith; we cannot *know*, for knowledge is of things we *see*." The fact is that the greatest and most certain part of our knowledge is of things we do not *see*. The whole edifice of scientific knowledge is built upon three principles which we only *feel* must be true, and which do not admit of logical proof:—the principle of uniformity in Nature, the principle of identity, and the principle of causality.

Similarly, the recognition of right from wrong, of good and evil, and the ideas of "justice, veracity, and the common good of all" are *felt*, not *known*. Whence this certainty based upon "feeling"?

I do not hesitate to say that, as a result of 30 odd years' experience of men and things on both sides of the Atlantic, there seems to me, philosophically and scientifically, no escape from the conclusion that the origin of the moral sense is to be sought in an "Eternal power not ourselves which makes for righteousness," and that the only satisfactory exposition of Matthew Arnold's abstract conception is to be found in the Christian faith as originally professed by this country.

So long as the great majority of the children of the masses are brought into the world under the conditions now prevailing; so long as the minds of the young are allowed to develop during their most impressionable years in such surroundings and exposed to such influences and examples; so long as the inculcation of the sense of responsibility to God the Creator and Preserver of all mankind is left out of account in the education of the young, so long will the pernicious doctrines of the positivist, the anarchist, and other "ists" continue to flourish and do their deadly work in perverting the morality of humanity.

One word in conclusion. The view is often expressed that if a man conduct his business on the lines of the Sermon on the Mount, he will find himself in the bankruptcy court sooner rather than later.

In a sense this is perfectly true. It is, however, equally true that the sense in which it is true is *not* the sense in which the Founder of Christianity would have men conduct their business. The admonitions in the Sermon on the Mount are counsels of perfection for the individual, and do not apply to the administration of collective justice. If a man smite us on one cheek, we are not enjoined to turn somebody else's cheek to the smiter. A man may be as charitable as he pleases with his own money, but he must not deal with other people's money as he likes. A judge may submit to be swindled and not have recourse to his legal remedy without thereby, even impliedly, sanctioning the swindling act, but he must not, in the exercise of his office, compel those who are swindled to act likewise. Although our Lord never avenged any injury done to Himself, He nevertheless dealt with those who were defiling the Temple in drastic fashion. He did not waste words in argument, but punished the infraction of the moral law, which was subversive of public morality, by overturning the tables of the money-changers and driving out these breakers of the moral law *by force*.

There is a virile, as well as an emotional, side to the Christian religion. The undue predominance of the emotional over the rational is as dangerous—as regards the common good—as the undue predominance of the rational over the emotional.

We should aim by education to bring about that proper equilibrium "between introspective thought and the outer world of action" which involves the

recognition that justice "is a positive, affirmative force, which entails active duties as well as passive rights."

Huxley, who may be termed, at least, an unbiased witness, expressed himself as "seriously perplexed to know by what practical measures the religious feeling, which is the essential basis of conduct, was to be kept up, in the present utterly chaotic state of opinion on these matters, without the use of the Bible"; and in the same essay* he writes: "If I were compelled to choose for one of my children between a school in which real religious instruction is given, and one without it, I should prefer the former."

Unless Mr. Berriman's Committee—or some other authority—recognise and act upon this governing factor as a root principle in education, they will no doubt turn out skilled men, but not "good" men; their efforts will be productive of palliative measures only, for they will not strike at the root of the evil, and no real progress will be made towards the attainment of the goal they have in view.

MODERN ARC LAMPS AND INCANDESCENT LAMPS.

(Concluded from page 532.)

Exterior Lighting.—Where out-of-doors lighting is concerned, or the illumination of large workshops, &c., half-watt lamps have to compete with flame arcs, the characteristics of which may be thus summarised :—

	Open flame arc; carbons side by side.		Enclosed long-hour flame arc; vertical carbons.	
	D.C.	A.C.	D.C.	A.C.
Colour of light	Yellow	Yellow	White	White
Candle-power (mean lower hemispherical)	1,300—4,000	1,500—3,600	2,000—4,000	1,200—2,500
Watts per m.h.-s.c.p. (lower)	0·24—0·17	0·16—0·19*	0·2	0·25—0·3*
Burning hours: single and double lamps	17 & 35	17 & 35	150	110

* With choking coil.

In other words, the half-watt lamp has to compete with a one-fifth watt lamp, so that where current economy is im-

iciency is not, however, everything. The form of the light distribution curve is especially important in exterior lighting, the object being generally to distribute light as uniformly as possible over a wide area—reducing the intensity of illumination on ground near the lamp in order to increase illumination at more remote points between lamps.

The open flame arc with carbons side by side (fig. 5) does not give a good distribution of light, as regards producing uniform illumination over a wide area. Curve 1 (fig. 9) is the Rousseau curve corresponding to that ideal polar dis-

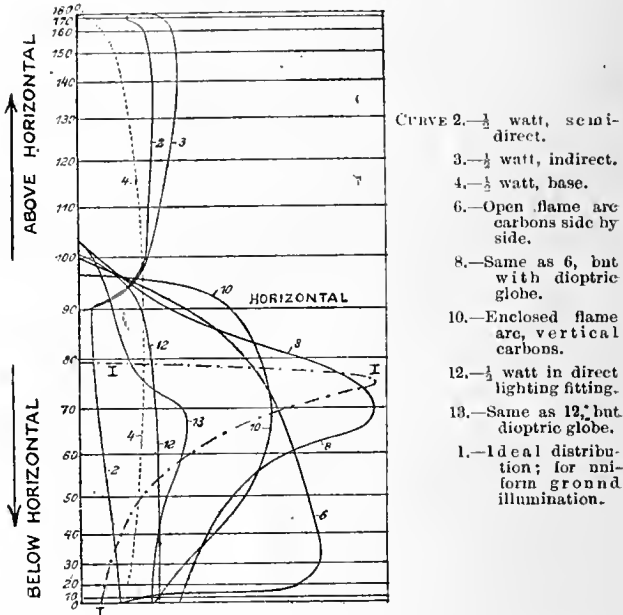


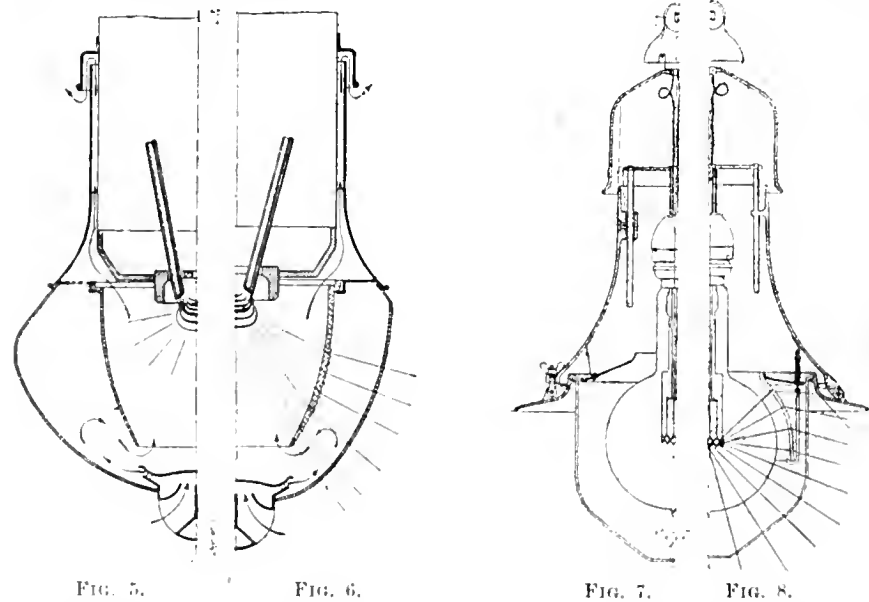
FIG. 9.—ROUSSEAU DIAGRAMS FOR VARIOUS LAMPS.

tribution of light which would give uniform ground illumination. The other curves refer to the several types of lamps specified in the "key" adjoining the figure; each curve is reduced to the basis of 500 watts consumption, including ballast in arc lamps, hence the curves are directly comparable. From curve 6 it will be seen that the type of lamp shown in fig. 5 gives a maximum candle-power at 50° or 60° below the horizontal instead of at about 15°. By the addition of a dioptric globe (fig. 6), the polar distribution is improved immensely, and the corresponding Rousseau curve (No. 8, fig. 9) shows quite good approximation to the ideal form. The long-hour enclosed flame arc with vertical carbons also gives a good distribution of light for wide range illumination (see curve 10, fig. 9).

Fig. 2 shows the polar distribution from a half-watt lamp in a fitting with enamelled shade (fig. 7), and curve 12, fig. 9, is the corresponding Rousseau diagram. This distribution is good from the point of view of lighting workshops, but a greater proportion of light at 15° to 20° below the horizontal and less at 30° to 90° below the horizontal are needed to provide reasonably uniform ground illumination, using lamps relatively far apart. A dioptric globe (fig. 8) may be used to improve the normal distribution of light, and thus to yield the Rousseau curve 13, fig. 9. About 10 per cent. loss is caused in light passing through a dioptric globe, as compared with 50 per cent. loss in diffuse reflection.

It will be seen that curves 8 and 13 (fig. 9) are similar. In other words, there is little to choose between a vertical carbon flame arc and a half-watt lamp (using a dioptric globe in each case), in point of light distribution. The difference lies in the higher efficiency of the flame arc, already noted.

The areas under the various curves in fig. 9 are propor-



portant owing to the cost of current or other reason, the flame arc has an immense initial advantage. Current efficiency.

* "The School Boards: What they Can do, and What they May do." (Critiques and Addresses, pp. 50 and 51.)

tional to the total light emitted by the different lamps, and we have here a very clear graphical representation of the relative efficiencies of the lamps as used in practice.

First Cost and Working Cost.—It is important to fix definitely the relative first cost of equivalent arc and half-watt lamp installations, but the difference is generally small. Individual half-watt lamps and fittings are cheap as compared with arc lamps, but more of the former are required in most cases, and there then comes the extra cost of additional wiring, switches and fuses. Part of the ballast resistance needed by arcs may be provided by using the smallest leads consistent with safe temperature rise. Half-watt lamps connected in parallel must, on the other hand, be provided with comparatively heavy leads, in order that the voltage drop may be small.

Carbon costs and the cost of bulb renewals vary with circumstances, but are generally about equal so long as the half-watt lamp fitting protects the bulb from rain and snow without subjecting it to overheating. Cheap, ill-designed fittings waste more by premature lamp failures in a year than they save in first cost, as compared with good fittings.

Attendance costs are lower for half-watt lamps than for arc lamps, but they are not negligible, for the former need a thorough cleaning once or twice a month. Maintenance costs, apart from the bulb and carbon items already considered, are much lower in a half-watt lamp installation than where arcs are used :—

TABLE II.—TOTAL WORKING COSTS OF FLAME ARC AND HALF-WATT LAMPS.

Assuming 1,760 m.h.-s.c.p. and including interest, depreciation, attendance, maintenance and renewals.

Energy cost per unit.	500 burning hours per annum.		3,000 burning hours per annum.	
	Flame arc.	Half-watt.	Flame arc.	Half-watt.
d.	s. d.	s. d.	s.	s.
0·35	45·0	37·3	171	171
0·7	51·0	51·0	220	270
1·18	60·9	71·6	270	377
1·76	73·6	95·0	343	514
2·35	88·0	119·6	415	660

The figures in Table II compare the total working costs (interest, depreciation, carbon and bulb renewals, attendance, and maintenance) for a flame arc lamp and a half-watt lamp, each of 2,000 hefners hemispherical (1,760 h.-s.c.p.), assuming various prices for energy and 500 and 3,000 working hours per annum. Under some conditions the advantage of lower cost lies with the arc ; under others with the half-watt lamp. So it is also with the general merits. Sometimes it is advantageous to have the more powerful units in which arc lamps are obtainable, the yellow light, well penetrating smoke or steam, and the rugged construction, unaffected by vibration and rough handling. Sometimes the glow lamp is chosen on grounds of more convenient wiring, lighter equipment, and easy maintenance by unskilled persons. If the current be very cheap and/or burning hours short, the glow lamp may show, in addition, a saving of money.

The conclusions indicated by these notes are that the gas-filled tungsten lamp is entirely preferable to arc lamps in lighting small and medium-sized interiors, especially where semi-direct or indirect lighting is practised. For lighting open spaces or large, lofty shops, both flame arc and gas-filled tungsten lamps will continue to be used. In such service, both types of lamps have their advantages and disadvantages, and choice can be made only by consideration of individual circumstances.

Loose Switches.—When Annie E. Hovey, a Scarborough boarding house manageress, was summoned, last week, at the local Court for a lighting offence, she offered the defence that the vibration of the door had caused the electric switches to drop and put on the lights in unoccupied rooms. The police constable said he thought that this was quite likely, as the switches were very loose. He said the bulbs had now been taken off the light fittings. The lady was fined 5s.

INDUSTRIAL CONDITIONS OF TO-DAY.

By "OUTSIDER."

WE notice in one of the week-end papers the formation of a new alliance between employers and employed. The objects in view are stated as follows :—

1. The securing of a living wage.
2. The regulation of the hours of labour.
3. Women to have equal pay with men if work, skill and output are equal.
- 4 (and following). The improvement of working conditions and the increase in output.

During the past few weeks the columns of the REVIEW have shown a renewal of the symptoms of unrest which prevail in the power-station side of the electrical world. This trouble has been stirring for years, and to an outside the conditions imposed by the war would seem to have aggravated it. A quantity of ink is used nowadays in dealing with labour questions in arranging promising schemes for the *rapprochement* of masters and men. The majority of these plans are unfortunately, however, mere in the nature of pious hopes, which it is to be feared will never cut much ice. Strikes and rumours of strikes appear in the Press, and letters of complaint in the technical journals, re the poor prospects of this or that branch of the industry, and in conversation with the man in the street one hears threats of trouble to come after the war. The aims of the new alliance above set out would seem to provide adequately for the worker, whereas the employer only just sneaks in at the finish for an increased output. However a little ventilation of these points will do no harm, and may even save some disappointment. Without confining attention exclusively to the power-station workers, or any one branch, a few notes may be made as to the existing industrial conditions.

Taking the items as they stand, the wage question is, a matter of course, first. It is not easy to-day to define living wage. Wages expand and prices soar in regular alternation. There are those who hold the opinion that wages and prices are engaged in an insane competition, the result of which is not at present clear. Apparently the worker who secures a living wage is the one whose Union is powerful enough to enforce its demands for an incremental step by step with the increase in the prices of life's necessities. The others take their chance among the "also rans." The farm labourer gets 30s. per week, the unskilled factory hand and the semi-skilled a little more or less, according to their job and locality. Skilled people draw all sorts of rates, from three guineas standard upwards, and in places like Sheffield men and boys are paid unheard of wages. The clerical worker contents himself with a war bonus, the amount of which depends sometimes upon a new constant—the extent to which his employer's profits are liable to excess profit tax. We do not cavil at this, but merely mention it by the way. There were, we remember, firms who reduced their salary bill at the outbreak of the war in order to economise ; we wonder if those salaries are still limited and reduced. Apparently power station attendants are not sharing in the big rises. The pay of another State servant—the ordinary Tommy—is grossly unjust, and especially so in the case of one who has risen from the ranks and is without private means. Some workers, therefore, are overpaid and some the opposite. It might not be impossible for one of our enormous new Departments to take the wages question in hand, and to standardise them a little ; this would ensure more equality of treatment than prevails at present. We are all controlled, and the State is the one tribunal which possesses the necessary authority to set the matter upon a proper basis, at least for the duration of the war. Few will quarrel with our opinion we imagine, that the large prices are more due to high wages than the reverse.

The second point, hours of labour, is regulated to-day solely by the grim necessity which war imposes and the shortage of labour intensifies. Most people have to work very long hours, and the consideration of the working day is, therefore, more in the nature of an after-war proposition. The claim for equal pay for the same work as between men

and women is interesting and opportune. Whether our experience is representative or not, it goes to show that as yet women's pay is less than men's pay by at least 25 per cent. Further, signs are not wanting that the intention of employers is to substitute women for men permanently. We have no desire to lay down the law to employers, who are free to train women as they may. At the same time, most of the men so replaced are in the trenches to-day, and as many of them as do return will want work. This points to a reduction in wages some day as a direct result of female competition. The new alliance will score heavily on the side of the men when it secures equality of pay by increasing the woman's wage, yet care may be necessary, or the process will be *vice versa*.

The several remaining points on the list refer to conditions of work and increased output. Output, judged by prevailing standards, would seem to call for no special worry. The war has done more for it than all the Blue-books, technical schools, institute proceedings, and political parties have accomplished in two or three decades. Output is soaring, but conditions of work are bad. Workers jeopardise their fellows' lives by criminal carelessness; strikers still down tools and barter for more money. Thousands of married women workers whose job ends with the war are subject to a weekly deduction on account of unemployment insurance, for which they will get little or no return, because they will not claim it. Employers still advertise for "junior" assistants in large power stations at small wages, when there are no juniors about, save returned disabled soldiers. Men must do this job or that, or go into the Army. Others, with Tribunal influence, are excused service on condition that a munition works receives them. These latter are often of little use, yet others who have been years in the same works have to go, willy-nilly, into the ranks. The presence of an Irish labourer on a farm has sent many a married Englishman into the Army. These are all, as our American Allies say, "some" conditions. The Minister of Labour proposes to establish we know not how many new labour exchanges. More to the purpose would be a systematic visit to our labour centres, in and out of some of the 5,000 controlled works; there he might find food for serious thought. All the eminent speakers skate round the subject most carefully, and exhale pious platitudes. The workers are heart and soul in the war; the pacifist occupies a lonely furrow, but profits and prices are so distended that unrest in some quarters is inevitable. The man in the street is sated with the written homilies which have rained on him lately as to what he must or must not do, while he sees others making their own commandments. It will be taken as a sign of the *bona fide* intentions of the people who talk so much of conditions after the war, if and when a small instalment of reform is instituted in the near future while the war is on.

NOTES FROM CANADA.

(FROM OUR SPECIAL CORRESPONDENT.)

On October 24th, in a small town of some 25,000 inhabitants, named Brantford, in Ontario, a monument was unveiled to commemorate the invention of the telephone by Dr. Alexander Graham Bell. The inventor himself was present, and related how, in the summer of 1871, his discovery was made, in Brantford, apparently owing to much experimental work having been carried out in Boston in those early days, some people have been under the impression that the telephone was actually invented there, but Dr. Bell stated that he was "glad to be able to come home and say that the telephone was invented here" (in Brantford).

The Duke of Devonshire, Governor-General of Canada, un-

veiled the monument, which is described by a daily paper as follows:—

The memorial stands upon an elevation in a small square in the heart of the city. In the centre, in a marble setting, is a great bronze bas-relief symbolising the transmission of sound through space, while mounted upon columns on either side are bronze figures representing humanity in touch. The conception of Walter Allward, the sculptor, is strikingly original, and its execution a remarkable piece of work.

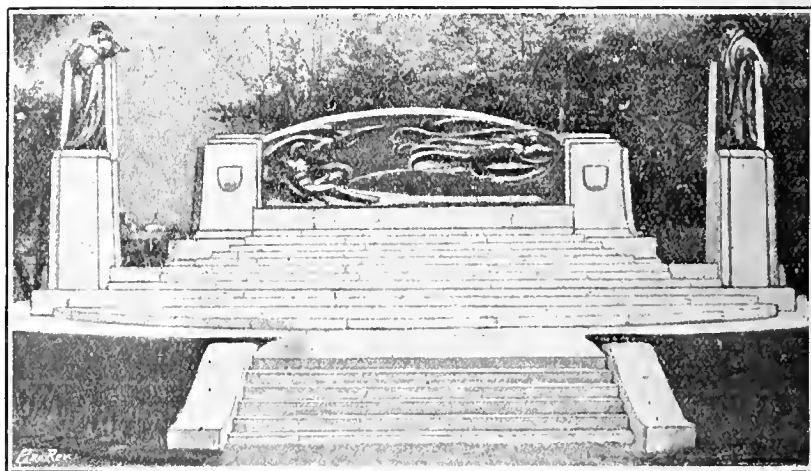
According to *Conservation*, a small monthly bulletin published by the Commission of Conservation, a new Order in Council has recently been passed by the Dominion Government to preserve to the public the ownership of water powers on Dominion lands. This Order provides that, whenever any Dominion lands are disposed of in future, that portion of them necessary for the protection of a water supply or bordering on, or close to a water power, and necessary for its development, will be conveyed only on a year-to-year lease. A provision to this effect is to be inserted in all letters patent. Apparently the Commission of Conservation takes some credit to itself for the passing of this Order.

The demand on Canada's great water powers for the supply of electrical energy is growing very rapidly, in the Provinces of Ontario and Quebec particularly, the war undoubtedly being chiefly responsible.

In Quebec, the Shawinigan Water & Power Co. expects before the end of this year to have 18,000 h.p. additional business. Various large companies taking big blocks of power have very greatly increased their demands; the Carbide Co. alone is said to be taking 10,000 h.p.

A transmission span 5,000 ft. long, with 350-ft. towers, is being erected over the St. Lawrence at Three Rivers. The Southern Canada Power Co. is planning extensions on a very big scale, and various others are proceeding on similar lines. The particular company named intends erecting 88 miles of high-tension transmission lines connecting up a number of cities.

The *Electrical News of Canada* for October 15th last con-



THE TELEPHONE MEMORIAL AT BRANTFORD, ONT.

tains an article by Mr. B. L. Steele, Professor of Physics, State College, Washington, in which the efficiencies of various types of cooking ranges are given. The following are interesting:—

Flame contact burners (kerosene, gas, &c.)	20 p.c. to 35 p.c.
Electric heaters, surface	45 p.c. to 65 p.c.
Electric heaters, enclosed	70 p.c.
Electric heaters, immersion	90 p.c.

Very great care appears to have been taken to account for all factors which would affect the relative results.

In British Columbia there are reports that various companies will spend considerable sums of money on power development. The Kootenay Power Co. intends building a high-tension line to cost about 2½ million dollars, and the Canada Copper Co. will spend a similar amount on work at Copper Mountain.

The power situation in the Province of Ontario is becoming very awkward, due to the immense demand for electric power for munitions purposes. No doubt this demand has been augmented, apart from other causes, by the high price of coal (bituminous coal costs from two and a half to three times as much as before the war), and by last year's actual shortage, when it was almost unobtainable; but this does not alter the fact that the Hydro-Electric Power Commission will this winter be hard put to it to find enough power to go round. Already the Toronto Hydro-Electric Commissioners are advertising in the daily papers requesting people to use as little current as possible, even in their homes, between the hours of 1.30 and 6 in the afternoon.

Sir Adam Beck, the Chairman of the Provincial Commission, is urging the Dominion Government to stop, or largely reduce, the export of electrical energy at Niagara Falls, so as to leave as much as possible available for Canada's own needs, enabling the munitions factories to continue their opera-

tions unhampered by lack of power. Rather naturally, the United States' firms who have been purchasing this power for years, and whose power requirements for war purposes have been increasing very much in the same way as those of Canadian firms, protest against the power being taken from them. What the Dominion Government will do in the matter remains to be seen; at present it is probably a somewhat delicate international question, for both sides appear to be in a position to argue that the power is required for war work.

Another question which is before the Government just now is the application made by a private corporation to build a dam across the St. Lawrence river at Cornwall, Ont., with a view to hydro-electric development. The Commission of Conservation, which has already done much good work in looking after the rights of the Canadian public in respect of water powers, has taken the matter up, and is strongly supported by the Hydro-Electric Power Commission of Ontario.

It may not be generally realised in England that this Commission, in addition to having actually developed two water powers of small size at Wasdell's and Eugenia Falls respectively, and to supplying power from several other moderate-sized plants in the Province which have been taken over, recently took over the entire plant equipment and property of the Ontario Power Co. at Niagara Falls; the Commission is now operating this large station for itself.

The great Chippewa development scheme is also in hand now, preliminary work having been started some little time ago. This scheme involves the building of a canal from Chippewa (above Niagara Falls) to a point near Queenston, some 13 miles in length. By this means, besides getting all the head of water available at the Falls, amounting to about 165 ft., a further 130 ft. or so, due to the difference in level between the foot of the Falls and Queenston, is made available, thus almost doubling the power obtained for each unit quantity of water.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Prohibited Imports.

May we appeal through your columns to all lovers of fair play for assistance and advice?

Your readers know that we have introduced into this country thousands of public-utility devices essential for economy, and of a design not manufactured in this country, but urgently needed at the present time. In spite of the importance of these goods, a total prohibition has been placed on their importation. "Hotpoint" heating and cooking apparatus has not only done, and is doing, good service here, but it is in the unique position of being guaranteed for long periods.

This prohibition is not only on new goods, but on spare parts necessary to enable us to carry out our obligations. Thus, not only is a new business being unnecessarily destroyed, but our good name for straight dealing is jeopardised by this refusal to grant us permission for repair parts to the extent of *even one cubic foot per month*.

How is it that at least two English concerns are still able to continuously advertise American electric vacuum cleaners? These were prohibited in June, 1916; we, the actual American makers, have had none since! Again, import licences have been granted to approved flash-lamp importers for between 25 per cent. and 50 per cent. of their 1916 imports—this, we agree, is valuable merchandise; an unknown proportion go into useful and important service, while an equally unknown proportion are idle toys. Could not some of the tonnage thus wasted be utilised for important coal and labour-saving goods which are not, and never have been, manufactured in sufficient quantities in this country?

Why not have a fair arrangement? Either definitely prohibit all such goods if competent, unbiased authorities advise such a course, and make no exceptions and favour none, or else grant permits for 10 per cent., 20 per cent., or some percentage of previous trading, so that we can all at least exist, and retain our good name, for which we have worked, and of which we are proud.

Hotpoint Electric Heating Co.

L. G. HAWKINS, Manager.

London, W., December 4th, 1917.

P.S.—Expressions of opinion, assistance, and advice from central-station engineers and dealers would be appreciated.

The E.T.U. or the A.E.S.E.?

I have noted for some weeks past that a controversy is proceeding in your columns between the E.T.U. and the A.E.S.E. While some good points have been discussed, the vital point has always been side-stepped, viz., the actual status of the "charge," or "shift" engineer. It must always

be remembered that while an engineer does not wish to be deemed snobbish, at the same time he has to preserve discipline amongst his men, and it cannot be denied that should an engineer join the same society as his men, there are some who would be quite ready to take advantage of it, and so spoil all the good that would otherwise accrue. At the same time, an engineer cannot afford to ignore the men altogether, for it is quite possible for those men to run the job without him, should his society decide to take "industrial action," or whatever other form of attack they decide upon. The only course open to him is to join a society that has a working agreement with that of the men. In my way of thinking, "industrial action" is to a great extent unnecessary, as has been proved since the outbreak of war by the settlement of cases by arbitration, which, though not what we may call absolutely satisfactory, has at least been accomplished without the privations and inconvenience of strikes. Before closing, I should like to endorse Mr. Vincent's letter, in which he practically advocates the fusion of all unions catering for the electrical trade. At present I only know of one union that caters for all grades, and that is the National Amalgamated Union of Enginemen, Firemen, Mechanics, Motormen and Electrical Workers, who represent practically all the generating stations in London.

W. H. Streeter.

London, N.W., December 10th, 1917.

Diesel Engine Fuel.

"Pulveriser's" article, "Diesel Engines and the War," is very timely, and ventilates a real grievance of Diesel engine users.

"Pulveriser" suggests that the present situation in regard to the use of Diesel engines has arisen out of the system whereby each Government Department works in its own water-tight compartment, and is quite oblivious to what is happening beyond its own limited horizon. The facts appear to confirm "Pulveriser's" view. How else are we to reconcile the Creosote Controller's order, dated October 23rd, 1917, limiting the use of tar oil for Diesel engines, with the unofficial hint dropped from an official source about 12 months ago to "adjust your Diesel engines to burn tar oil"? Or the Ministry agreeing, less than six months ago, to munitions concerns extending their existing Diesel engine plant with further Diesel engines?

If the Navy must have all the tar oil in the country, then is it not the Government's duty to ensure a supply of suitable petroleum oil, at reasonable prices, for the Diesel engines already installed? Perhaps they cannot altogether control foreign oil companies, or insist upon English oil companies importing the fuel into the country, but they can at least fix a reasonable figure upon insurance rates for ship and cargo.

A number of contracts made between a large English oil company and sundry Diesel engine users, the contracts dating from 1916, may now have to be modified or cancelled. That, at least, is the oil company's suggestion. They have asked their customers under contract with them to accede to an increase of £5 a ton over and above the contract price "to cover part of the Government insurance rate on ship and cargo." They go on to state that when the contract was entered into insurance rates were a few shillings a ton, whereas now they are 20s. a ton. The oil company have made a bad bargain, and, from the ethical point of view, it is to be regretted that they should write to their customers suggesting modifying or cancelling the contract. But from the commercial point of view, Diesel engine users require to be assured of future supplies, and it is, therefore, desirable that the oil company should not be too hardly hit. The right and graceful thing for the Government to do is to revise the basis of insurance rates, fixing them at the price ruling at about the time when the above-mentioned contracts were made. The method of achieving this is suggested by "Pulveriser," namely, for the various Departments concerned to have a conference on the matter. To settle the fuel-oil problem for Diesel engines, representatives of the following Departments should confer:—

1. Admiralty (Fuel Oil Control).
2. War Office (Recruitment Department and Contracts).
3. Coal.
4. Food.
5. Shipping.
6. Railway Transit.
7. Creosote.

A decision arrived at in this manner would be accepted as fair at least by the majority of Diesel engine users, who would then know that their complaints had received due attention.

Flameplate.

Electricity and Agriculture.

It may be taken as agreed that there is to be a great development in the service that electricity is to yield to agriculture, the only wonder being that so little has been done already.

One of the chief reasons would appear to be the complete lack of intercourse between the two professions, and as a practical suggestion for getting over this difficulty I would propose that the Institution of Electrical Engineers should,

together with the representative societies of agriculture and horticulture, appoint a joint committee whose duty it would be to investigate the problems, and put them in the way of being solved.

It should be the duty of such a committee to arrange inter-society meetings for the reading and discussion of suitable papers, thus bringing into closer intercourse the two interests concerned.

The idea need not be confined to agriculture; as it is, our learned societies work too much in "water-tight compartments," and a closer collaboration would tend to produce greater efficiency all round.

E. S. S.

[Our correspondent is evidently unaware of the existence of the I.M.E.A. Committee on the Development of Electricity in Agricultural Areas, and, in common with others in a similar position, seems to call for more energetic propaganda by the Committee. It may be noted, too, that the Agricultural Committee of the Conjoint Board of Scientific Societies, which is also investigating this matter, is representative of both agriculture and engineering.—EDS. ELEC. REV.]

HEAT ENGINES.

IN the Thomas Hawksley Lecture at the INSTITUTION OF MECHANICAL ENGINEERS, on November 30th, Capt. H. RIALI SANKEY, C.B., R.E., outlined the history of various forms of prime movers. He said that the prevailing commercial custom with the steam engine was to state the number of pounds of steam per I.H.P. or B.H.P. or K.W.-hour, but this led to serious error in the case of engines running with superheated steam, and was contrary to the recommendation of the Committee on Engine and Boiler Trials of the Institution of Civil Engineers in 1897, which adopted the theory of equivalent feed, expressed as follows:—

Equivalent feed = actual feed \times heat required per lb. of steam/11,100.

With low degrees of superheat the error was not very great, but with high degrees of superheat the error was considerable. For example, in a test on a battery of steam turbines of 200 B.H.P. running at 3,000 R.P.M., steam pressure 195 lb., superheat 200° F., and vacuum 28.7 in., the steam consumption given in the ordinary way was 8.5 lb. per B.H.P., but, according to the equivalent feed formula, it was 9.6 lb., an error of 11.5 per cent. In a second case there was an error of 28 per cent. Therefore, the heat economy of steam engines should be quoted in terms of equivalent feed, or preferably, in the number of B.T.H.U. required to produce one I.H.P.-hour.

Reciprocating engines were gradually being replaced by the steam turbine for electric power station work, and to-day the slow-speed reciprocating engine was practically defunct for this purpose.

It was unfortunate that the suggestion by Thwaite, in 1895, to use blast-furnace gas led many engineers to the conclusion that large gas engines generally were practical. They did not recognise the difference between blast-furnace gas and producer gas. The result was that many firms took up the manufacture of gas engines, but had to drop out, so far as the majority were concerned, after losing much money.

The figures of heat economy for steam, gas, and oil engines had shown little improvement of late years. The practical limit had been reached, and there was little, if any, further improvement to be looked for. The best results now obtainable were:—

	B.T.H.U. PER I.H.P.-HOUR.
Steam turbines	11,000
Gas engines	10,600
Diesel engines	7,700

Both gas and oil engines had reached their limit as to size, but the steam turbine could be built in much larger units than had yet been attempted. Therefore, notwithstanding the considerably higher heat economy of gas and oil engines compared with the steam turbine, the latter would hold the field for large units, both for land and marine service, the reason being that it was a true rotary engine, and it would occupy this position until a satisfactory gas turbine was evolved. A few small experimental gas turbines had been built; so far, however, there had been no real progress, the main difficulty being to obtain material for the blading which would withstand the very high temperature of the impinging gas. There was also to be considered the loss due to compression of the combustible mixture of gas and air, which loss greatly reduced the intrinsically higher thermal efficiency of the internal combustion engine so that under the best conditions it was not likely that the practical economy of the gas turbine would be more than a few per cent. better than that of the present gas engine. An experimental gas turbine must be of a very large size, and private enterprise would not be justified in incurring the great capital expenditure which would be necessary. The real object was to utilise the world's fuel supplies—coal, oil and peat—to the best all-round advantage, and to that end increasing attention was being paid to devising means whereby fuel should not be burned to obtain heat until the so-called by-products had been separated. The recovery of by-products would

only be economical in very large plants, and the same might be said of the generation of electricity in this way. Consequently, it might be expected that in the future coal and peat would be gasified in producers of such a character as to recover the maximum amount of by-products, and that the remaining gas would be used for generating electric power. Generally the monetary value of the by-products was greater than that of the heat-producing element of the fuel; hence, when they had been separated, it might be said that the cost of the fuel would be negligible. In fact, it would be the gas which was the by-product. From this it followed that the small percentage of economical gain in the gas turbine would be largely reduced in value. There was, therefore, justification for the conclusion that the gas resulting after the separation of the by-products would be used under boilers for generating steam for driving large turbo-generators.

WATER SUPPLIES AS SOURCES OF POWER.

By CECIL H. ROBERTS, M.Inst.C.E.

(Abstract of paper read before the INSTITUTION OF WATER ENGINEERS.)

MANY waterworks are in a position to generate power from the water before it reaches the service reservoirs, and in some cases, especially in districts far from coal supplies, water power could be generated and supplied at a reasonable cost. Some watersheds are capable of supplying as much as 100 million gallons of water per day from a considerable elevation, and the difference in level between the impounding reservoirs and the service reservoirs varies in different waterworks up to and over 500 ft.

Assuming that the surplus power available between the impounding reservoir and the beginning of the aqueduct amounts to 500 H.P., this could be utilised to operate turbines driving dynamos, and the electric power so generated would be sufficient to provide all the light and power required by a town of considerable size: the revenue obtainable, with very reasonable charges, would be in the neighbourhood of £15,000 per annum, sufficient to warrant a substantial outlay of capital on the necessary works.

A further advantage of combining power plant with upland waterworks lies in the fact that, as storage works on a large scale are often an essential part of a waterworks, a small proportion only of the cost of such works would be chargeable against the power scheme, and the outlay on pressure pipes, which would probably be comparatively short, ought not to be heavy.

A proposal to use for lighting and power purposes the power (about 400 H.P.) available at the Longdendale works of the Manchester Corporation was reported on by Sir Alexander Kennedy as long ago as 1899: although nothing was done at that time, hydro-electric works have since been constructed for utilising some of the power locally by Mr. Holme Lewis, the present water engineer of Manchester. Dr. Deacon, in 1902, described how a portion of the surplus power in the aqueduct of the Vyrnwy Works was utilised at Oswestry to operate "Brotherton" engines. More recently in the Birmingham Waterworks water turbines and dynamos have been installed for using a portion of the power available in the compensation water.

When the difference between the level of the impounding reservoir and that of the town to be supplied is considerable, it may be at times possible, without prohibitive additional cost, to construct the power house at a distance from the impounding reservoir and at a lower level, in order to secure a greater pressure at the turbines and utilise a larger proportion of the potential power. Although such a case might be complicated by compensation questions it would afford some advantages, such as the possibility of taking additional water from neighbouring watersheds, and thereby increasing the capacity of the power plant, and the reduction of cost of the machinery due to the greater head of water. The cost of generating power (the load factor remaining the same) varies inversely with the power and the pressure of water.

In some districts small towns or villages in the neighbourhood of the works could be supplied with electricity in bulk for lighting and power purposes; in other districts, light railways, saw mills, wool pulping, mines, quarries, chemical and other works might be supplied on mutually advantageous terms, and in the future agriculture should also provide a market for electric power; in fact, there should be few districts in which a market could not be obtained or created.

Opposition might be raised in Parliament to the combination of works for the joint supply of water and power, but in view of the national value of cheap power for industrial purposes and the necessity of conserving coal supplies as much as possible, such opposition might not be great.

In the discussion which ensued, Mr. A. J. E. Binnie said that, acting on the instructions of the Ministry of Munitions, his firm last August looked into the question of water-power possibilities. He had come to the conclusion that in this country they had between 200,000 and 300,000 H.P., which could be developed at prices starting at £2 10s. up to about £6 10s. per H.P.-year.

The general trend of the discussion went to show that it was only in the West Highlands that there was anything like sufficient water power available to make the generation of electricity possible on a paying scale in the British Isles, owing to the want of altitude of our water-bearing hills.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Halo" Reflector.

The "HALO" Co., of 7, Exchange Buildings, 6, St. Mary's Gate, Manchester, have placed on the market an easily fitted reflector ring for incandescent lamps, which is employed in the manner shown in fig. 1. The reflector ring is of glass, English-silvered, and provided with three adjustable copper clips to enable it to be fitted to the lamp bulb; it increases the downward light to a

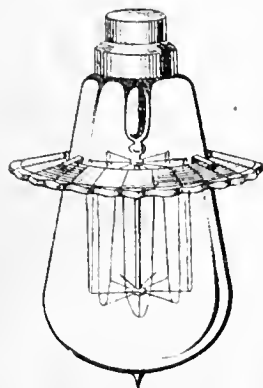


FIG. 1.—"HALO" REFLECTOR IN PLACE.

marked degree, as, indeed, is shown by a National Physical Laboratory test in which it was found that with the reflector there was 24.6 c.p. under the axis as compared with 4 c.p. without it—a 200-volt, 40-watt, ordinary metal filament lamp being used.

The reflector is slipped over the bulb before inserting the latter in the holder, and is shown in the view level with the base of the lamp filament.

A Simple Lock Washer.

In a letter to *Power*, Mr. P. H. GRIGSBY, of Gloucester, Ohio, describes a lock washer which he has used for several years, and which is effective, simple, and easily made. In the illustration A is a slot in the washer, and B is a small hole at the same radius as C, which is a small cone-shaped projection. When used on metal, he says, "place the washer in position and with a centre punch

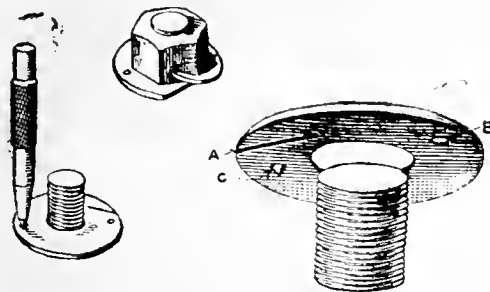


FIG. 2.—LOCK WASHER FOR WOOD OR IRON.

make a depression through hole B, rotate the washer until projection C fits into the centre-punch mark, screw down the nut, and turn up the edge of the washer at slot A, alongside of the nut. When used on wood, no punch mark is necessary. This washer can be cheaply made by a single operation of a punch press."

LEGAL.

TRAMCAR COLLISION CLAIM.

IN Dumbarton Sheriff Court, the Anglo-Swedish Electric Welding Co., Ltd., Glasgow, claimed £302 from the Dumbarton Burgh and County Tramways Co., Ltd. The action was a sequel to a collision between a motor-lorry and a tramcar. The Sheriff decided that the collision was directly due to the fault of the driver of the tramway-car, and found the defenders liable to the pursuers in damages, which he assessed at £266, with expenses.

SOLDIERS' TRAMWAY FARES.

AT the West Riding Court, last week, the Magistrates heard a test case as to travelling facilities for a soldier. The Yorkshire (West Riding) Electric Tramway Co. summoned Corporal Robert Brown, of the Royal Defence Corps, a guard at a neighbouring internment camp, for travelling on a car and refusing to pay full fare. Up to

a few weeks ago soldiers had been allowed to travel at half-fare, but the privilege was withdrawn, and now artisans, mechanics, or daily labourers were the only people allowed to travel at half-fare. Defendant claimed to be a daily labourer as much as any other workman, and said soldiers took it as an insult that they should be excepted because they wore the King's uniform. The case was adjourned for a week for consideration.

GAS LIGHT AND COKE CO. v. HACKNEY BOROUGH COUNCIL.

(Continued from page 537.)

ON December 6th, Mr. A. J. Walter, K.C., continued his address on behalf of the respondents, the Metropolitan Borough of Hackney, in support of the judgment of Mr. Justice Astbury. He said that in the Long Eaton case a power user who took light made his load factor worse, and yet was charged less per unit, though the station was worse off by his taking light, as its plant was used fewer hours each quarter. In Hackney a light user who, for each unit he used for light, had under the scale to use 4 units for power, greatly benefited the station by using the plant for more hours each quarter, and was rightly charged less per unit for his total supply than was charged to a mere light user with his worse load factor. No case had been suggested of unfair discrimination between power users; and, in fact:—

1. On the scale complained of, every power user had the same right of using 20 per cent. of the total supply for lighting.

2. The scale complained of was only available for factories and workshops. If a man used power alone he paid less per unit on his maximum demand scale than the man who used power and light, owing to the automatic working of the load factor.

MR. COLEFAX then replied on behalf of the appellants.

On December 7th, Mr. Colefax concluded his arguments, and their Lordships reserved judgment.

HOLT v. A.E.G. ELECTRIC CO., LTD.

IN this case, to which brief reference was made last week, a settlement was arrived at in the Chancery Division on December 5th, before Mr. Justice Younger.

Mr. Holt claimed salary under an agreement, notwithstanding that he had been called to the Army. The company, which is wound up under an Order of the Board of Trade, under the Trading with the Enemy Act, by its Controller, admitted that this was a case in which a payment might be made, but raised the objection that under Sec. 1, Sub-Sec. 7, of the Act, this action could not be brought without the consent of the Board of Trade.

HIS LORDSHIP directed that the sum agreed upon in Chambers should be paid to the plaintiff in full settlement of his claim, holding that the section relied upon did not preclude the plaintiff from bringing his action without the consent of the Board of Trade.

WAR ITEMS.

Exports to China.—The "London Gazette" for December 11th contains further names of persons and bodies in China to whom exports may be consigned.

Shipbuilding.—The Minister of National Service has issued a special appeal for suitable men employed in non-essential undertakings to take up unskilled work in shipyards. It is considered that men who are doing work that women could do should volunteer, but they must possess the necessary physical strength for work in shipyards.

Trading with the Enemy.—The "London Gazette" for December 7th contains further lists of persons and bodies in the following countries with whom trading is prohibited:—Argentina, Paraguay and Uruguay, Bolivia, Brazil, Chile, Denmark, Greece, Hayti and Dominican Republics, Netherlands, Netherlands East Indies, Norway, Peru, and Spain.

Tungsten Ores.—In the "London Gazette" for December 7th there is printed in full the new Order of the Ministry of Munitions applying Regulation 10A to tungsten ores, molybdenite and metal, and products therefrom, and requiring returns.

Trade Policy.—Last week we quoted a reference by the *Daily Chronicle* to the recommendations of Lord Balfour of Burleigh's Committee on trade after the war. The *Daily Telegraph* understands that there are three documents—a majority report and two minority reports. "One of the minority reports, signed by Lord Faringdon and others, advocates the imposition of an *ad valorem* tariff of 10 per cent. on imported manufactured and semi-manufactured goods, lower duties to be imposed by arrangement with foreign countries. There is a Free Trade minority report, which is against a general tariff. The majority report, which is supported by some of the Free Trade members of the Committee, takes a middle course. It advocates a tariff on imported manufactured and semi-manufactured goods, the maximum to be below 10 per cent. It is believed that the three reports concur in recommending that special steps be taken to preserve key industries, such as aniline dyes and optical glasses. Other industries important to the national well-being, which have been restarted during the war, ought to be preserved from the effects of foreign competition until thoroughly established."

Exemption Applications.—At the request of the National Service Representative, Fulham Tribunal reviewed the certificate of conditional exemption granted to an electrician, 39, married, passed for general service. The respondent said he was engaged in installing electrical plant at a glycerine works on behalf of a Queen Victoria Street firm. Official documents were produced showing that if the certificate was cancelled his retention would be claimed by the Ministry of Munitions. In reply to the Chairman, the man said he worked 11 hours a day seven days a week. The Tribunal decided to make no variation.

The Manbre Saccharine Co., Ltd., opposed an application to the Fulham Tribunal to vary the certificate of conditional exemption granted to an electrician in their employ, aged 39, married, who was granted conditional exemption a year ago. He had charge of the electric lighting and power plant, and was responsible for all fittings and telephones. He had been with the firm for 12 years, and had only one assistant. The machinery was running continuously, and the man frequently had to work all night in addition to his regular work seven days a week. No variation was made.

At Newhaven, temporary exemption was sought by E. Hilton (18), assistant engineer at the Rottingdean electricity works. The engineer (Mr. J. W. Brown) said that there were only himself and Hilton left at the works, and he would be content if the Tribunal allowed exemption until daylight-saving came in force next year, as then he would be able to manage without him. The Tribunal refused the appeal, but Captain Boyne undertook that Hilton should not be called up until March 25th, the Chairman saying that that meant that he would not have to join the Army until 10 days after that date.

An electrician in business in Saltergate appealed to the Chesterfield Tribunal for exemption for an assistant (18, grade 2), but the appeal was rejected.

At Weymouth, Messrs. Brooking & Co., electrical engineers, appealed for H. J. Barrow (31, Class A), wireman. His certificate of conditional exemption has been withdrawn, and he was given temporary exemption until Feb. 28th.

The East Sussex Appeal Court heard an application for extended exemption made by an electrical engineer at Burgess Hill (41, B1). He said that he had sole control of a generating station supplying, among other things, power and light to munition factories, and that he had been urged to undertake further supplies for munition works. Major W. W. Grantham (National Service Representative) submitted that, having regard to the time already given to appellant, arrangements should now be made. The Court allowed three months' open exemption.

At Reigate, an appeal was made for exemption for C. W. Read (36), shift engineer at the Corporation electricity works, on the ground that he was indispensable and in a certified occupation. He was given conditional exemption.

At Windsor, Mr. N. L. Jackson, Stoke Park, applied for exemption for V. H. Froud (37), electrician, and six months' temporary exemption was allowed.

At Chatham, Messrs. Barnard appealed for exemption for H. W. Whittaker (18, grade 3), electrician at the Theatre Royal. Exemption was refused, with 28 days' grace.

BUSINESS NOTES.

Christmas, 1917.—We shall be glad if readers, contributors, and advertisers will note that the greater part of our issue of December 28th will have to go to press some days earlier than usual, owing to the Christmas Holidays. A notice by our advertisement department appears elsewhere in the present issue. We shall be glad if advertisers and contributors will forward their "copy" and manuscript much earlier than usual. New advertisement copy and alterations to existing insertions should be received by Friday morning, December 21st.

New Co-operative Scheme to Develop British Export Trade. Mr. G. C. Mandleberg, chairman and a managing director of Messrs. J. Mandleberg & Co., Ltd., Pendleton, Manchester, has placed before British manufacturers and producers the outline of a scheme on national lines for the direct encouragement and development of the British export trade.

The main proposal is to organise British manufacturers and producers into a body for the specific purpose of securing more orders from overseas. Mr. Mandleberg suggests the formation of a corporation to develop trade in old and more especially in new markets for the mutual benefit of members. The method proposed is to make available for all firms in the new British Manufacturers' Corporation, which is the title suggested, the means which business experience shows to be the most effective in developing foreign trade. This is the employment of representatives abroad, men of first-class ability, and possessing thorough knowledge of the business conditions in the different foreign countries to which they will be appointed, and where they shall be resident. They will be known, it is suggested, as agents-in-charge. They will find and appoint the right men as local selling agents for individual firms, get first news of fresh trade openings, report on the standing of possible customers, and generally superintend the

business interests of all firms in the organisation. The result, it is suggested, would be to give every firm in the organisation the advantages of a branch in many parts of the world without the expense of establishing and maintaining it. Mr. Mandleberg contemplates an organisation of a 1,000 members subscribing £100, or £200 each per annum. With a fund of £100,000, or £200,000 per annum, he suggests, very strong inducements could be offered to likely men to be agents-in-charge. The latter would have adequate staffs of experts to assist them, and a code system could be devised to facilitate prompt communication. Mr. Mandleberg points out that no existing organisation covers this ground, while the scheme would be complementary to the new Government proposals for helping overseas trade. We are informed that the scheme is being widely discussed in Lancashire, and is being actively supported by manufacturers there. It is intended that steps shall shortly be taken to form a provisional Committee, and formulate the scheme in detail.

To electrical manufacturers and traders the argument that only by increased output, as compared to pre-war production, shall we be able to carry the inevitable increased taxation, and maintain increased wages to meet the extra cost of living after the war, is already very familiar. If we are at the same time to quote competitive prices, the cost of production must be reduced by the adoption of the most modern improvements.

The demand for this increased output is to be looked for partly by a larger demand from the home market, and largely by a big expansion of the export trade. As we have urged for many years past, we shall have to find new markets and to intensively encourage the existing ones. For many firms in the electrical trade, especially the smaller ones, this will best be effected by co-operative action either in production or in salesmanship or in both. The electrical industry knows this well enough, and efforts are being made in a number of directions. Probably they would have been far more widely adopted and more energetically pursued had not the uncertainties and prepossessions of war-time imposed a handicap. It has long been recognised that our industry will be most efficiently served by specialised representatives; everybody knows that in the past the general representative dealing in all things in common, with electrical manufactures sandwiched in somewhere or other, has not been a successful British electrical trade-getter. Whether under Mr. Mandleberg's scheme it will be possible to give our large department of specialised technical industry that peculiar representation that it unquestionably requires, will doubtless be answered by electrical manufacturers for themselves. As a general export trade organisation there is doubtless great scope for the proposed British Manufacturers' Corporation, and it may be that some of our smaller firms may find it good policy to investigate the scheme and give it their support. We therefore quote below the main functions which it is intended to perform:—

1. To superintend selling arrangements for every firm in the organisation.
2. To appoint selling agents for individual firms or combinations of firms where agents have not hitherto been appointed.
3. To report, where desired, on the standing of purchasers.
4. To carry out, if desired, any financial arrangements between producers and purchasers where transactions lie outside ordinary business routine.
5. To act in an advisory capacity to members if they need information as to the best methods of securing further trade.
6. To get early information of possible orders and communicate immediately with the local agents of manufacturers concerned. Where no local agents have been appointed, the information could be conveyed to the home manufacturers.
7. To act as legal representative of any firm in the corporation should any dispute over goods arise.
8. For the purpose of facilitating communication between manufacturers and their agents it would probably be desirable to open offices in the chief manufacturing centres here, with a small staff in each. A code system could then be devised as a medium of communication between the home centres and the agents-in-charge everywhere.

The corporation would have as its one and only object the encouragement of direct trade on the lines indicated. It would not be a corporation for the earning of dividends. The entire benefits would go to members. Control could be vested in a board of directors selected with particular reference to their knowledge of the export trade in the various countries.

Siam.—According to a recent official return, the imports of electrical goods and apparatus at the Port of Bangkok during the last fiscal year attained a value of £65,770, as compared with only £31,610 in 1915-16.

Electrical Machinery in British Malaya.—A section of the annual report of the Senior Warden of Mines in the Federated Malay States is devoted to the inspection of electrical plant in use in the country. From the last report, by Mr. W. Eyre Kenny, M.Inst.C.E., it appears that in the F.M.S. alone there were 80 installations of generating plant in 1916, of which 50 were in the State of Perak and 22 in Selangor. The employment was as follows, in kw.:—Mining, 7,918; agricultural, 200; general, 228; Government, 10. In kw. it was allocated as, follows:—Power, 7,936; lighting, 2,865, giving a generating aggregate of 10,801 kw. Government plant was responsible for most of the lighting. The above figures refer only to generating plant driven by prime movers. There is, in addition, motor-generating plant in use of about 400-kw. capacity. The h.p. of motors employed aggregates about 10,250, the increase from the previous year's figure of 9,000 being due mainly to the inclusion in last year's return of auxiliary and converting plant in Kuala Lumpur electric light station. Mr. Eyre Kenny reports that the larger power plants, which are, perforce, controlled by first or second-grade electrical engineers, are, as a rule, kept in good condition; smaller mine-lighting plants, which are generally controlled by native chargemen, supervised by Europeans, who have little or no electrical knowledge, are not so satisfactory.

The statistics of the Imports and Exports Department of the Straits Settlements show that the United Kingdom supplies most

of the electrical machinery and accessories in use in British Malaya. For four years the total value of imports and exports was as follows:—

		Imports.	Exports.
1913	...	£73,978	£8,321
1914	...	50,898	13,046
1915	...	39,690	23,705
1916	...	11,203	21,336

The United Kingdom's share of the 1914 imports amounted to £39,108, Germany's to £13,310, and the United States' to £2,075. The statistics for 1913 are compared below with two war years:—

	1913.	1915.	1916.
United Kingdom ..	£58,415	£39,795	£33,450
Germany ..	9,474	221	—
Denmark ..	973	415	883
Japan ..	827	931	1,784
United States ..	787	1,598	2,310
Italy ..	649	884	1,610
Sweden ..	427	—	—
Austro-Hungary ..	160	—	—
Netherlands ..	184	1,391	580
Hong-Kong ..	—	—	1,198
China ..	—	—	732

The only figures calling for special mention in the above table are those of the Netherlands, which suggest that possibly German exports found a way out through Dutch ports. It is easy to understand how the United States and Japan have been able to expand their markets in the Far East during the present upheaval in Europe; but the statistics for Hong-Kong and China are less easy to explain, unless it be that the enterprising engineering firms of Hong-Kong and Shanghai have carried their enterprise into new fields of manufacture. More likely this is a transit trade of which the original port of shipment is lost for statistical purposes. To anyone unacquainted with the trade of the Straits Settlements ports, the proportion of exports may appear high. As a matter of fact, only a small proportion of the exports leave the Malay Peninsula for Siam and the Dutch Indies, most of the goods being exported by rail to the hinterland provided by the Federated Malay States, which took £6,195 in 1913, £19,921 in 1915, and £13,871 in 1916. In the latter year, the un-Federated Malay States took electrical machinery and accessories valued at £3,470, and as the Malay Peninsula is being rapidly opened up by railway and road communication, there should be a growing demand for machinery of all sorts in this region after the war.

Catalogues and Lists.—BRITISH THOMSON-HOUSTON CO., LTD., 77, Upper Thames Street, London, E.C. 4.—76-page illustrated catalogue of wiring installation accessories, covering their standard types of material in general use, such as lampholders, switches, wall plugs, ceiling roses, cut-outs, distribution boards, fuse boxes, wood blocks, insulators, &c. The list is conveniently arranged in five sections, each dealing with a particular type of accessories. The outer half of each page is given up to the illustrations, and the inner to descriptive and other details of the devices. No prices are included in the list, owing to the price fluctuations in this class of material under war conditions; but the company issues regular monthly quotations on such material. Among the lines of particular interest in the list are:—New line of porcelain type Goliath-Elison screw lampholders designed to comply with the requirements of the Admiralty and other Government Departments; new substantial designs of brass-cased Goliath holders; standard bayonet and Edison screw holders, in both porcelain and brass case types; the "Quiklok" cover ceiling rose, which can be wired on the bench and secured in position on the ceiling by a quarter turn of the wrist; the B.T.H. interlocking switch plug; also a line of new pattern distribution fuse boards and a new range of insulators.

MESSRS. ALFRED HERBERT, LTD., Coventry.—Illustrated postal card showing their First-Aid Cabinets for factories.

BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—Twenty-page descriptive list (No. 2,180), giving full details with illustrations, tabulated data, dimensions, and shipping particulars, respecting their vertical spindle induction motors.

Book Notices.—*The Inspection of Screw Gauges for Munitions of War.* By H. J. Bingham Powell, M.Inst.C.E.—We have received this pamphlet from the author, the Inspector in Charge, Department of Gauges and Standards, British Ministry of Munitions of War in the United States; it was written to assist gauge makers and manufacturers of munitions of war in acquiring accurate gauges, by standardising their own methods of inspection. While this question is of vital importance, it is an exceedingly difficult one, and has occupied the attention of a number of experts of the highest standing for some years past, especially since the outbreak of war. The author describes various methods of accurately measuring the pitch of screws, including a machine devised by himself, and deals also with the measurement of the three diameters of the threads of plug and ring screw gauges. The pamphlet will prove of great interest and utility to all manufacturers whose work involves the production of screw gauges accurate within very narrow limits.

We have received a copy of the *Skyscraper*, the magazine of the London Electrical Engineers (R.E.T.), a production which should take high rank amongst the many publications of the same type which have been established during the war. The December issue is accompanied by a coloured card of Christmas greetings, appropriately illustrated with a display of searchlight beams and an anti-aircraft gun, designed by Sapper Broad; with this issue the first year of publication is completed, and we note that the Editors, who, for obvious reasons, had hoped it would be the last, are now prepared to carry on for another year. The magazine is full of good stuff,

including humorous anecdotes and sketches of life on active service ("by the sea"), short stories, an essay on "Charles Dickens and Music," chess problems and puzzles, &c. It is admirably produced, and reflects great credit on the literary and artistic abilities of the staff.

"Telegraph Practice." By J. Lee. London: Longmans, Green, and Co. Price 2s. 6d. net.

"Telephone Troubles." By W. H. Hyde. London: S. Rentell and Co. Price 7d. net.

Calendars for 1918.—MESSRS. J. HOPKINSON & CO., LTD., of Britannia Works, Huddersfield, have sent us a useful wall calendar. The design consists of a large sectional view of one of the firm's valves with a block of daily date slips based thereon, while at the sides there is neatly inset in small type a complete calendar for the year.

Social.—A successful social evening, in aid of local war charities, was held by the employees at the Phoenix Dynamo Manufacturing Co., Ltd., Bradford, and their friends, last Saturday, at a new canteen on the works. Mr. Pybus, the managing director, presided.

Anglo-Italian Trade.—The British Italian Commercial Association (Inc.) has been registered to promote the extension and development of mutual trade and economic relations between the British Empire and Italy, to collect and circulate statistics and commercial information, &c. The first directors are Mr. R. Benson, Mr. J. W. B. Pease, Sir Francis Barker, Sir Chas. L. Ottley, Sir Algernon Firth, Sir Hy. Babington Smith, and Mr. G. P. Harben (Commissioner for Italy). Secretary, Mr. J. F. Rose, 5, Victoria Street, S.W. 1.

Prices Increased.—THE STERLING TELEPHONE AND ELECTRIC CO., LTD., announce that owing to the continued advance in wages and manufacturing costs generally, they have further increased their prices. All prices in their catalogue are plus 80 per cent. advance, with the exception of switchboards and accessories thereof and C.B. switchboards, which are plus 100 per cent. advance. The advance dates from Monday last.

Liquidations.—MORRIS & WITHAM, LTD., 9, Southampton Street, Holborn, W.C.—Under a compulsory winding-up order made last October, accounts have been lodged showing gross liabilities £3,483, of which £2,159 is expected to rank against assets valued at £1,387. The deficiency to the contributories is estimated at £1,774. According to the Official Receiver's report, the company is interested in various inventions and applications for patents relating to metal-filament electric lamps, in conjunction with the late Mr. J. A. Allison; sums amounting to £89 appear to have been expended thereon, but the company's interest is valued in the statement at £50. The failure of the company is attributed to the guarantee by it of payment of an engineering company's debts.

NATIONAL PROVINCIAL ELECTRICITY CORPORATION, LTD.—A meeting of creditors is called for December 20th, at Balfour House, Finsbury Pavement, E.C. 2. Mr. S. Gillatt, liquidator.

KINGSTON & CO., LTD., Margate.—A statement of affairs issued by the liquidator (Mr. John W. Scarlett) shows a deficiency of £407. It was submitted to the meeting held last week.

INVICTA ENGINEERING CO., LTD.—Creditors must send particulars of their debts, &c., to the liquidator, Mr. F. C. Harper, 27, Chancery Lane, W.C., by December 25th.

Bankruptcy Proceedings.—SAMUEL STEPHEN COSTER, electrical, &c., engineer, who had traded at 14, Gladstone Road, West Ham, under the style of S. S. Coster & Co.—The public examination was held last week, at the London Bankruptcy Court, before Mr. Registrar Hope. The accounts showed liabilities £670, and assets, "bad book debts, £490." Questioned by Mr. E. Leadham Hough, Senior Official Receiver, the debtor said he began business in August, 1908, with a capital of £150, in partnership with one Roscoe, at 141, Bishopsgate Street, E.C. The business was not a success, and was abandoned 10 months later, all the debts being paid in full. He subsequently started a similar business alone, but used the trading style of S. S. Coster & Co. The bankrupt was examined at considerable length regarding certain purchases made by him, and eventually Mr. Hough observed, "I suggest to you that you have been carrying on what was practically a long-firm fraud by misrepresenting your status in order to obtain credit." The bankrupt denied having done anything of the sort. He was ordered to furnish cash and goods accounts, and the sitting was adjourned till January 23rd.

Auction Sale.—By order of the liquidator, Mr. J. Holmes will sell by auction, at Margate, on Thursday, December 18th, the electrical plant and stock-in-trade of Kingston & Co., Grotto Gardens (in voluntary liquidation). For particulars see our advertising pages to-day.

Trade Announcement.—Messrs. David Bone & Co., of Glasgow, announce that, owing to the new Government Act regarding the registration of business names, they have altered the firm name to DAVID BONE & JOHN McNICOL, but the constitution of the firm is unaltered.

Argentine Republic.—The imports of electrical goods into the Argentine Republic during the six months ending with June last attained a value of only £298,000, as compared with £353,000 in the corresponding six months of 1916.

Italy.—A new company has lately been formed in Rome with a capital of £160,000 and the title La Società Italiana Carboni Elettrici.

LIGHTING AND POWER NOTES.

Atherton.—The electrical engineer reports that there is a growing demand for electrical fires in the district, and a number of these have already been connected to the supply.

Ballymoney.—The Council has requested Mr. J. McClenaghan, of the Portstewart Electric Supply Co. and the Ballymoney Gas Co., to submit a scheme for the lighting of the town. Mr. McClenaghan had asked permission to erect poles for street lighting.

Batley.—PRICE INCREASE.—The T.C., last week, approved the minutes of the Electricity Committee containing an increase in charges for current for power and heating by 27½ per cent. on pre-war rates.

Birkenhead.—WAGES.—The agreement between Wallasey and Birkenhead Councils respecting the wages and conditions of labour of the employés at the respective Corporation electricity works, has been terminated by mutual consent.

Blackburn.—The Corporation has appointed a special Sub-Committee to deal with the question of the necessity of proceeding with the work of constructing the new generating station at Whitebirk.

Bootle.—EXTENSIONS.—The T.C. has agreed to an amended scheme for the provision of additional plant, at an estimated cost of £80,000, subject to the approval of the authorities.

Burton-on-Trent.—PLANT EXTENSION.—Subject to the usual consents, a scheme is to be carried out for electricity extensions at a cost of £42,290. The items which make up this total are as follow:—Turbo-alternator, £19,500; foundation for turbo, £2,000; Babcock & Wilcox boilers, complete with chimney, £9,640; settings, £800; stokers, £2,400; steam pipes, &c., £1,600; switchgear, £3,850; excavating and laying main, £1,500; alteration to roof, £1,000.

Clayton.—PROVISIONAL ORDER.—The U.D.C. has now decided to apply for its own Provisional Order for electric supply.

Cavan.—WORKHOUSE LIGHTING.—In connection with the electric lighting scheme for the workhouse, the engineer estimated the cost of plant at £529, and the clerk said the price of a 27-H.P. plant offered him was £710. It was intimated that a second-hand plant available at Sheffield at £315 might suit, and it was decided that it should be inspected.

Cork.—The Corporation has accepted the services of Mr. J. P. Tierney, of Dublin, to report on the city electric lighting plant.

Dartford.—PRICE INCREASE.—In order to meet the increase of 2s. 6d. per ton on the price of coal, the U.D.C. has increased the price of current for lighting, as from the end of the year, by 10 per cent., making a total advance on pre-war rates of 40 per cent., and for power by 10 per cent., a total rise of 45 per cent.

Darwen.—PRICE INCREASE.—The price of electricity has been increased by 10 per cent., both for motive power and lighting purposes.

Dublin.—WORKING CAPITAL.—The Corporation has adopted a recommendation of the town clerk and the city treasurer that steps be taken to secure legislation to enable the Electricity Supply Committee to borrow for working capital. An amendment for postponement until the report of the electricity undertaking for the period to March, 1916, was in the hands of the members, was rejected by 26 votes to 9.

Mr. J. J. O'Neill, in moving the resolution, said that they had been in debt to the bank £40,000 or £45,000 for the past seven years, but they had had a loan to credit. For the past four years they had borrowed no money, for their borrowing powers were exhausted. The loan being also exhausted, it was natural that the bank should feel uneasy when the £40,000 was owing and no interest payable.

Mr. Ryan said the proposal was one of the most pernicious ever heard in the Council Chamber. The Committee asked to be permitted to pay interest on an overdraft of about £50,000. He did not think the Corporation should have power to pay interest on overdrafts at the bank while money was due to the concern by consumers of current. Why were their debts not collected?

Mr. Foley pointed out that there was a deficit of £52,000 on March 31st, and urged that the Council should have before it the difference between current accounts and the amount of overdue accounts.

Mr. Sherlock said the Committee wanted to borrow money to pay wages and other charges pending the period when the consumers' accounts were paid in. The money had been got from the bank for years; but the bank now said it could not advance the money without interest being paid. The Corporation's experts told them it would be necessary to borrow £50,000 at 5 per cent. Every Corporation in the kingdom had power to pay interest on overdrafts to bankers. He mentioned Edinburgh, Glasgow, Aberdeen, Leeds, Dundee, Rathfriland, and other places where electricity had been making a profit in 1911, but where there were now losses, and said an undertaking like their own, which was able to meet increased charges and involve a loss of only £1,600 a year, was one of which they ought to be proud.

Mr. Beattie expressed regret that Mr. D'Alton's expert report on the undertaking had not been adopted. He designated the concern as a miserable failure, and argued that unless there was a complete change of management things would go from bad to worse.

Alderman Quaid said he could not see why the undertaking should be a failure, in view of the way in which it was advantaged.

Mr. Foley said it was unreasonable that £52,000 should be allowed to remain outstanding in one year. He then moved the amendment, which was defeated.

The Dublin Citizens' Association Executive has passed a resolution viewing with alarm the bank overdraft of £50,000 on the electricity undertaking, and protesting against the Corporation seeking powers to pay interest on the overdraft.

Dundee.—In connection with the reference to a Committee of the T.C. of the extension of the electricity department, Mr. Paton moved that the Committee be also instructed to take into consideration the conservation of the national coal supply at present being considered. The proposal was agreed to.

Felixstowe.—PROPOSED E.L. PURCHASE.—The Lighting Committee reports that it is of opinion that the Council should consider the question of taking over the electricity undertaking under the powers contained in the agreement, which was for a term of 25 years from November 11th, 1904, at the end of which the company was to hand the undertaking over; in the meanwhile, with the sanction of the L.G.B., the Council had to provide the capital required for extension. In the event of the Council taking it over at the end of 15 years, it had undertaken to pay to the company a sum of 2½ per cent. per annum, in respect of the unexpired 10 years, on the capital provided by the Council to November, 1919. Up to date the Council had provided £30,000, and 2½ per cent. on that was £7,500. In addition, there was some equipment which might be bought by the Council if it could agree to a price, and which would amount to about £2,000. The Council would have to borrow the money to buy the company out; the preparation and presentation of the case would cost about £500. It was decided to prepare the case for an application to be made to the L.G.B. for sanction to borrow the necessary money.—*East Anglian Times*.

Gloucester.—PROPOSED LOAN.—Subject to approval, the T.C. has decided to apply to the L.G.B. for a loan of £350 for cable extensions to a local works.

Hornsey.—PRICE INCREASE.—The Council has decided that, as from the readings of the meters at the end of the Christmas (1917) quarter, the prices to be charged for electricity for lighting and power shall be increased by the addition of an amount equal to 40 per cent. of the prices charged on August, 1914; and that from January 1st next the increase of 25 per cent. on the meter rents be withdrawn.

Kirkcaldy.—PRICE INCREASE.—The Electric Lighting and Tramway Committee has decided to increase the charges for lighting and power by 25 per cent., being a total increase of 50 per cent. on pre-war prices.

Leeds.—WAR BONUS.—The General Purposes Committee has agreed to advance the war bonus of Corporation employés from 9s. to 15s. per week for men and to 12s. for women, those affected being persons in receipt of not more than £250 per year, and excluding certain members of Trade Unions with whom other negotiations have been completed.

Littleborough.—The suggested alteration of the supply of current to the Littleborough section of the Rochdale Corporation tramways has been approved by the Controller of Electric Power Supply, but he has now intimated that he cannot grant facilities for obtaining cable at the present time. The chairman and engineer are engaged in trying to secure second-hand cable for the purpose.

Liverpool.—LOAN SANCTION.—The City Council has received the consent of the L.G.B. to the borrowing of £52,000 for mains in the Aintree and North End districts.

London.—ISLINGTON.—The Electricity Committee recommends that, commencing with the March quarter accounts, the charges for electricity be increased as follows:—50 per cent. increase above pre-war prices for all energy supplied at 1d. and under per unit; 33½ per cent. increase above pre-war prices for all energy supplied to private consumers at any charge above 1d. per unit; charges for public lighting to be increased from 1'54d. to 1'3d. per unit.

The City of London E.L. Co. announces a further 10 per cent. increase in electricity charges, from March, 1918, making a total of 30 per cent. for power and 20 per cent. for lighting and heating on pre-war rates.

STEPNEY.—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking for the year ended March 31st last show a total income of £131,867, being an increase of £30,336 over the previous year. The total expenditure amounted to £94,710, an increase on 1916 of £25,421; this left a surplus of £40,156 to be carried to net revenue account, as compared with £35,242 in 1916, and after providing for interest, sinking fund and other charges, there was a deficit of £3,581, as compared with a deficit of £5,864 in the previous year. There has been an increase in the number of units sold from 21,971,891 to 27,011,530, the output being as follows:—Private lighting, 4,319,893 units; power and heating, 10,873,362 units; in bulk for lighting, power and heating, 5,316,376 units; public bulk supply, 6,292,676 units; public lighting, 179,223 units; the total average cost per unit sold was 1'232d., as against 1'055d. in the previous year.

The engineer, Mr. W. C. P. Tapper, in his report states that coal cost 3s. 8d. per ton more than in 1915-16, which, on the year's consumption of 53,630 tons, represented an increased expenditure on this item alone of £9,382; he also points out that the coal bill is enhanced by between 3s. and 4s. per ton due to the fact that all the coal is now rail borne, as a result of the stoppage of supplies by sea, thus entailing extra cost in taking to the Poplar Dock and barging to Limehouse; this represents from £8,000 to £10,000 per annum.

As regards the deficit, which has been transferred to the reserve fund, unless the existing 50 per cent. advance in charges proves sufficient to avoid any further drain on the fund, a complete revision of the Council's tariff will be essential.

L.C.C.—The Finance Committee recommends the sanction of the Council to the borrowing of £38,555 by the Battersea B.C. for a 5,000-kw. turbo-generator and 1,500-kw. rotary converter.

Loughborough.—PRICE INCREASE.—The T.C. has decided to increase the cost of electricity for power by 10 per cent. Alderman Bumps, moving the resolution, said the increase was necessitated by the extra cost of coal and wages; the revenue account showed that the output of current had increased by over 80 per cent.; the income had increased for the half-year from £3,141 to £5,645, but the charges had also increased by £1,880. The profit had increased from £527 to £1,142; repairs had cost £633. He considered they might look forward to a satisfactory financial return at the end of the year.—*Nottingham Guardian*.

Lurgan.—The Council has referred to a Committee the question of providing electric light at the waterworks, Castor Bay.

Manchester.—PRICE INCREASE.—The City Council has approved the Electricity Committee's proposal that an advance of 20 per cent. be made on the charges for electricity for lighting, industrial power, and domestic power as from the December quarter, 1917. The total war additions are now:—Lighting, 30 per cent.; industrial power, 35 per cent.; and domestic power, 30 per cent.

Monaghan.—WORKHOUSE LIGHTING.—On the B. of G. discussing the lighting of the workhouse, a member remarked that but for the high prices of material they would have had the electric light long ago.

Menston.—E.L. PROPOSALS.—A meeting of the rate-payers is to be called to discuss the terms on which the Electrical Distribution of Yorkshire, Ltd., is prepared to supply electricity to the village.

Nelson.—STREET LIGHTING.—Owing to present conditions, the Electricity and Tramways Committee has declined to consider the question of street lighting by electricity from the tramway standards.

Newcastle-under-Lyme.—BULK SUPPLY.—The Council has decided to submit particulars of the scheme (as submitted by the electrical engineer) for taking a bulk supply of electricity from the Stoke-on-Trent Corporation, to the Ministry of Munitions, the B. of T., and the L.G.B., for their approval, after the same has been submitted and approved by the Stoke-on-Trent Council.

The engineer's proposal for bulk supply was to install a 150-kw. rotary or motor-converter, costing roughly £1,200; mains, 1,325 yards, £1,200; E.H.T. and L.T. switchgear, £400; contingencies, £200; making a total of £3,000. He pointed out that the saving in cost of generation would be more than sufficient to pay interest and sinking fund on the capital expended, as the present fuel cost was nearly 3d. per unit; also that additional plant would be required shortly to deal with the load in the recently extended borough area.

Oldham.—PRICE INCREASE.—The Corporation has decided that, as from December 25th, and until further notice, the prices of electrical energy will be increased as follows:—(a) All lighting rates (with the exception of the flat rate), increase of 15 per cent.; (b) all power, heating, and cooking rates (with the exception of cotton mills under agreement), increase of 15 per cent.

Rochdale.—The Corporation has declined an application from the Todmorden Corporation for a bulk supply of electricity, owing to no surplus plant being available.

Rotherham.—SUPPLY DEVELOPMENTS.—The Electricity and Tramways Committee has approved of a report of a joint conference of representatives of Sheffield and Rotherham Corporations that it is desirable that a Committee should be formed, consisting of representatives of the Sheffield and Rotherham Corporations and other authorities interested, and large consumers of electric current, to consider as to the propriety and possibility of the best and most economical production and distribution of electric current in the Sheffield, Rotherham, and surrounding district, and that at the earliest practicable stage in the proceedings the Yorkshire Electric Power Co. and the South Yorkshire colliery proprietors should be brought into consultation.

Sheffield.—Representatives of the Corporation have been appointed on a Joint Committee to consider the question of electricity supply in Sheffield, Rotherham, and adjacent districts. It has been decided to accept an offer received from the North Metropolitan Electric Power Supply Co. to purchase the power factor rectifier now installed at the Sheaf Street station.

South Africa.—A scheme for the electric lighting of Untali, Rhodesia, has been prepared, and in view of a large flow of water existing in the locality, it is thought that power also will be generated.—*British South Africa Gazette*.

Southampton.—PRICE INCREASE.—The T.C. has further increased the charge for energy for lighting, power, and heating by 20 per cent. as from the meter readings for the December quarter, making a total advance on the pre-war rates of 10 per cent.

Stafford.—PRICE INCREASE.—The T.C. has agreed to a recommendation that the price of electricity should be increased by 3d. per unit for lighting and power, with the same discounts as at present, except that the consumers for power not exceeding 200 units per quarter be returned a discount of 5 per cent. instead of 2½ per cent., and that such increase should take effect from the last reading of the meters during the current quarter.

Wallasey.—BULK SUPPLY.—The T.C. has undertaken to supply electrical energy in bulk to the Hoylake and West Kirby District Council under the B. of T. scheme.

Walsall.—SALE OF PLANT.—In connection with the disposal of old plant, the Council has sold two 500-kw. generators for £6,000; two D.C. generator sets, a condensing plant, and a boiler with stoker for £900; and two economisers and a pump for £598. It is estimated that on the present year's output, the saving in working costs at Birchills compared with the old working costs will be approximately £10,000. A 200-kw. transformer is to be purchased at an estimated cost of £250, and a motor vehicle for the department, at a cost not exceeding £200. The South Staffordshire Tramways (Lessee) Co., Ltd., has agreed to pay an increased charge of 40 per cent. for a temporary additional supply of current given to it, and also to pay a similar advance for the present supply.

Warrington.—PRICE INCREASE.—The Corporation has confirmed the proposal to increase the price of electrical energy for all purposes by 10 per cent. from January 1st next.

Watford.—LOAN APPLICATION, &c.—The U.D.C. has applied to the L.G.B. for a loan of £780 for E.L. purposes. The charge for energy for lighting has been advanced by 3d. per unit, that for power from 10 to 20 per cent., and the existing prepayment meter rental of 1d. per week raised to 2d., from the end of the December quarter. No extra charge is to be made for public lighting.

Wolverhampton.—PROPOSED LOAN.—Application is to be made to the L.G.B. for sanction to a loan of £1,800, being the difference between the estimated cost of additional converter plant and the estimated amount to be received on account of the sale of the last two of the old reciprocating sets. The engineer has also been authorised to purchase not more than three additional canal boats for the conveyance of coal.

TRAMWAY AND RAILWAY NOTES.

Bradford.—A record of accidents to Corporation work-people during the past year shows 276 of all kinds, of which 15 have proved fatal. The department which heads the list is, not unnaturally the tramways, which has experienced a hundred mishaps. The gas department comes next. The total number for the year is above the average.

Continental.—SWITZERLAND.—According to the financial Press, the figures of the Swiss Budget for the year 1918 have now been published, and it has been agreed to push forward the electrification schemes of the Gothard Railway, for which a credit of 12 million francs is sanctioned. The power stations at Ritom and Amsteg are in course of erection, and work on the section Erstfeld-Bellinzona is in progress.

Glasgow.—ACCIDENT.—Last week a double-deck car overturned, after leaving the track at a sharp corner. The car was crowded, and two persons were killed and 30 injured, one of whom has since succumbed to his injuries.

Kirkcaldy.—It is proposed to link up Kirkcaldy, Kinghorn, Burntisland, and Rosyth by tramway.

Lancashire.—CHRISTMAS DAY SERVICES.—No agreement has yet been arrived at in regard to the tramway service in Manchester and Salford on Christmas Day, though further meetings are to be held this week. The Manchester cars carried half a million passengers last Christmas Day. The Wigan T.C. has decided to suspend its service, in view of the excessive hours worked by employes since the outbreak of war.

Lancashire and Cheshire Wages.—It is stated that an application for still another war bonus will shortly be made by all sections of tramway workers throughout Lancashire and Cheshire. The amount asked for will be 10s. a week, in addition to what is being already paid.

Leeds.—PARCELS DELIVERY.—The Tramways Committee, in response to a request from the Government officials who have charge of the scheme for the co-ordination of road transport that more use should be made of the tramways for the conveyance

of parcels, has appointed a small Sub-Committee to investigate the matter and report to the Committee. At present the tramways do not specially cater for the carriage of parcels, the reasons being that the passenger traffic has been sufficiently lucrative and the desire not to compete with the local carriers. The modified system in operation provides for the carriage of parcels up to half a hundredweight from the city to any part of the system. There is, however, no collection of parcels for delivery in the city except on the condition that such parcels will be called for at the central tramway offices. The main difficulties in the way of an extension of the system are the labour shortage and the problem of distribution, collection, loading, and delivery, constituting a much greater problem than the actual carriage of the goods. The railway companies operating in the city have restricted their areas of delivery during the war.

Manchester.—**REVISED FARES.**—The revised scale of fares on the Corporation tramways comes into operation on December 16th. On some routes there is no alteration, but generally about 640 yards have been taken off the 1d. stages on the main routes. As the average length of the 1d. stage on the principal routes will be 2 miles 757 yards, the Manchester service will still be amongst the cheapest in the country. At the City Council meeting an amendment to refer the matter back was lost, it being pointed out that increased fares were inevitable if the department was to meet the added cost of working.

Rochdale.—The lighting of the tramway routes by lamps from the tramway standards has led to application for similar privileges from the Whitworth, Littleborough, Milnrow and Norden District Councils. The Tramways Committee has granted the concession, subject to proper safeguards, and at the payment of 21d. per 100-watt lamp per hour, the work of erection and maintenance to be done at the District Council's expense. The Electricity Committee charges the tramway department 21d. per unit for these special lighting supplies—double the ordinary tramway traction price.

Stoke-on-Trent.—The local branch of the Amalgamated Association of Tramway and Vehicle Workers has asked for a standard rate of wages for all grades of labour, a maximum week of 48 hours, with overtime at time-and-a-half, and a fortnight's holiday, with pay, after 12 months' service.

Wigan.—At the T.C. meeting recently, it was stated that it had been found that the L.C.C. cars which had been offered to augment the local services were unsuitable. A deputation had interviewed the authorities, and Mr. McElroy, on behalf of the latter, had visited Wigan, and obtained information as to the local position, and the matter of additional rolling stock was now in the hands of the Tramway Control Committee.

TELEGRAPH AND TELEPHONE NOTES.

Batley.—Six Heckwoldwike youths were summoned at Batley, last week, for throwing stones at telegraph insulators. Ten insulators were broken. The eldest, a lad of 21, was fined £1, and 3s. costs, and the others had to pay 13s. each.

China.—An agreement has been drawn up and is awaiting the Chinese President's approval between a Chinese and a syndicate described as Danish, by which China grants wireless telegraph rights. The *North Mail's* Peking correspondent fears that the German Telefunken Co. is interested financially and politically.—*Daily Mail*.

Dutch Indies.—The Dutch Government has asked for a credit of five million florins for the erection of a wireless station for communication between Holland and the Dutch Indies. The work will be executed by the Telefunken Co., of Berlin. The receiving installation will be ready in three months, and the sending installation in 18 months.

Long-Distance Telephony.—San Francisco papers announce the invention of a new device for the clear transmission of the voice over practically unlimited distances on surface wires or submarine cables by Dr. S. N. Barnuch of that city. Experiments have been carried out over wires and cables of lengths varying from 30 to 100 miles and over experimental artificial lines up to distances equal to 3,000 miles, and have given such positive results that engineers of the Government and of two large public utility corporations have interested themselves in the invention. According to Dr. Barnuch, his system makes repeaters unnecessary.—*Telephone Engineer*.

United States.—Terms have been settled between the United States Government and the Marconi Wireless Telegraph Co. of America with regard to the remuneration and compensation to be paid to the company in respect of all the company's wireless stations.

CONTRACTS OPEN AND CLOSED.

OPEN.

Argentina.—February 23rd 1918. Rosario Municipality. Establishment of telephone service within the municipal radius. Conditions on application.

Bolton.—January 15th. Electricity Committee. One 7,500-kw. turbo-alternator with condensing plant. See "Official Notices" December 7th.

Brighton.—December 18th. Electrical fittings for the B. of G.: Mr. Horace Burfield, Clerk, Prince's Street.

Spain.—The municipal authorities of Pruna (Province of Seville) have lately invited tenders for the concession for the electric lighting of the town.

CLOSED.

Bolton.—Electricity Committee. Accepted tender: Messrs. G. & J. Weir, Ltd., for a steam turbine feed pump for the Baek-o'-th'-Bank generating station.

Glasgow.—The Tramways Committee has recommended acceptance of the following offers:—

250 steel tires.—H. Bessemer & Co., Ltd.
500 Brown Bayley's Steel Works Ltd.
Oils.—Blacklock & Macarthur, Ltd.; Marks & Johnson, Ltd.; J. & D. Hamilton, Ltd.; J. Murray & Son, Ltd.
Chilled Iron Brake Blocks.—Carron Co.

Lancaster.—T.C. Two motor-bus car bodies. Mr. Jas. Hardy, Lancaster. £245 each.

Sheffield.—City Council.—Accepted tenders for the Electricity Department:—

J. W. Harrison, Ltd.—Cast-iron pipes.
A. Reyrolle & Co., Ltd.—Further 30 panels of extra H.T. sub-station switch gear.
Foster Bros., Ltd.—Pipework.
Edward Bennis & Co., Ltd.—Suction ash plant.
R. White & Sons.—Lifts and rails.

Swansea.—Corporation. Six tenders were opened for the supply of the 5,000-kw. turbine plant necessary for extensions in the borough, and that of the British-Thomson Houston Co., Ltd., was accepted at £25,516. Cables and other accessories will have to be obtained, and application is to be made to the L.G.B. for sanction to raise a loan of £42,000 for the purpose.

Wolverhampton.—Corporation Electricity Committee. Accepted tenders:—

British Thomson-Houston Co., Ltd.—Spare parts for telfer plant, £133.
Stirling Boiler Co.—Duplicate stoker, driving shaft and reduction gear, £94.
G. & J. Weir, Ltd.—Two turbine-driven boiler feed pumps, £480 each; spare parts for present pumping set, £46; two special Hydrokineter nozzle heaters, £44; two non-return valves for Weir pumps, £36.
Reyrolle & Co., Ltd.—Spare oil switch, £82.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, December 14th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Paper on "The Use of Soap Films in Solving Torsion Problems," by Mr. A. A. Griffith and Mr. G. I. Taylor.

Electro-Harmonic Society.—Friday, December 14th. At 8 p.m. At the Holborn Restaurant (Venetian Chamber). Smoking Concert.

Greenock Electrical Society.—Saturday, December 15th. Visit to Glasgow Central Station.

Thursday, December 20th. At 7.45 p.m. At 22, West Stewart Street Discussion on "Fuses and Circuit Breakers," opened by Messrs. McDougall and Toppin.

Association of Mining Electrical Engineers (West of Scotland Branch).—Saturday, December 15th. At 3 p.m. Visit to Messrs. Mavor and Coulson's Works, Glasgow. Concert at Trades House Restaurant, 89, Glassford Street.

Society of Engineers.—Monday, December 17th. At 5 p.m. At the rooms of the Geological Society, Burlington House, Piccadilly, W. Lecture by Mr. Chalmers Kearney on "High-speed Railways after the War."

Junior Institution of Engineers.—Friday, December 14th. At 8 p.m. At 33, Victoria Street, S.W. Paper on "Rotary Engine and Rotary Pump," by Dr. W. E. Lilly.

Saturday, December 15th. At 2.15 p.m. Visit to the Britannia Pencil Works, Newcastle.

Monday, December 17th. At 7.30 p.m. At 33, Victoria Street, S.W. Paper on "Engineering in the Brewing Industry," by Mr. C. R. Turner. Adjourned annual meeting.

Royal Society of Arts.—Monday, December 17th. At 4.30 p.m. At John Street, Adelphi, W.C. Cantor Lecture on "Progress in the Metallurgy of Copper" (Lecture III), by Prof. H. C. H. Carpenter.

Wednesday, December 19th. At 4.30 p.m. Paper on "The Cold Storage Industry," by Prof. J. Wemyss Anderson.

Illuminating Engineering Society.—Tuesday, December 18th. At 5 p.m. At the Royal Society of Arts, 18, John Street, Adelphi, W.C. Presidential address by Mr. A. P. Trotter.

Institution of Civil Engineers.—Tuesday, December 18th. At 5.30 p.m. At Great George Street, S.W. Paper on "The Buenos Aires Western Railway Tunnels under the City of Buenos Aires," by Mr. W. L. L. Brown.

Institution of Electrical Engineers.—(Newcastle Local Section).—Thursday, December 19th. At 7 p.m. At the Mining Institute. Presidential address.

(Yorkshire Local Section).—Tuesday, December 18th. At 7 p.m. At the Philosophical Hall, Leeds. Paper on "Electrical Cooking as Applied to Large Kitchens," by Mr. W. A. Gillott.

Liverpool Engineering Society.—Wednesday, December 19th. At 8 p.m. At the Royal Institution, Colquitt Street. Paper on "The Need for Research Work on the Propulsion of Full-sized Ships," by Mr. A. T. Wall.

Belfast Association of Engineers.—Thursday, December 20th. At 7.45 p.m. At the Municipal Technical Institute. Paper on "Electro-metallurgy," by Mr. G. L. Roslyn.

NOTES.

£300 Wanted at Once.—An effort is being made to bring up the invested funds of the Electrical Trades' Benevolent Institution to £10,000 before the close of the year. The following is a copy of a letter issued by the Secretary (Mr. F. B. O. Hawes) to certain members of the industry. As will be observed, £300 is the sum required, and we earnestly hope that it will be forthcoming. The trade has not been worried by this Institution very much of late, owing to the war; but its needs will be pressing when hostilities come to an end, and we appeal for a Christmas response, so that the five-figure total may be reached. The address of the Secretary is as given below, and he will gladly receive any help that readers have it in their heart and in their power to render. Thoroughly believing in this excellent organisation, we strongly recommend it to the sympathy of all. We shall be pleased to pass on to Mr. Hawes any donations or promises that may be sent to us here by letter, by phone, or by telegraph:—

"Dear Sir,—At the last annual general meeting of this Institution Mr. Campbell Swinton contributed a gift of £100 in the hope that by a few others following his example, the funds might this year reach a figure exceeding £10,000. With this object also Sir David Salomons has increased his liberal regular contribution by a further gift of £20.

"The present invested funds are far too small to meet the calls for pensions and temporary assistance which will doubtless be made soon after the War.

"My Committee are very anxious that the £300 required should be obtained before the end of the year. May I ask for your assistance?—Yours faithfully,

"F. B. O. HAWES, Secretary.

"18-21, Park Mansions, Vauxhall Park,

"South Lambeth Road, London S.W.

"December 12th, 1917."

Mischievous Sport.—At the Wakefield local Court, last week, three youths were fined £1. and 5s. costs, for throwing stones at an electric arc lamp. The police said that during the past six weeks £9 4s. 11d. worth of damage had been done to electric lamps in a certain neighbourhood, in addition to damage to gas lamps.

Volunteer Notes.—COUNTY OF LONDON VOLUNTEER ENGINEERS (FIELD COMPANIES).—Headquarters, Balderton Street, Oxford Street, W. 1.

Orders for the week, by Lieut.-Colonel C.B. Clay, V.D., commanding:—

Office for the Week.—Second Lieut. F. Gaywood.

Drills.—Week ending Friday, December 21st, 1917:—

Monday.—No. 3 Company, Left Half. Recruits, signalling, 6.30.

Tuesday.—Physical drill and bayonet training, 7.30.

Wednesday.—No. 1 Company, 6.30.

Thursday.—No. 2 Company, 6; signalling, ambulance, 6.30.

Friday.—No. 3 Company, Right Half. Recruits, 6.30.

Masketry.—Belvedere Road, Tuesday, Wednesday, and Thursday, 5.30 to 7.

Note.—Christmas Holidays: Headquarters and the Range will be closed from the 22nd to the 28th, both inclusive.

The Medical Officer will attend for examination of recruits, &c., on Thursday, at 6.30.

Unless otherwise indicated, all drills will take place at Headquarters.

(By order) MACLEOD YEARSLEY, Capt. and Adjutant.

Decimal Coinage.—In an excellent little pamphlet just issued by the Decimal Association, after recording the consensus of opinion on the part of the Institute of Bankers, the Association of Chambers of Commerce of the United Kingdom, and the Decimal Association in favour of the adoption of the pound sterling as our monetary unit, divided into 1,000 mils, the Association gives the following reasons why the present is an opportune time for making the change:—

1. Relief to the poorer classes would be afforded by the substitution for our present "penny" coinage of the more finely graded "mil" coinage, which would inevitably result in a closer relation between the cost and the price of food and other daily necessities bought in small quantities.

2. Under the new system all prices and charges now expressed in pence would be quoted in mils, and the present period of fluctuating values is obviously a most opportune time for making the small adjustments incidental to this change of practice.

3. Millions of our people are now obtaining practical first-hand experience in the use of coinage arranged on a decimal basis, this being the basis already adopted by all our Allies.

4. The withdrawal from circulation of the crown, half-crown, and threepenny piece would afford some relief at this time of abnormal shortage of silver.

5. The present close co-operation between the Government and the owners of public and semi-public services gives a favourable opportunity for the speedy adjustment of such tolls, fares, &c., as are now fixed by Statute.

Belfast Arbitration.—At a meeting of the Belfast Tramways and Electricity Committee, last week, a letter was read from the Electrical Trades Union on the subject of the application of an award of Mr. Doughty, K.C., in the matter of an arbitration between the Union and the National Federated Electrical Association, representing the Belfast employers and contractors, and a communication from the Electrical Contractors' Association having been read to the effect that the award had been complied with in so far as their members were concerned, the advance was ordered to be paid, pursuant to the Council's Standing Orders. A further letter was read from the Electrical Trades Union on the subject of the application of the 12½ per cent. bonus award, and the consideration thereof was held over for further information. A

letter was also read from the district secretary of the Amalgamated Society of Engineers, transmitting copy of an award of the Committee on Production in relation to their recent application, and the consideration of it was held over pending a further communication being received from the Belfast Employers' Association on the subject. The Committee had under consideration the question of the provision of additional plant at the electricity station, and ordered a communication to be addressed to Sir John Snell on the subject.

Water Heating by Electricity.—On November 2nd, Mr. W. J. Wilson gave a lecture on "Electric Water Heating," before the Junior Institution of Engineers. He pointed out the obvious advantages of using electricity for heating and cooking in respect of cleanliness and reduction of work. The heating of water on a large scale, say, for baths, has, however, some drawbacks, and there are some problems to be solved before the best results can be obtained. One of the main drawbacks—not inherent in the apparatus itself—is the price of electricity. At lighting rates water heating in bulk is not a commercial proposition.

Electric heating systems may be classified as follows: (1) Thermal storage; (2) geyser; (3) separate hot water tanks; (4) circulating systems with storage tanks. In these the design is influenced by the desirability of running the apparatus constantly in order that advantage may be taken of the cheaper electricity rates which are available for sustained and steady loads.

The Therol heater (Class 1) is designed to run 24 hours per day, i.e., it has a 100 per cent. load factor. A heater taking 200 watts delivers 20 to 30 gallons of water at 110° F. per day, or 9 gallons at boiling point.

The Losles heater (Class 1) is controlled by a thermostat, so as to maintain the water at any desired temperature from boiling point downwards. The 10-gallon size can give 20 gallons per day at 200° F., and is rated at 500 watts.

The Ferranti heater (Class 1) is generally arranged to take 350 watts, and is capable of raising 38 gallons through 60° F. in 24 hours. By means of an arrangement of slow circulation of water it is possible to obtain boiling water from this heater in one hour.

The first class of heater is useful only where the demand for water is more or less continuous, but not for such work as baths, for example. It cannot deal with this type of service unless excessive storage is provided, with its inevitable high heat losses. It has no emergency valve, and a very small leak may seriously affect its efficiency.

The electric geyser (Class 2) is the quickest heater, but its loading has to be heavy, and switchgear becomes a serious item. For example, with water flowing at a rate of 5 gallons per minute, 40 kW. would be required to raise the temperature through 54° F. For ordinary lavatory use a geyser to supply hot water requires from 5 to 8 kW.

For a succession of baths it is best to provide a separate hot-water tank (Class 3). A standard pattern in use contains 15 gallons, and is provided with an immersion heater taking about 10 kW. In this the 15 gallons can be raised through 90° F. in 20 minutes, and, allowing 20 minutes per bath, the bath can be kept in constant commission. The consumption of energy for three baths is thus 10 units.

A thermostatic control can be fitted to this type of heater, and this, assisted by a clock-switch and electric bell, can work wonders in a lazy bachelor's flat.

The fourth class of heater is inefficient, although giving no trouble in working. Large heat losses are inevitable in any circulating water system. With bare pipes and water at 130° F. the loss may be, say, 34 watts per sq. ft. In 24 hours 250 ft. of 1 in. pipe would lose 72 units. Efficient lagging may reduce this loss by 60 per cent. or 70 per cent.

Electric apparatus being so clean, convenient and reliable, quite a profitable load of respectable dimensions may be obtained by a supply station, provided that energy is supplied at a reasonable price.

Birmingham Corporation Electrical Employees.—The Birmingham Corporation Electricity Committee and representatives of the Electrical Trades Union are holding a meeting to consider demands made by the Union on behalf of the electrical workers that they shall participate in the awards applicable to the Union and not in the usual municipal advances. It is stated that the demand was lodged in November by the Birmingham district secretary of the E.T.U. on behalf of youths and men who were formerly members of the Gas, Municipal, and General Workers' Society and have been admitted to the E.T.U. The secretary (Mr. Beardmore) also applied for 25 per cent. proportionate extra salary for all periods of night shift work, for shift engineers, for switchboard attendants, and for assistant switchboard attendants employed at the generating stations; and for time and a quarter for night shift for attendants and assistants at sub-stations.

"This is equivalent to a demand for the recognition of all these men as engineers, and if conceded would have entitled them to participate in all the awards made to skilled workers by the Committee on Production instead of waiting for concessions made to the general body of municipal workers.

"On December 3rd, however, a letter was received by Mr. Beardmore from the Department, declining to recognise the claims of these men apart from the general labourers of the Corporation, and when this letter was presented to a meeting of the Birmingham Station Engineers' Branch of the Union, of which all the men affected are members, it was decided to instruct the general secretary to adopt all possible methods to secure their demand.

"Mr. Beardmore, thereupon, forwarded notice of the intention of the men to cease work if their demands are not conceded by the 14th inst."—*Birmingham Gazette*.

Legal.—ELECTRICAL INSTALLATIONS, LTD., v. EDE AND TOWNSEND, LTD.—In the Lord Mayor's Court, on December 10th, before Assistant Judge Jackson, sitting without a jury, this case was heard and disposed of. The plaintiffs, electrical engineers of Martin's Lane, E.C., sued the defendants, printers, of Tabernacle Street, for £25, balance of account for work done and material supplied in connection with an electrical installation at the defendants' premises. The defendants early in the present year were moving from premises in Southwark Bridge Road to Tabernacle Street, and the plaintiffs were asked to adapt an electric installation at the latter premises, to bring it up to date, and make it suitable for their (defendants') requirements. This the plaintiffs did, at a cost of £55. The defendants had paid £30 on account, leaving the balance sued for due. The defendants counter-claimed for a sum of £1, alleging that that sum was paid to the plaintiffs for work done, which they had not carried out. Walter James Hayward, assistant engineer to the plaintiffs, said he supervised the work carried out by his firm on the defendants' premises. He had discussed the matter of adapting the installation on the premises as much as possible, with Mr. Tomlin, of the defendant firm, and had pointed out that it would be preferable to put into the premises an entirely new installation. An experienced mechanic was put on the job, which took about ten weeks to complete. Edward William Clifton, electrical fitter, who carried out the work for the plaintiffs, said that during the time he did the work there was no complaint that he was wasting time. He found that the installation he had to work upon was done by amateurs from time to time, and a great many of them. He had never seen such wiring before, and the whole of the lighting was on one circuit. He had made four new circuits, and bunched what remained on three other circuits. The job was made up to date as far as it was possible. Alfred Tucker, manager of the plaintiffs' maintenance jobbing department, said £8 6s. was the net cost of materials used by them on the defendants' work and £30 2s. 3d. paid for labour; 33½ per cent. was added to cover establishment charges. The charge for labour seemed a little out, but upon inquiry he found there had been a good deal of "testing labour," which would not have been required in putting up an entirely new installation. When the account was sent in to the defendants they complained that it was exceedingly vague, and that the only thing definite was that it was for £55 0s. 6d. They asked for details, which were given. For the defence, Mr. William Ede, managing director of the defendant company, said that the plaintiffs held an electrical maintenance contract from them while in their old premises in Southwark Bridge Road. When moving to Tabernacle Street they desired the existing electric installation in the portion of the premises they were occupying to be adapted to their use. He saw a representative from the plaintiffs, who he thought was a traveller, and got an idea as to the cost of the work. When the plaintiffs' account came in, however, he thought the charges made by them were excessive, and payment was refused. Mr. Kirk, electrical engineer, and Mr. George Edward Vigor, partner in the firm of G. H. Boyd, builders and decorators, were called to speak as to the overcharges in the plaintiffs' account. The Assistant Judge, after hearing the evidence, gave judgment for the plaintiffs on their claim for £20 6s. 9d., and on the counter-claim, with costs.

L.C.C. and Vehicle Charging.—The General Purposes Committee has had under consideration a communication from the Commissioner of Police with regard to street fittings for supplying fuel, energy, &c., to motor vehicles, and has referred the matter to a number of other Committees, which have reported against the proposals. As this matter is of great future importance to electric vehicle users, the objections which we reprint below will be studied with interest, and no doubt assessed at their true worth:—

1. Motor vehicles waiting at supply points along tramway routes would compel slow-moving traffic to move on to the tramway tracks, thus causing obstruction to fast traffic and greatly increasing risk of accident.

2. The standing of motor vehicles, especially in the case of large vans, pantechnicons, &c., would obscure the view of pedestrians crossing the road, and would be a fruitful cause of accidents.

3. Any supply points situated near tramway stopping places would obstruct and cause danger to pedestrians entering or leaving the trams.

4. The width of footway in many thoroughfares is already so narrow that pedestrians overflow into the carriageway, and the adoption of the proposed scheme would increase the danger arising on this account.

5. The main thoroughfares of London are of such dimensions that supply depôts would cause obstruction.

Exit Gas Heating.—Dr. Waldo, Coroner for the City and Southwark, advises those who preside over courts of justice, and who suffer from malaise, to have samples taken of the air, and to look to the heating arrangements. Pointing out that the temperature in his two Courts recently could only be raised to 18° and 52° respectively, he remarks, "Such a temperature cannot be endured in comfort by people sitting still. A temperature of 66° is required by people of middle age or above it."

The L.C.C. chemist Mr. Coste, analysed the air at the Southwark Court, and found that the gas radiators loaded the air with ten times the normal amount of carbon dioxide and gave off an irritant gas, as well as aqueous vapour.

Dr. Hartley (St. Bartholomew's) also reported the presence of carbon monoxide, a highly poisonous gas, "which," observed the Coroner, "gives rise to headache, lung irritation, and other symptoms."

The gas radiators have now been replaced by electric stoves.—*Daily Chronicle*.

Books for British Prisoners of War.—We have received from Mr. A. T. Davies, chairman of the "British Prisoners of War Book Scheme (Educational)," Victoria and Albert Museum, South Kensington, S.W. 7, a brochure giving a further account of the working of the scheme, the purpose of which is to provide "interesting and purposeful occupation to men for whom such occupation is a matter of vital necessity," to prevent their demoralisation by the *ennui* of prison life. Books have been sent to over 200 prison camps; books have been provided in 44 languages, and dealing with some 115 subjects. In the nine months from January to September, 1917, 6,500 requests for books were received from prisoners, and 7,500 parcels of books were dispatched, including some 43,700 educational books. The present rate of expenditure is £250 per month, of which $\frac{2}{3}$ is represented by purchases of books, and a standing stock of at least 12,000 volumes has to be kept at South Kensington. Numerous letters testifying to the immense benefit derived by our captive brothers from these books are extracted in the brochure, and it is stated that £5,000 is needed at once—there are 500 camps not yet covered. Donations are earnestly requested; if these take the form of books, a list, giving dates or editions, should first be sent. Great assistance can also be rendered by local effort, and those who wish to send books to friends in prison can use the scheme for the purpose. The following are a few of the subjects on which books are asked for:—Management of Dynamos; Switchboards; Practice of Electric Wiring (Munro); Switches and Switchgear; Electricity (Hobart); Practical Wiring (Metcalfe); Electricity (Kapp); Electric Lifts and Cranes; Dynamos; Alternating Current; Electric Tramcar Driving; Electric Motors; Electric Fittings; Small Dynamos and Motors.

Electric-Light Switching.—SIXTH BATCH EXAM.—As the advanced-grade results had to be got out first, and as much work remains to be done in completing the examination of the numerous intermediate and preliminary papers, the previous publication of the advanced-grade passes has been thought advisable, especially as many of the examinees have been waiting for some time. These results are given below. The complete results will be published during January or February.

ADVANCED GRADE.—The names are given in order of merit. Six book prizes and certificates:—

H. C. WILKINSON, Wh.Sc., Stud.I.E.E. (Portsmouth).
F. H. Goudenough, Lance-Corporal R.E. (Isle of Wight).
 T. R. Priest (Birmingham).
 C. L. Drury (Derby).
N. A. Jassawalla, L.M.E., Bombay (Karachi, India).
 J. W. Platt (Manchester).
 H. C. Whitfield (Burslem).
 T. H. Ingle-Scott, I.E. Telegraphs (Karachi, India).

The names in italics above and below denote the gaining of an advanced certificate for the second time, this fact debarring the examinee from taking a prize.

Certificates.—*H. Grimshaw* (Goldborne, Lanes.), *T. C. Hodges* (London, W.), A. V. Cattrell (Barrow-in-Furness), D. Cairns (H.M.S. *Royal Oak*), T. J. Trewitt (South Shields), T. C. Long (Bristol), R. F. Galea (Malta), S. E. Reason (London, E.), T. Wheatley (West Lothian, Scotland), W. C. Larkman-Taylor (Croydon), W. Maddock (Warrington), M. Yusif (Upper Sudan, Egypt), W. H. Gregory (Melbourne), F. Townsend (Cape Town). Twelve competitors failed.

A new advanced-grade paper is just being published, and may be had on request from Messrs. A. P. Lundberg & Sons, 477–499, Liverpool Road, London, N. 7.

Institution and Lecture Notes.—Royal Institution.—The following are amongst the lecture arrangements before Easter:—Prof. J. A. Fleming, a course of six experimentally illustrated lectures, adapted to a juvenile auditory, on "Our Useful Servants: Magnetism and Electricity," commencing December 27th. Sir R. T. Glazebrook, two lectures, on "The National Physical Laboratory." Prof. Sir J. J. Thomson, six lectures, on "Problems in Atomic Structure." The Friday meetings will commence on January 18th, when Prof. Sir James Dewar will deliver a discourse on "Studies on Liquid Films."

Institution of Electrical Engineers.—At the meeting of the NEWCASTLE LOCAL SECTION, to be held on Tuesday next, there will be a reception by the president of the Institution, Mr. C. H. Worthingham, with the chairman of the Local Section, Mr. A. H. Marshall, followed by an address by the president. A good attendance is specially hoped for.

The Award of the Committee on Production.—Mr. H. Faraday Proctor, hon. secretary of the I.M.E.A., has forwarded to the engineer members of the Association copies of correspondence which has passed between him and the Committee on Production with regard to the date from which the award of 5s. per week is to be paid. The Committee states that the advances granted under the award of November 6th for the engineering and foundry trades are first payable on the pay-day for the first complete pay-week in December. If, for instance, the pay-week commences on a Thursday, then the first complete pay-week in December commences on the 6th, and the advances are payable for the week ending December 12th.

Fatality.—At an inquest into the death of G. McIntosh, 72, which followed injuries received in the electrical power station, Laganbank Road, Belfast, the jury returned as their verdict that deceased died from fracture of the cervical column caused by the accidental falling of a boiler plate; the accident was caused by a defective bolt, the property of the Corporation.

New Methods of Electrical Treatment.—The medical correspondent of the *Daily Mail* states that "the best equipped electrical workshop in Europe for repairing injured soldiers" was the description an R.A.M.C. colonel recently applied to the Radcliffe Infirmary at Oxford.

An electrical apparatus which totally numbs the severest nerve pains, while, at the same time, gradually bringing about a permanent cure, a machine which will cure acute "water on the knee" in one 20-minute "exposure," and another which charges the patient up like a storage battery, are a few of the wonders shown to the correspondent.

A young soldier suffering from ceaseless pain in one hand, caused by an obscure injury to a nerve, was treated by an ordinary-looking electric battery from which two wires led, one being held in the injured hand and the other attached to a metal plate at the back of the neck. The current stops the pain in the hand, the periods of freedom increasing after each treatment.

For the removal of wasting growths a patient is connected with a special type of battery. When he is "fully charged" the operator brings a needle-pointed metal instrument almost into touch with the tissue to be removed. A flame of electricity jumps from the patient to the instrument, and the growth is instantaneously destroyed. Through the free passage afforded to heat rays, the germ in the growth is literally "cooked" by the electric discharge being concentrated on so small an area, thus producing a high current density. The effect can be seen during an operation as a grey coagulation or destruction of the tissue.

The problem of how to exercise electricity on paralysed muscles without unduly stimulating the healthy ones has been solved by means of a newly perfected system of condensers, which causes the injured muscles slowly to contract and relax, while the healthy ones remain quiescent.

Rathenau and an Enduring Peace.—In our issue of January 26th, 1917, we quoted an article by Dr. Walther Rathenau, of the A.E.G., on preparations, "in the economic sense," which must be made for "the next war." "When the next war comes it must not be a year too soon." The well-known electrical magnate has just been addressing the annual meeting of the A.E.G. in Berlin, and what he now seems to desire is an "enduring peace." A Renter telegram from Amsterdam, published in the *Times*, quotes the following from his speech:—

"The war has entered the state of liquidation. The climax is past. The British thought that the war could be regarded as only a sum in arithmetic, and that in a given period an entirely isolated country must have exhausted its war supplies and be forced to give up the war, but no material exhaustion is to be feared in Germany. Human and moral factors, resolution, organising will and self-confidence, are stronger factors than mechanical powers. Lord Lansdowne's letter displays the reawakening of a spirit of soberness and moderation. Our foreign affairs are in strong hands, which we trust, and I hope that the political liquidation will be ended so that an enduring peace may be assured."

The Non-Ferrous Metal Industry Bill.—The House of Commons, on Tuesday, resumed the discussion of this Bill. Several speeches were delivered criticising the measure. Its supporters held that it was essential to prevent foreign merchants from getting control of the metal merchants of this country, and that we were only protecting our own interests when we took steps to deprive Germany of the power of control. One speaker said that the discussion raised the question whether or not we meant to retain control over our essential key industries. Mr. Runciman criticised the Bill on various grounds, and wanted it, after second reading, to be referred to a Select Committee. Mr. Bonar Law ultimately replied at length. He said that if we were to attempt to eliminate German influence from the essential industries, we must have safeguards of the kind proposed, and some Government Department must take the matter in hand. The Bill was based on one of the Paris Conference resolutions, which were all drafted by Mr. Runciman. Mr. Bonar Law showed how the Germans had exercised their power. Our enemies must be let to know that we should not hesitate to use our powers to get rid of German penetration in this matter. The main question at the end of the war would be the supply of raw materials. They would be scarce in every industry. The longer the war lasted, the less there would be to go round, and as the Allies would help themselves first, the less there would be for Germany of essential commodities. In order to have independence at home, they must get rid of German control. After further discussion, the amendment moved by Sir F. Banbury rejecting the Bill was lost by a majority of 103 votes. The Bill was then read a second time, and by a majority of 76 was referred to a Committee of the whole House.

Christmas Fire Warning.—The British Fire Prevention Committee has issued a special warning in connection with Christmas entertainments in hospitals, camps, private assemblies, &c. The danger of ignition of dry evergreens, Christmas trees, paper lanterns, cotton wool, celluloid, &c., is pointed out, and the public are warned not to make the slightest change in electric wiring without consulting a competent electrician or an electrical inspector. Buckets of water should always be available, and stout blankets are useful for smothering incipient fires.

Copies of the "Warning" (No. 22a) are obtainable gratuitously from the Committee at 8, Waterloo Place, Pall Mall, London, S.W. 1, upon written application, with the necessary return postage enclosed.

Copper from America.—Professor H. C. H. Carpenter, of the Imperial College of Science, speaking at the Society of Arts, on Monday, said the demand for copper during the war had been enormous. It was impossible to estimate the aid given to the Allies by the copper manufactures of the United States, for so far no substitute for the metal at an equivalent price had been found. It was calculated that last year the United States produced 860,000 tons of copper, compared with 592,600 tons in 1912.—*Morning Post*.

Budapest without Light.—A Renter dispatch from Zurich says that the whole of Budapest has been entirely without gas since last Friday evening, when the supply was suddenly cut off, and the whole city plunged in total darkness, as the electric street lighting was suspended two years ago. The gasworks stoppage was due to the use of inferior Prussian coal, which choked the retorts.

Appointments Vacant.—Charge engineer for the Paisley Corporation Electricity Department; costs and stores clerk for Worcester Corporation Electricity Works; charge engineer (£130 +) for the York Corporation Electricity Department; station superintendent for the Stalybridge Joint Tramways and Electricity Board; commercial secretary (£300) for the Borough of Wolverhampton Electricity Department; junior shift engineer (52s.) for the Borough of Stockport Electricity Department; power superintendent (£200) for the City of Birmingham Gas Department; assistant engineer for the Bootle Corporation Electricity Works. See our advertisement pages to-day.

Steam Turbine Accidents in the United States.—A recent issue of *Power* contains some interesting statistics relating to the more serious accidents which have occurred to turbo-electric plants in the United States, apparently during the past eight years or more.

This is a subject on which both users and manufacturers are naturally disinclined to invite publicity, although much valuable information on the causes of accidents is obtainable from the records of failures and breakdowns of machinery.

Of the accidents cited by our contemporary, 19 were stated to be due to "explosion"; of these, two were definitely attributed to excessive steam pressure; three others to "over-speed"; while a fourth—in which a rotor burst—could be credited to the same cause, and it would be interesting to know what proportion of the remaining unspecified cases of "explosion" were due to over-speed, which figures as the cause of two further accidents not classified as "explosions," though evidently having serious consequences.

Seven cases of blade stripping are mentioned, due to shaft deflection, the presence of foreign substances in the machine, &c., the results being much less serious than in the accidents previously mentioned.

In addition to the above, 11 miscellaneous accidents are recorded, including three of turbine sets destroyed by unspecified causes; two due to pieces of rotor breaking off and jamming; one due to oil failure at a step bearing; another to generator case distortion; another in which the shaft was thrown out of its bearings, and two unspecified accidents.

In a great many cases the turbine or generator, or both, were completely wrecked.

All the cases except one relate to American plants, the exception being at Trieste. The most serious cases of loss specified were at Baltimore, where two large turbines owned by a railway company exploded, causing \$260,000 loss, while a third vertical turbine in the same city, belonging to a light and power company, also exploded (due apparently to the failure of a relief valve), causing \$175,000 loss; at Los Angeles (Cal.), three turbines wrecked by one explosion resulted in an estimated loss of \$250,000.

Although the list is a lengthy one, and not complete, it covers a number of years; it was apparently supplied to our contemporary with a view to refuting a statement by a correspondent that turbine explosions due to over-speed or over-pressure in the lower stages had been few and far between.

The Use of Inland Waterways.—The County Purposes Committee of the Common Council of the City of London has considered the recent letter of the Canal Control Committee, urging manufacturers and traders to increase their use of our inland waterways, and has expressed its cordial approval of the proposal, adding the opinion that it will be to the great advantage of the trading community if the inland waterways are unified and improved with a view to their extended user. The latter object can best be attained by the construction of a central authority, with Parliamentary powers, to take over and develop the existing system of inland waterways on the lines of the Port of London Authority Act, 1908, with such modifications as are considered necessary to meet the circumstances. The Committee further recommends that the Government be urged to give effect to the recommendations of the Royal Commission appointed in 1906 to inquire into and report upon the Canals and Inland Navigations of the United Kingdom.

The A.S.E.—The funds of the Amalgamated Society of Engineers have increased this year to over two million pounds. The membership is 270,000.

A private delegates' meeting of the Society was held on Tuesday, to consider a suggested amendment of the constitution to enable fusion with other Unions desirous of affiliation, thus facilitating joint action in matters of common interest.—*Times*.

Inquiries.—Makers of traction armature coils are asked for.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station and Tramway Officials.—The employees of the Leigh Corporation electricity works presented Mr. A. T. SMITH, the borough electrical engineer, with a gold wristlet watch as a token of their regard and esteem, on his appointment to the British Dyes, Ltd., Huddersfield.

Darwen Town Council has decided to release its tramways manager, Mr. F. J. S. HOSKENS, to enable him to accept an appointment as assistant dilution officer under the Ministry of Munitions at Manchester. He will retain his position as manager, giving attention to the department in the evenings, without salary. The arrangement is an experimental one, and is for a period of three months.

Leigh (Lancs.) Electricity Committee, from 141 applicants, has appointed Mr. J. B. HUDSON, deputy electrical engineer of Bootle, as electrical engineer of Leigh, at £300 a year.

Aberdeen Council has advanced the salaries of Mr. R. HUNTER, station engineer, and Mr. A. H. M'KAY, mains superintendent, from £250 to £280 as from November 1st, with a further increase of £20 next year.

The South Shields Electricity Committee recommends advancing the salary of the electrical engineer by £50 per annum.

The salary of Mr. C. W. COOKSON, accountant and collector to the Walsall electric supply department, has been increased from £188 to £214 per annum.

The following increases of salary have been approved by the Establishment Committee of Sheffield City Council in connection with the new power house:—J. R. WILLIAMS, assistant station superintendent, Kelham Island, to be resident constructional engineer at a salary of £275 (including £25 increase); S. NEWTON, shift engineer, Kelham Island, to be assistant station superintendent at a salary of £225 (including £25 increase), rising to £250 in 12 months; E. ATKINSON, shift engineer, Neepsend, to be assistant station superintendent at a salary of £250 (including £50 increase).

The Erith U.D.C. has advanced the salary of Mr. J. C. WILLIAMS, the electrical engineer and tramway manager.

The Birmingham Electric Supply Committee has reduced the number of applications for the position of secretary to the department, in place of Mr. Howard Foulds, to three. A recommendation will shortly be made to the City Council.

The Worcester City Council has approved the following advances, on the recommendation of the Electricity Committee:—Charge engineer, from £141 per annum to £3 per week, and 5s. war bonus; another charge engineer from £133 18s. to £2 15s. per week, and 5s. war bonus; chief assistant and mains superintendent, from £225 to £250 per annum; station superintendent, from £205 to £230 per annum.

The Burton-on-Trent Electricity Committee has decided that the remuneration of the charge engineers be increased from £150 6s. to £165 per annum, and that of Mr. C. J. McILBOURNE be increased from £217 to £240 per annum.

Mr. W. S. VIGNOLES, Grimsby borough electrical engineer, has been gazetted Lieutenant-Colonel. Mr. Vignoles, who was attached to the local Volunteers, offered his services at the outbreak of war, and went out to France in 1916.

Sergeant NUTTALL, who was a member of the Grimsby Corporation electricity staff, has been awarded the Military Medal.

The Tunbridge Wells Corporation has decided to raise the salary of Mr. G. A. POWNALL, the chief assistant engineer, by £50—£20 now, and two yearly increments of £15.

General.—Congratulations and good wishes to Captain HENRY M. LEAF, D.S.O., R.M.A., formerly of the London Electrical Engineers, on the occasion of his marriage to Miss A. M. E. CUST, which took place at Chelsea on Tuesday last. Swansea Corporation Electric Lighting Committee has unanimously re-elected Mr. ALEX. SINCLAIR Chairman for the ensuing year, and Abt. Geo. COLWILL Vice-Chairman.

Mr. E. T. SHADERS, on leaving the Sterling Telephone Co., Ltd., Dagenham (Essex), has been presented by the staff and employees with a suit case, and a wristlet watch for his wife.

On the occasion of his marriage to Miss Gertrude Willats South, daughter of Mr. J. A. Smith, of Holmwood, Great Baddow (Essex), Mr. ALBERT EDDINGTON, A.M.I.E.E., assistant manager to the Marconi Co., Ltd., Chelmsford, has been presented by the Chelmsford and London staffs with a silver tea and coffee service, with trays.

A commission in the Egyptian Labour Corps has been given to Mr. ALBERT ARTHUR PIRSTON, district superintendent of the electrical department of the Sudan Government Railway at Port Said, and formerly of the North Staffs. Railway electrical department at Stoke-on-Trent.

Mr. J. E. DUNSON, London office manager for Messrs. Bruce Peabody & Co., Ltd., of Edinburgh, was married on December 6th, at Westbury on Trym Parish Church, to Vera Maud, only daughter of Mr. and Mrs. Willie James, of Glenthorn, Westlawn-on-Trym, Bristol. A few days previously Mr. Dunson was presented with a clock as a souvenir of the occasion from his friends in the firm.

Roll of Honour.—The Military Medal has been awarded to Corporal J. A. BARLOW, Machine Gun Corps, an employee in the public lighting department of Stepney Municipal electrical undertaking, for conspicuous bravery and devotion to duty whilst acting as a runner during recent operations at Passchendaele.

Gunner A. W. CASS, R.G.A., was killed in action on 20th ult. He was a representative of the B.I. & Helsby Cables, Ltd., Newcastle Branch.

Private G. W. WRIGHT, Northumberland Fusiliers, reported missing, was employed at the Blackburn Corporation electricity works.

Private G. HART, of the Argyll and Sutherland Highlanders, who has died from wounds, aged 26, was employed by Messrs. Dick, Kerr & Co., Ltd., Preston.

Signaller W. WATERMAN, West Yorks. Regiment, who has died of wounds, was an electrician with his father at Hyde Park Road, Leeds.

Second-Lieutenant G. WOLSTENHOLME, R.F.C., is in hospital suffering from a nervous breakdown following a fight in the air. He was employed as an electrical engineer with the Rochdale Electric Co., Shawclough, Rochdale.

Private T. WALKER, of the Lancashire Fusiliers, killed in action, was employed by Messrs. W. T. Glover & Co., Ltd., Trafford Park.

Lieutenant ALEX. LAING, R.E., aged 25, whose death is reported, was employed at the Wigan Corporation electricity works, and later in the Blackburn Corporation electricity department.

Private R. H. SMITH, A.S.C. (Motor Transport), killed in action, served his apprenticeship at Canterbury with Mr. E. J. Philpot, electrical engineer.

Private J. W. MORRIS, Royal West Kent Regiment, killed in action, was at the outbreak of war engaged in Brazil with the Western Telegraph Co. He returned home to join up in June, 1915.

Corporal W. J. RUSSELL, who was with Messrs. Siemens Bros., of Woolwich, has died of wounds received in action.

Private B. PARR, N. Staffs. Regiment, reported killed after being missing, was on the staff of Messrs. Taylor & Tunnicliffe, Hanley.

Driver C. W. GARDINER, who has died of wounds, and who recently won the Military Medal for gallantry, was an electrical engineer, formerly with Messrs. C. Lee & Sons, Bath, and Messrs. Street, of Bournemouth.

Lieutenant R. C. NUDDS, R.E., who has died of wounds, enlisted at the outbreak of war from the staff of the British Westinghouse Co., Ltd., Manchester.

Private G. H. PAYTON, who was on the staff of the Midland Electric Corporation, Ltd., has fallen in action.

Captain ALDER LEWIS TRIBE, King's African Rifles, younger son of the late Mr. Alfred Tribe, F.R.S., has been killed in action.

Captain A. M. MACDONALD, M.C., Seaforth Highlanders, who has been killed, was completing a course of electrical engineering at Aberdeen when war broke out, and he enlisted.

Private F. DURMAN, an electrical engineer, formerly of Glasgow, has been killed in action.

Captain NORMAN TAYLOR (30), R.E., who has been mentioned in dispatches, was engaged with his father in the firm of Messrs. F. W. Taylor & Co., electricians, Albion Works, Milsbridge.

Mr. J. A. Robertson, borough electrical engineer of Salford, has received information from the War Office that his son, Second-Lieutenant C. A. ROBERTSON, of the 8th Manchester Regiment, is missing. Previous to joining the Officers' Training Corps in October, 1916, Second-Lieutenant Robertson was employed in the works of the British Westinghouse Electric and Manufacturing Co., Ltd.

NEW COMPANIES REGISTERED.

H. & E. Donald, Ltd. (149,068).—Private company. Registered December 6th. Capital, £5,000 in £1 shares. To take over the business of copper-smiths, manufacturers of copper cylinders, boilers, pans, dome-topped boilers, calorifiers, cisterns, &c., carried on by H. B. Donald and E. S. Donald, at South Accommodation Road, Leeds; also to carry on the business of electrical engineers, &c. The subscribers (each with one share) are:—H. B. Donald, 82, Dewsbury Road, Leeds, copper-smith; E. S. Donald, Windsor Terrace, Garforth, copper-smith. The first directors are:—H. B. Donald and E. S. Donald. Registered office: South Accommodation Road, Leeds.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Brecknell, Munro & Rogers, Ltd. (79,766).—Capital, £20,000 in 2,000 pref. shares of £5 each and 20,000 ord. shares of 10s. each. Return dated November 19th, 1917: 11,829 ord. and 1,058 pref. shares taken up; 10s. per share called up on 767 ord. and £5 per share on 1,058 pref.; £5,673 10s. paid; £7,031 considered as paid on 14,062 ord. Mortgages and charges: £7,900.

Wright & Wood, Ltd.—Satisfaction in full on November 24th, 1917, of mortgage dated August 28th, 1917, securing £520 16s.

Hackbridge Cable Co., Ltd. (146,684).—Capital, £25,000 in £1 shares. Return dated September 15th, 1917. 20,000 shares taken up; £2 paid; £19,998 considered as paid. Mortgages and charges: Nil.

Blackburn, Starling & Co., Ltd. (61,302).—Capital, £12,000 in £1 shares. Return dated July 27th, 1917. All shares taken up. £8,100 paid; £3,900 considered as paid. Mortgages and charges: Nil.

CITY NOTES.

The report for the year ended June 30th, 1917, states that the balance to credit of profit and loss is £34,681, from which is deducted interest on both classes of debenture stock, £15,987, leaving a profit of £18,695, plus £4,025 brought forward, leaving an available balance of £22,720, which is dealt with thus:—Munition levy to June 30th, 1916, £7,295; to write down expenses of issue of preference shares, £2,158; carried forward, £13,267. The capital expenditure during the year, before providing for depreciation, amounted to £10,900, of which £3,400 is in respect of additions to buildings, and £7,500 to plant and machinery, the latter being almost wholly for extensions to the lamp works. The profits shown in the accounts, taking into consideration the difficulties the company had to contend with during the year under review, and as were foreshadowed in the chairman's speeches when dealing with the fresh issue of capital, are as high as the directors had anticipated. The proceeds of the issue of the 100,000 preference shares shown in the balance sheet was not available for the company's business until within a few days of the close of the financial year, therefore the trading for that period received no benefit from this additional capital, whereas, as had been previously pointed out to shareholders, the lack of working capital seriously hampered the company's previous operations. Although every endeavour has been made, in entering into contracts, to provide for the increased cost of production arising from time to time by the rise in wages and cost of raw materials, it has been found impossible to synchronise the price obtainable for the company's products with the spasmodic and rapid advances in wages, over which the directors had no control, and this is reflected in the reduced gross profits earned. With the advent, however, of the new capital, enabling the company to take full advantage of discounts upon some of the raw materials purchased, which discounts are, however, now being considerably restricted, and generally to buy on better terms, it is hoped that the accounts for the current year will show more encouraging results.

The engineering side of the works has been, and still continues to be, almost wholly employed on Government orders. The output of lamps has suffered in consequence of large numbers of skilled employees, trained at the expense of the company, leaving the works to take up munition work elsewhere, necessitating the training of fresh workers. This difficulty has to some extent been overcome, and since the period covered by the accounts the output of lamps has largely increased, and manufacturing costs have been somewhat reduced.

The company's operations abroad have been much hampered by reason of the difficulties in obtaining adequate shipping freights, resulting in the Colonial branches not showing that expansion they would have done under normal conditions, and satisfactory profits cannot be looked for in this direction during the continuance of existing conditions.

The anticipated profits have been still further reduced, to the extent of approximately £2,500, by the fact that the company's holding in deferred shares of Altrincham Electric Supply, Ltd., has, during the past year, produced no return, that company's operations having been affected by the Daylight Saving Bill, general economies in the use of current for domestic lighting, and the high price of coal. Additional power contracts, however, have recently been entered into, and it is hoped that a fair return from these shares will be forthcoming during the current year.

There is a considerable sum due by the company for loans, which the board is anxious to reduce as early as possible, and with the commitments for munition levy, interest on the debenture stock due January 1st, and dividend on preference shares due in February, the available cash, although showing a far stronger position by reason of the proceeds of the preference share issue, will not leave more than sufficient margin to carry on the business and meet these engagements; for these reasons the directors are not in a position to recommend a dividend upon the "A" shares.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.

The accounts for the year ended September 30th, 1917, show, after making provision for doubtful debts and war contingencies reserve, which includes excess profits duty, a net profit of £162,149, plus £40,216 brought forward. The preference dividend absorbed £12,500, interim dividend on the ordinary shares £12,500, and there is restored to reserve fund £50,000, leaving the disposable balance at £127,356. A final dividend of 15s. per share, free of income-tax, on the ordinary shares, is recommended, making 10 per cent. for the year; £30,000 is to be put to officers' and employees' staff fund, and £59,866 is to be carried forward. At the meeting on 20th inst. shareholders will be asked to vote £30,000 towards an officers' and employees' staff fund. Col. Weston Jarvis is with H.M. Forces in France, but Capt. Nigel Hanbury is at present home for a short time on leave.

Cape Electric Tramways, Ltd.

Mr. L. BRITMEYER presided at the annual meeting, held in London on December 5th. Referring to the improvement that had taken place in traffic receipts, he said that the number of passengers carried on the Cape Town and Port Elizabeth systems was the highest on record since the flotation of the company. Unfortunately, the working expenditure was also a record, and was greatly in excess of that of normal times owing to the universal prevailing conditions—high cost of materials and wages, and the additional taxation recently imposed by the Union Government of South Africa. In Cape Town, owing to an unusually dry season, a very serious water famine was experienced, which necessitated the undue use of salt water for road watering purposes to the detriment of the permanent way, as salt water corroded the rails more than ordinary water. Fortunately their own water tank storage capacity was sufficient to supply all the water necessary for the service of the boilers during the hours of the curtailment of supply, so that no serious inconvenience was actually caused to the running of the system. The outlook for the coming year was promising, but the difficulty of obtaining supplies was still a matter of grave anxiety.

Adelaide Electric Supply Co., Ltd.—Mr. R. P. SELLON presided, on Monday, over an extraordinary general meeting at Finsbury Pavement House, E.C. He said that, as last year, owing to delays of the mails consequent upon the war they were not able before the end of the year to issue the audited accounts and hold the annual general meeting. The directors had, however, assured themselves by communication with the local directors at Adelaide, that the year's results warranted the declaration of the usual final dividend upon the ordinary shares. They had felt that it would be for the general convenience of the shareholders that that matter should be dealt with without waiting for the accounts. These had now come to hand, and it was anticipated that they would be able to hold the annual meeting early next year. He moved that a final dividend be paid on the ordinary shares of 7 per cent., free of British income-tax, making 12 per cent. for the year.—The resolution was carried.

Ross Electric Light & Power Co., Ltd.—For 1916 the gross revenue was £1,185, as against £1,315 for 1915; the expenditure was £1,141, as against £1,026, leaving a balance of £44 to be carried to net revenue. The loss brought forward from 1915 was £57, and allowing for £282 interest on temporary loans the net loss is £298. Energy sold for lighting fell 15 per cent., but to meet this to some extent the proportion of units generated to units sold was reduced. The company applied to the Board of Trade for the revision of the maximum charges for current, and there being no valid objection made, the maximum charges were raised from 7d. per unit, and for any quantity up to 20 units per quarter 11s. 8d. respectively, to 8d. per unit and 13s. 4d. per quarter. There were 155 consumers (142 lighting and 13 power) 6,089 30-watt lamps equiv.) at the end of 1916.

Barbados Electric Supply Corporation, Ltd.—The trading profit for the year ended June 30th, 1917, was £2,970, against £2,633 for 1916, and £2,231 for 1915. £495 has been charged against trading for repairs and renewals, as against £514 in 1916; this consists chiefly of the cost of replacing poles. The greater part of the work of replacement has now been carried out. The number of consumers advanced from 1,222 to 1,403 during the year, and the 25-c.p. equivalent connections from 17,489 to 19,562. In view of the difficulty of obtaining materials of all kinds, the progress is considered satisfactory. Capital expended during the year: £1,191 for further house connections and additions to mains. The loan which fell due for repayment on June 20th, 1917, has been renewed for a further five years.

Manx Electric Railway Co., Ltd.—Gross receipts for year ended September 30th, £9,573; gross expenditure, £9,625; loss, £52. Adding the debit balance brought forward £19,170, and debenture interest £9,000, there is a debit balance on revenue account of £28,222. The passengers carried were 119,683, against 111,982 in the previous year, as against between 700,000 and 800,000 in normal years. The above debenture interest has again been funded by the issue of second debentures.

Power-Gas Corporation, Ltd.—The results of trading during the year to September 30th show a profit of £21,915, plus £11,120 brought forward. Dividend 6 per cent. per annum on the ordinary shares, less income tax, £11,977; £1,380 to reserve, and £13,678 carried forward.

Eastern Telegraph Co., Ltd.—Dividend at the rate of 3½ per cent. per annum, less income-tax, on the preference stock for the quarter ending December 31st, 1917, and the third quarterly interim dividend of 1½ per cent. on the ordinary stock, free of income-tax.

Calcutta Electric Supply Corporation, Ltd.—The number of units sold to consumers during the four weeks ended October 26th, 1917, has amounted to 2,210,246, compared with 2,038,767 units in the corresponding four weeks of 1916.

Coventry Chain Co., Ltd.—Dividend of 7 per cent. on the ordinary shares for the half-year ended August 31st last, also a bonus of 5 per cent., making 15 per cent. for the year, less tax.

British Vacuum Cleaner Co., Ltd.—Profit for the year ended September 30th, £2,095. Dividend at the rate of just over 2½ per cent., carrying forward £1,041. There has been an improvement in the company's position during the year.

J. F. & G. Harris, Ltd.—The net profit for the year ended at June 30th, 1917, was £529. The preference dividend absorbs £282. £121 is carried forward.

Canadian General Electric Co., Ltd.—Quarterly dividend of 2 per cent. for the three months to December 31st, being at the rate of 8 per cent. per annum, on the common stock.

Hungary.—The Felten und Guillaume Kabel, Draht und Drahtseilfabrik Gesellschaft, of Budapest, is increasing its capital from £40,000 to £120,000.

East London Railway Co.—Interest 8s. 9d. per cent., less income-tax, on "B" debenture stock for the year.

STOCKS AND SHARES.

TUESDAY EVENING.

Most markets in the Stock Exchange are dull and depressed. The principal reason is the state of affairs in Russia, with the possibility of peace negotiations between that country and Germany resulting in the release of such numbers of enemy troops as may increase the difficulties on the other fronts. Money is fairly plentiful, but there is no particular anxiety on the part of the public to invest it, and the success of the War Bonds is, of course, one of the minor factors in the situation that makes for heaviness in Stock Exchange markets. Amongst the few satisfactory spots may be counted the strength of electricity supply shares, and the firmness of the manufacturing issues as a whole, while the attractions of the good-class cable companies come more and more prominently into view as the chance of an increase in the income-tax grows stronger.

In the list of manufacturing shares, British Westinghouse Preference have fallen ½ in consequence of a few sales by holders tired of waiting for developments that do not develop. The Edison Swan report is now available, and nothing is said therein with regard to the rumours which have been current as to a possible agreement of interests amongst the manufacturers. The company has done only fairly well; gross profits show a falling-away as compared with those of the previous twelvemonth. The accounts go up to the end of June last, and the report points out that the proceeds of the issue of the 100,000 Preference shares was not available until within a few days of the close of the financial year. The directors state, however, that with the advent of this new capital, enabling the company to take full advantage of discounts and other terms, it is hoped that the accounts for the current year will show more encouraging results. As we anticipated last week, no dividend is declared on the "A" shares. The price has fallen about a florin on the issue of the report, and is now 25s. 9d. On the other hand, the company's 4 per cent. debenture stock has hardened to 75½.

The big rise in the price of India-Rubber shares which has taken place recently finds an excellent reason in the report just issued. The record for the past few years shows remarkable fluctuations. Whereas in 1913-14 there was a loss of nearly £19,000, in 1914-15 this was converted into a net profit of £80,000, which further jumped to £134,000 last year. The net profits for the year just ended are now returned at £162,000, so that in four years there is a difference of no less than £180,000 in the profits. The directors retain the dividend at 10 per cent., which is, paid free of tax, equivalent to 13½ per cent. under the gross rate, and they carry forward £90,000, an increase of nearly £20,000 as compared with last year. Once more the price is 5s. better at 11½. General Electrics reacted a little to 20. Henley's have enjoyed the substantial spurt of 15s. to 16½.

The telegraph market is good throughout, Eastern Ordinary and Preference all being wanted. Eastern Telegraph has risen to 150½. "China" shares to 15, and Western Telegraph to 15½, being what the Stock Exchange calls a good market. A dull spot is provided by Marconis, where the price of the shares has slipped back to 32, while Americans reacted sharply to 25s. 6d. with a subsequent rally to 24s. This fall came about on the sales by speculative buyers apprehensive of the general outlook. Other descriptions of Marconis are also a little weaker, but it is in Americans that the principal activity has occurred.

Electricity Supply shares are quietly firm. No changes have occurred in the price lists of the London companies. Newcastle-on-Tyne ordinary have gone back to a pound. British Electric Traction are dull, the ordinary has weak-

ened to 32½, while the participating preference keeps about 74½. Transport issues are not popular just now. Home Rails remain depressed and weary. Underground "A" shares dropped to 5s. 6d. Metropolitan Consolidated is ½ down at 22. London & Suburban Traction ordinary changed hands at half-a-crown on Monday, the preference at 6s. 6d., and the ½ per cent. first debenture stock at 61½. London United Tramways 4 per cent. debenture has also been dealt in this week, at 35. The last payment of interest on the stock was made nearly a year ago.

The whole of the Mexican Utility group is very flat. Mexico Tramways First Mortgage bonds have lost 7½, and the Light & Power Co.'s Firsts are 6 lower. Pachuca Fives have slumped to 32½, and the other issues of the concerns, while showing less drastic drops, are well-nigh nominal in their prices. Affairs in Mexico seem to drift from worse to worst, and the apparent hopelessness of the situation is making holders of Mexican bonds ready to sell for whatever they can get.

Brazilian Traction keep firm, although the Rio rate of exchange is a trifle unsteady. Anglo-Argentine Trams first preference are 1/16 down; none too great confidence is felt in the chances of the next dividend being paid. Bombay Electric preference gave way ½, other Indian shares retaining their strength.

Babcock & Wilcox have receded along with most other iron and steel descriptions; the shares at 3 3/16 are 3/32 lower. Rubber shares are flat, on a fresh decline in the price of the produce. The various markets for tin-mining issues are better. Armaments are dull, with a few exceptions, of which Vickers stand out conspicuously. Business in most of the markets runs on very thin lines.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.						
	Dividend		Price			
	1915.	1916.	Dec. 11, 1917.	Rise or fall this week.	Yield p.o.	
Brompton Ordinary	10	9	6½	—	£6 18 6	6
Charing Cross Ordinary ..	5	5	4½	—	5 17 8	8
do. do. 4½ Pref.	4½	4½	88	—	6 13 4	4
Chelsea	4	8	2½	—	5 9 1	1
City of London	8	8	13½	—	6 9 9	9
do. do. 6 per cent. Pref. ..	8	6	10½	—	5 18 6	6
County of London	7	7	11	—	6 7 8	8
do. do. 6 per cent. Pref. ..	6	6	10½	—	5 18 5	5
Kensington Ordinary	7	6	6½	—	5 11 7	7
London Electric	8	Nil	1	—	Nil	
do. do. 6 per cent. Pref. ..	6	4	8½	—	5 8 8	8
Metropolitan	8	8	8½	—	4 12 4	4
do. do. 4½ per cent. Pref. ..	4½	4½	8½	—	7 4 0	0
St. James' and Pall Mall ..	8	8	7	—	5 14 6	6
South London	5	5	3	—	6 13 4	4
South Metropolitan Pref. ..	7	7	21/6	—	8 10 6	6
Westminster Ordinary	7	7	6½	—	5 5 8	8
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	8	8	96½	—	6 4 8	8
do. do. Def.	83/8	1½	28½	—	6 8 4	4
Chile Telephone	8	8	7½	—	5 11 4	4
Cuba Sub. Ord.	5	7	9½	—	7 11 4	4
Eastern Extension	8	8	15	+ ½	5 6 8	8
Eastern Tel. Ord.	8	8	150½	+ 1	5 8 4	4
Globe Tel. and T. Ord.	7	7	13½	—	5 1 10	10
do. do. Pref.	6	6	10½	—	5 17 1	1
Great Northern Tel.	22	24	36	— ½	6 12 6	6
Indo-European	18	18	62½	—	6 8 10	10
Marconi	10	16	8½	— ½	4 15 10	10
Oriental Telephone Ord. ..	10	18	8½	—	8 4 0	0
United R. Plate Tel.	8	8	65½	+ ½	5 17 8	8
West India and Pan.	6d.	6d.	1½	—	5 8 6	6
Western Telegraph	7	8	16½	+ ½	5 5 0	0
HOME RAILS.						
Central London, Ord. Assented	4	4	60½	—	6 12	
Metropolitan	1	1	2½	— ½	4 15 0	0
do. do. District	Nil	Nil	15½	—	Nil	
Underground Electric Ordinary	Nil	Nil	13	—	Nil	
do. do. "A"	Nil	Nil	5/6	—6d.	Nil	
do. do. Income	6	4	81½	—	4 18 2	2
FOREIGN TRAMS, &c.						
	Dividend					
	1915.	1916				
Adelaide Sup. 8 per cent. Pref.	8	8	4½	—	6 3 1	1
Anglo-Arg. Trams, First Pref.	5½	5½	2½	— ½	9 11 4	4
do. do. 2nd Pref.	5½	—	2½	—	—	
do. do. 5 Deb.	5	5	66½	— ½	7 10 3	3
Brazil Traction	4	4	46	+ 1	—	
Bombay Electric Pref.	5	8	9½	— ½	6 4 9	9
British Columbia Elec. Rly. Pice.	5	5	42½	—	11 15 4	4
do. do. Preferred	Nil	Nil	30	—	Nil	
do. do. Deferred	Nil	Nil	28	—	Nil	
do. do. Deb.	4½	4½	68	—	7 5 7	7
Mexico Trams 5 per cent. Bonds	Nil	Nil	81½	— 7½	Nil	
do. do. 5 per cent. Bonds	Nil	Nil	33½	— 1½	Nil	
Mexican Light Common	Nil	Nil	22½	—	Nil	
do. do. Pref.	Nil	Nil	81	—	Nil	
do. do. 1st Bonds	Nil	Nil	34½	—6	—	
MANUFACTURING COMPANIES.						
Babcock & Wilcox	15	15	3½	— ½	4 14 1	1
British Aluminium Ord. ..	7	10	1½	—	8 8 1	1
British Insulated Ord.	17½	20	0	—	6 13 4	4
British Westinghouse Pref. ..	7½	7½	21½	— ½	5 11 4	4
Callenders	20	20	14½	—	8 18 0	0
do. do. 5 Pref.	5	5	4½	—	6 1 8	8
Castner-Kellner	22	20	8½	—	5 15 6	6
Edison Swan, fully paid	—	—	2½	—	Nil	
do. do. 4 per cent. Deb. ..	4	4	75½	+ 1	5 6 0	0
Electric Construction	7½	7½	1½	—	5 6 4	4
Gen. Elec. Pref.	6	6	10½	— ½	5 14 3	3
do. do. Ord.	10	10	20	— ½	5 0 0	0
Henley	25	25	16½	+ 2	7 11 5	5
do. do. 4½ Pref.	4½	4½	4	—	6 12 2	2
India-Rubber	10	10	14½	+ ½	5 15 7	7
Telegraphs & Con.	20	20	41½	—	5 15 7	7

[* Dividends paid free of income-tax.]

GAS FIRING BOILERS.

By T. M. HUNTER, M.A., B.Sc.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS.)

(Concluded from page 551.)

Boiler Draught.—The efficiency of a boiler depends for any given combustion arrangement on two factors—the gas pressure and the chimney draught. Gas pressure regulates the quantity of gas admitted to the boiler; the chimney draught regulates the air drawn in at the boiler front, and also the speed at which the products of combustion travel through the boiler. Given a gas which does not materially change in its composition, a boiler will always give uniform results provided that the gas pressure and the chimney draught are constant. If the products of combustion travel through the boiler at a certain constant speed, the question of regulating the gas is a comparatively easy one; whereas if a boiler is joined to a stack, the question of draught is more difficult. The draught obtainable from a given stack varies with the temperature of the waste gas entering the stack and with the outside temperature of the atmosphere. For this reason the author would advocate where possible the adoption of automatic damper control, or of induced draught. With a constant draught and a constant gas pressure there should be no difficulty whatever in obtaining a constant maximum efficiency on a gas-fired boiler.

The theory is often propounded that the efficiency of a boiler increases with the velocity of the products of combustion; this theory is incorrect.

Boiler Settings.—Boiler settings sufficiently substantial to limit the conduction losses by insulating a boiler are equally necessary for coal and gas-fired boilers. It is preferable to have a poor boiler with a good setting than the best boiler with a bad setting.

The losses of efficiency by way of boiler settings are twofold—the loss through infiltration of false air into the boiler through the brickwork, and the loss by radiation and conduction of heat from the boiler out through the brickwork. As regards the entry of false air, all this air must be heated to the exit temperature of the gases. The actual heat thus carried away to the chimney is not the whole of the loss, as there must also be taken into account the loss in temperature of the flue gases when mixed with the false air. This lowers the ratio of the temperature of the gases to the temperature of the boiler tubes, and therefore reduces the efficiency of the heat exchange. The loss of efficiency by infiltration of false air is in many cases 15 per cent. or more.

The procedure in order to discover air leakages in boiler settings is very simple. If a sample of the waste gas taken at a distance of 15 ft. from the burner nozzles, or in the case of Lancashire boilers at the end of the first flue, yields a certain percentage of CO₂, the same proportion of CO₂ should prevail throughout the boiler. Should there be a decrease in CO₂, it would prove the presence of air leakages, and by taking tests at varying distances from the burner nozzles, the places where air leakages occur can be exactly ascertained. As soon as these air leakages have been found they must be stopped. The first thing to be done in such a case would be to clean the outer side of the brickwork settings thoroughly, remove all loose mortar, and repoint the brickwork. This will, as a rule, greatly improve matters, but brickwork settings have generally a very large number of small crevices which are hardly visible to the eye. In order to close these it is necessary to cover the brickwork settings with several coats of thick tar, which should be renewed from time to time until the whole of the brickwork is covered with $\frac{1}{4}$ in. layer of tar.

The losses through radiation and conduction of heat from a boiler are not sufficiently realised. When we consider that there are boilers which lose $\frac{1}{2}$ per cent. from these causes, and others which lose 15 per cent., it is evident that matters require attention. Owing to the difficulties of accurately measuring large volumes of gas in the state in which it is used for boiler firing, it is practically impossible to measure directly the radiation loss while gas firing a boiler. The usual practice is to test this loss when coal firing the boiler, and to assume that the loss is the same while gas firing. The results of a large number of tests of well-protected boilers, which were published some time ago, showed that in no case was the radiation loss over $2\frac{1}{2}$ per cent.

One very common mistake, for which one has to pay very dearly, is to have boilers in the open air, and not in a boiler house. As the radiation losses are dependent on the temperature inside the brickwork, the thickness of the brickwork, the temperature on the outside of the brick, and the wind velocity, the radiation losses in the winter months, with rain and high winds, must be very much larger than in the case of summer heat. A 30 ft. \times 8 ft. Lancashire boiler working continuously on gas raises steam worth over £2,000 per annum at present. It is possible in almost every case to save 5 per cent. in the radiation loss by putting a house round a boiler, saving £100 a year.

Another mistake which is very frequently made is that the brickwork is not thick enough. It is no economy to build

light boiler settings, as the additional cost of heavier walls, &c., will very soon be repaid on the savings in radiation. For a Lancashire boiler in the open air, the radiation loss from the exposed front is about 1 per cent., showing a loss of £20 per annum, a sum which would pay many times for the cost of a suitable covering. As a rule, modern water-tube boilers have suitably thick brickwork settings.

In cases where it is not convenient or practicable to determine the losses of a boiler through radiation and conduction of heat by means of a careful test of the boiler with coal firing, these losses may be roughly estimated at the following figures:—

	In boiler house.	In open air.
Water tube boiler	1 $\frac{1}{2}$ p.c. to 3 p.c.	6 p.c. to 8 p.c.
Lancashire boiler	5 p.c.	10 p.c. to 12 p.c.

Combustion.—A good combustion arrangement will give complete combustion with an excess of air of 10 per cent.; but with the usual industrial gases there are such large fluctuations in the composition and calorific value that we do not usually dare to reduce the excess of air for continuous working under 20 per cent. on account of the danger of having unburned gas in the waste gases. Good combustion can only be attained by providing an intimate mixture of air and gas. Complete combustion should take place very rapidly, at the highest possible temperature, and with the smallest possible excess of air.

Each case has to be considered in all its details. It is not always safe to say that a certain combustion arrangement will suit because it is working successfully in another plant under somewhat similar conditions.

Combustion arrangements have to be designed to suit three different conditions of gas pressure:—

1. Steady pressure of 1 in. water gauge or more.
2. Intermittent pressure, ranging constantly from 1 in. water gauge or more, to nil, with total stoppage of the gas flow and extinction of the flame.
3. Very low gas pressure, or a pressure which may sometimes be high, but is low for considerable periods.

(1) For a steady gas pressure the Bunsen type of burner gives the best results. A good burner of this type provides its own primary air, which amounts to 60 per cent. of the air necessary for combustion. The gas, acting as an injector, draws in this air, and also mixes thoroughly the air and gas before ignition takes place. Whether or not the burner is doing its duty in this respect can be tested by taking a CO₂ reading of the gas-air mixture in the burner barrel. The secondary air, which is just as essential, is drawn in by the chimney draught, in conjunction with the injector action of the mixture emerging from the burner nozzle.

The maximum flame temperature should be found in the region of the boiler within a few feet of the burner, and there should be a minimum volume of flue gases carrying away heat to the chimney. The amount of gas to be burned in a boiler is only limited by the volume of gases with which the flues can deal under the conditions of gas pressure and chimney draught. Thus the boiler output is larger than it could possibly be with a bad combustion arrangement, in addition to the efficiency being improved.

(2) Intermittent gas pressure is found at most ironworks having no gas-cleaning plant. Each time a bell is lowered to admit the charge into a blast furnace, the gas pressure drops, and usually the gas fails altogether. Ordinary Bunsen-type burners are useless under these conditions. They light back at the gas inlet inside the mixing tube, and each burner requires attention from the boilerman every time the pressure falls—say every 10 minutes—an impossible proposition. It is only very recently that this problem has been solved. Burners have been developed which draw in and mix primary air with the gas in a similar manner to the Bunsen burner. These burners work on the injector principle. Their mixing tubes are made conical, expanding in cross-section from the gas inlet to the burner nozzle. This form offers practically no frictional resistance to the flow of the mixture of gas and air. It is well known that a flame travels through a mixture of air and gas at a certain definite speed for a known mixture. The burners are so proportioned that the speed of the mixture of air and gas at the burner nozzle is greater than the speed of the explosive reaction of the flame, and therefore, when the gas pressure is present, the gas burns at the end of the burner. When the gas pressure falls the gas burns at that point where the speed of the gas-air mixture corresponds to the speed of the flame. When gas fails, the flame is extinguished, and a small coal fire is kept in the boiler to ignite the gas when it returns. As soon as gas pressure returns, the velocity of the gas-air mixture forces the flame out of the mixing tube, and combustion continues at the burner nozzle as before.

It is found that this burner automatically adjusts over considerable variations of gas pressure, the weight of primary air drawn in to the weight of gas passing on account of the absence of friction in the mixing tube. At one English ironworks, on a Lancashire boiler working at a gas pressure of about 1-in. water gauge, it is found that the temperature of the waste gases is 315 deg. C., while the temperature in neighbouring boilers fitted with the old combustion arrangement is from 700 deg. C. to 900 deg. C., with combustion still taking place at the dampers.

- (3) To deal with gas at a very low gas pressure, and to get

a good mixture of gas and air, is impossible without mechanical assistance. No burner will mix them properly. A Bunsen-type burner would light back at once at such low gas pressures.

If the pressure of either gas or air is raised to 2 in. or more, the conditions are then similar to those in (1) where a steady gas pressure exists. The mixing in the burner is done either by the gas or by the primary air entering under pressure; and the secondary air is drawn in at the burner nozzle as usual. To raise the gas pressure, a fan is inserted in a bypass on the gas main, and three valves are provided to cut off the fan on each side and to close the gas main when the bypass is open. The fan to raise the air pressure has only to deal with 60 per cent. of the air required, but an air main is required connected to each burner. Although both these methods are costly, the results, both as to additional boiler load and as to improved efficiency, are so satisfactory as to pay many times over for the outlay.

When a short, intense flame is required, we must use either air or gas under considerable pressure. This method is well known in the case of gas furnaces for reheating and melting. From $1\frac{1}{2}$ to 2 lb. per sq. in. pressure on the air supply is the most suitable pressure, though excellent results are got with 12-in. (water gauge) pressure. The whole of the air needed for combustion is supplied by the mixing arrangement, no secondary air being used. The author believes that by this method, which puts the boiler under pressure, and by simply drawing off the products of combustion by the chimney draught, we should make a considerable advance in the direction of large boiler outputs combined with high efficiency.

A smaller combustion space is needed in proportion as the air and gas are more intimately mixed in the burners.

Preheated air and hot gas are of great advantage for boiler firing. Air preheated to 190 deg. C. was used at one plant, with producer gas of 150 therms per cu. ft. The sensible heat of the air added 5 per cent. to the calorific value of the gas, and thus raised the flame temperature. It depends upon where the heat is got, whether it really adds anything to the total efficiency. If the air or gas is heated by waste gas, say in an economiser or in passages outside the walls of the boiler, the heat then supplied is all clear gain.

Gas Measurement.—If the evaporation of a boiler is known, the only other thing required is to know the quantity of gas consumed. Here a serious difficulty arises. Wherever a large quantity of gas is concerned, gas measurements are difficult, and where the gas is of high and varying temperature and carries a large quantity of dust, they are next to impossible. Velocity measurements, with the assistance of the Pitot tube or throttling disk, or anemometer, cannot be trusted to give absolute readings, but they are very effective in giving readings which are relatively correct from day to day. To obtain the actual values there is no other way but to resort to theoretical calculation, and to draw up a balance-sheet for the carbon.

A meter of the rotary type should be calibrated by means of a gasometer, both before and after use, with the actual gas it is measuring. If this is not done, large errors may arise. With Pitot tube meters, the Pitot tube must be kept clean, and should be examined and blown out at short intervals. Meters working by the difference of pressure on the two sides of a throttling disk in the gas main are less apt to deceive than Pitot tube meters, because they are not so liable to be affected by eddies in the gas flow. Velocity readings should never be used unless the pipe in which they are taken is straight for about 10 diameters' length on each side of the point of reading. The author has used both Pitot tube and throttling disk gas meters at several different plants, and on the whole has had reason to be satisfied with the readings they gave of relative volumes.

Boiler Control.—There are three methods by which we can test what results are being got by a boiler, namely, (1) by measuring the gas supplied and the water evaporated, (2) by analysing and taking the temperature of the waste gases, as described above, and (3) by taking the combustion temperature. All these methods are good. The chemical method is slower and more laborious than the pyrometer method, but it is cheaper and gives much more information.

For testing the combustion temperature a pyrometer junction is inserted in each boiler flue within a short distance of the nozzle of the burner. All these junctions can be wired to one dial, with switches to connect each junction in turn to the dial. Such an arrangement is especially desirable if the engineer in charge has no time to be constantly at the boiler plant. He can have the dial in his office, and can at any moment read the temperature in front of each burner nozzle, and give instructions to the boilerman to attend to such burners as are not working satisfactorily.

A CO₂ recorder on the boiler flue is an excellent check on the results. It will be realised, however, that very deceptive deductions may be made from the readings of this instrument. Although the CO₂ reading is good, there may be unburned CO present, causing serious losses. If an instrument were fitted to record CO₂ and CO simultaneously, it would be the ideal arrangement for the chemical control of gas-fired boilers, and the author sees no reason why such an instrument should not be made and sold at a reasonable price.

A gas-pressure gauge should be fitted, if not at each boiler,

at least at every range, in a place easily seen by the boilerman. In addition, a differential draught gauge should be fitted to each boiler, showing the difference in draught between the front and back of the boiler, and a plain mark should be made on the dial at the reading which the boilerman is to maintain by means of his dampers. With these gauges it is an easy matter to instruct a boilerman how to control his burners without trusting alone to the appearance of the flame, even under varying conditions of gas pressure and chimney draught. On large boilers working at steady gas pressure it pays well to install automatic damper control to maintain a uniform chimney draught.

Water meters are a necessity for careful boiler control. At least one meter to every range of boilers is necessary. Gas meters should also be installed.

In all large works a man should be appointed to take general charge of the steam output. He need have no great chemical or engineering training, as his business is simply to run his boilers at their maximum efficiency, and all engineering matters would be reserved for the engineer or manager. A suitable man can be got for £4 a week in ordinary times, but of course he would require a little training from a chemist or engineer before he fully understood his duties. The author has trained one such man, and found that he picked up the requirements very quickly and carried out his duties most successfully. At a works raising 100,000 lb. of steam per hour the value of the steam is about £40,000 per annum. If the man in charge of the boilers, by his effective control, improves the efficiency by only 5 per cent., the £2,000 saved will pay his salary many times over. In addition, there is the advantage that the maximum possible supply of steam will always be secured. Even with the best combustion arrangements, the result of intelligent control will be a saving of at least 5 per cent. as compared with the results to be attained with the same installation run simply by boilermen, so that there is no possible excuse for a company that neglects to appoint such a man. In large American works the steam engineer is a recognised necessity, and he is a highly paid official.

The best outfit of recording instruments is useless unless a constant and intelligent use of them is absolutely enforced. All the temperatures, pressures, volumes, and analyses taken should be entered up in a special book. At least once a week a balance-sheet should be drawn up, showing the allocation of the gas to each part of the work and the results obtained therefrom. This should be submitted to the manager weekly, with the necessary explanation in case any result falls short of the required efficiency. If, in addition to this, the boilermen and the man in charge of the boiler plant are given a premium for maintaining good results, boiler control will soon develop into a fine art, and prove an important source of revenue.

PYROMETERS AND PYROMETRY.

DISCUSSION AT THE FARADAY SOCIETY'S MEETING.

(Concluded from page 534.)

Applications of Pyrometry to the Metallurgy and Heat-Treatment of Steel.—A group of papers, and as many speeches, dealt with this important aspect of the subject. Whatever may in the future be the outcome of some of the newer methods of measuring high temperatures already referred to, at present the various forms of optical pyrometers hold the field—not without a good deal of unfriendly criticism—for taking the temperature of molten steel. If the contention of Dr. W. ROSENHAHN proves to be correct, that the future must lie with a pyrometer the sensitive members of which are outside the furnace, this must always be the case, but it is well not to dogmatise on the future. Mr. J. A. RHODIN's view was that the optical pyrometer was essentially unsatisfactory, on account of the personal equation involved. The truth appears to be that this type of instrument is capable of extraordinary accuracy if it is used by carefully-trained observers and under proper conditions, namely, "black body" conditions, or the necessary corrections made if these be imperfectly fulfilled. The optical properties of the glass for the eyepiece was not to be lost sight of, Dr. J. A. HARKER reminded the meeting. These are fairly simple qualifications, and yet it would seem, judging from many speakers, that they are not clearly grasped even by expert users of pyrometers. One of the most fruitful results of the discussion should be to emphasise the care with which pyrometers have to be used—especially for temperatures above 1,500 deg. C.—and their readings interpreted. As to their limits of accuracy, Mr. COSMO JOHNS actually talked of variations of ± 2.5 deg. C. in readings taken at some 1,600 deg. C., and Prof. J. O. ARNOLD, F.R.S., using, in a particular series of experiments, five different types of pyrometer (the P ry thermoelectric radiation, the P ry bimetallic spiral spring, the Foster base-metal thermocouple, a modified Wanner radiation, and a M sure and Nouel radiation pyrometer), and employing different observers, arrived over a wide series of readings at a grand mean temperature of 1,296 deg. C., when 1,300 deg. C. was the temperature aimed at.

Both Mr. Cosmo Johns (Sheffield) and Dr. A. McCance (Glasgow) spoke on temperature determinations of liquid steel. Dr. McCance has now evolved a system under which nearly 12,000 determinations are made in the course of the year, using the Siemens optical pyrometer. His experience was that frequent standardisation was necessary, but if the proper precautions were taken, the apparent temperature of the slag surface could be kept constant between 1,630 deg. and 1,650 deg. C., to the great advantage of the furnace lining. The true temperature would be the apparent temperature less an amount depending on the temperature of the flame and the emissivity of the slag. The true temperature of liquid steel he considered to be 1,600 deg. C., and castings below this gave cold heats. Dr. W. H. Hatfield (Sheffield) found a disparity as great as nearly 200 deg. C. between the readings of the temperature of molten steel by a thermo-couple and the Cambridge optical instrument, due, of course, to imperfect black-body conditions. Both Dr. Hatfield and Dr. McCance had much to say which was of great interest as to the practical precautions to be taken in work of this kind, for which reference must be made to the full report of the discussion that will be published in due course. The bearing of the emissivity of the molten metal surface on optical pyrometer readings was discussed in some detail by Prof. F. G. Donnan, F.R.S. (University College, London), who showed curves and tables giving the necessary corrections in the case of gold, silver, and copper. It would be very useful if similar curves could be obtained for iron, steel, and molten slags. Mr. Cosmo Johns gave the results of his experiences of temperature measurements of molten steel, taken with optical pyrometers using monochromatic light, a system that had been in regular works practice for nearly four years. It appeared that skilled observers were able unaided to distinguish differences of 15 deg. C. when steel was flowing into a ladle, and 10 deg. when running into an ingot mould, so that any system of pyrometry called for an accuracy of ± 5 deg. C. More than this was attainable by trained observers if standard conditions of observation were adopted. Mr. Johns proceeded to state these conditions, both as regards the proper part of the stream to observe and the relative time of observation, seeing that the temperature of a flowing stream was bound to be either rising or falling. Observations on the temperature of the interior linings of furnaces after the steel had run out were of considerable interest as bearing on the softening or fusion range of the refractories employed. Under proper conditions, every detail inside the furnace was visible: joints in the brick work, junctions of sand banks with the side walls, port openings, and places where wear had occurred could all be perceived. A research on the emissivity of silica bricks at steel-furnace temperatures was called for. Dr. McCance's experiences agreed closely with those of Mr. Johns.

The application of pyrometry to the hardening of high-speed tools was discussed by several speakers, notably by Prof. J. O. Arnold. At Sheffield University the practice is to immerse the tool in a bath of barium chloride fused by a current which passes into it through iron electrodes. Perfect regularity of temperature is attained, 1,300 deg. C. being the point aimed at. Mr. P. Peckman (Manchester) keeps a temperature record of his hardening furnace by inserting a thermocouple into the bottom or side of the furnace. The readings of this being standardised it acts as a check, and it is unnecessary to take the actual temperature of the high-temperature zone. For the calibration of thermocouples he suggested, incidentally, to use a piece of steel of known transformation point. Mr. W. Carter voiced the opinion of many users when he urged the use of two kinds of pyrometers, a rough type for works use and a laboratory type for checking.

Pyrometry in Glass Making.—Some interesting remarks on this side of the subject were made by Mr. C. J. Pridde (Sheffield). In the glass industry the value of scientific pyrometry was just beginning to be appreciated. He advocated the use of optical pyrometers, first, because in a glass tank one had almost ideal "black body" conditions, and secondly, because thermocouples could not be inserted in the glass, and even in the roof their life was likely to be short. He saw no reason why the monochromatic glass required for optical pyrometers should not be made here. The instrument makers had only to specify exactly their requirements, and he felt sure the glass makers could discover a suitable glass.

The Measurement of High Temperature by Means of Pottery Materials.—Under this title Mr. H. Watkin, of Stoke-on-Trent, contributed what was perhaps one of the most interesting papers in the symposium. Unfortunately, metallurgy monopolised the field so long that it was nearly 10.30 p.m. before the Chairman was able to call upon Mr. Watkin, and his paper passed as read without discussion. The relation of temperature to degree of firing lies at the foundation of the work of the potter, and it is therefore not surprising that he has for long estimated his temperatures by their effect on his clays. Mr. Watkin tabulates these methods of ascertaining high temperatures as follows:—

1. By sight—by the colour of the oven's contents.
2. By the changes red clays undergo when heated.
3. By the translucency of certain trial pieces.
4. By the development of the rose-tint in enamelling colours.
5. By measurement of bulk or contraction.
6. By the feel or touch.

7. By the sense of hearing—judging of the sound when the ware is struck.

None of these time-honoured methods, however, are up to modern requirements, and they have been modified in the direction of greater sensitiveness, reliability, and constancy. The most famous of these improvements was the invention of the Seger cone in 1886, when Seger made up a series of cones having melting points from 1,150 to 1,350 deg. C. A still further use of the same principle has been made by Mr. Watkin in his "heat recorder," which consists of a block of very refractory ware with five circular recesses sunk into its top face. In these recesses are placed little pellets of fusible materials of definite composition and melting point. The fusion-point of each mixture has been carefully determined by comparison with a standard electrical pyrometer. The pieces that become fused are attached to the recorder, and the heat attained is thus definitely registered. These recorders have been found useful in many industries, as in pottery and porcelain manufacture, brick-making, gas works, glass works, and for numerous processes of annealing. The method seems to be unknown outside the pottery industry, and it is, therefore, well that it has had an opportunity to be brought before a wide public, for its simplicity—the absence of any measuring instrument—may render it useful in many an unsuspected direction. It must, of course, not be forgotten, as Mr. W. J. Rees (Sheffield) pointed out in a written communication, that all such methods measure not temperature, but heat-effect, and that the rate of heating has to be considered as well as the temperature attained. For firing pottery or burning refractories it is the amount of shrinkage which is of importance; nevertheless, as Major C. W. Thomas pointed out (also in a written communication), to enable the worker perfectly to control his process he needs to watch the progress of the shrinkage. It ought to be considered whether any method is capable of giving this information short of a recording instrument. This, however, is for the refractory maker to decide.

Exhibits.—A large number of exhibits, comprising probably every type of pyrometer now on the market, added considerably to the interest and usefulness of the meeting. Among the English instruments were to be seen those made by the Cambridge Scientific Instrument Co., the Foster Instrument Co., Mr. R. W. Paul, and Messrs. Siemens Bros. & Co., Ltd. Messrs. Hatfields, Ltd., showed a Harker electric furnace used for standardising optical pyrometers, and also a Brown furnace control pyrometer. Mr. Watkin illustrated his paper with a range of pottery temperature indicators and other specimens, and Mr. G. E. M. Stone showed his base-metal pyrometer referred to in his paper, and also some very instructive examples of faults which pyrometers are prone to develop. The Automatic Electric Furnaces, Ltd., showed the Wild-Barfield furnace for hardening gauges and tools.

ELECTRICITY IN COAL MINING.

At a meeting of the NORTH OF ENGLAND BRANCH OF THE ASSOCIATION OF MINING ELECTRICAL ENGINEERS, at Newcastle-on-Tyne, on November 24th, Mr. C. A. Nelson, the new President, delivered an address. He said there was no mining district in Great Britain which had the electrical advantages of Northumberland and Durham. They had at their call one of the largest electricity supply undertakings in the Kingdom, which, on account of its size, could offer energy to its consumers at a price per unit that no individual colliery could generate at, unless it had some special advantage. Practically all the Northumberland pits would find it to their advantage to take current from this source. During the last six years he had been constantly engaged in substituting electrical for steam plant. The first steps were directed to cutting off the low-pressure boilers, and the inefficient engines working from them. In each case comparative prices and costs were taken of up-to-date steam plant and electrical plant, and it was found in most cases that the electrical plant had the advantage. In comparing the cost of electricity taken from a supply company with that of steam plant, colliery engineers were apt to err in favour of the latter, and he had found by experience that depreciation and maintenance charges for steam plant were much under-rated. For instance, it was wrong only to take the cost of coal used, plus cost of firemen, and repairs and depreciation of boiler plant; they should allow for depreciation, maintenance, and repairs on steam and water-pipe ranges, boiler pumps, joints, special railway sidings, wagons, and bunkers, and, in addition to firemen's wages, their compensation, insurance, house and coals; for the locomotive, the driver and the shunter, as well as for a part of the agent's, manager's, engineer's, and engine-wright's time. The cost of the water supply also was often omitted from the estimate, as well as the cost of dealing with the ashes. As all these things were eliminated by taking current from a supply company, they should be charged against steam. At the actual machinery, there was a considerable saving in oils, packing, grease, &c. In elec-

trical winding he had also found there was a saving in wear and tear on the ropes and cages; and the maintenance cost of the shaft guides, conductors, &c., was reduced by reason of the smoother working. The maintenance of plant when electricity was used was reduced to a minimum, and a point of great importance was its efficiency. A steam engine might work inefficiently for weeks without the engineer being aware of the fact, whereas, with electricity, it was at once apparent on the meters, and could be attended to immediately. The efficiency of electricity, and its elasticity of application, would practically lead to its gradual replacement of all other power, and the sooner this was realised the sooner we should be able to overcome successfully international competition. The industrial development of this country was intimately connected with the development of the use of electric power. Large central supply stations efficiently managed could, owing to the diversity of their loads, do more to help this industrial development forward than any individual. The plant installed at the Wallsend and Hebburn Collieries was of approximately 13,000 B.H.P., and the energy used was 11,000,000 units per annum. They had two large direct-coupled winders, duplicates, and a third was being installed. The motor was 730/1,950-B.H.P., three-phase induction type, wound rotor and slip rings, 50 R.P.M. They lifted from 60 to 72 cwt. of coal per wind, and the units used were 5.7 per wind, the shaft being 1,080 ft. deep. The winders were built by the British Westinghouse Electric & Manufacturing Co., Ltd. Although the old steam winder had a 22-ft. drum, and the electric winder only 12 ft., the life of the rope had increased from two years one month, to three and a half years, when they had to remove it to comply with the Coal Mines Regulation Act, and, as the rope was in excellent condition when taken off, they had decided to apply to the Inspector of Mines to get the regulation time extended in favour of electric winders. It was in underground haulage that electricity, owing to the intermittency of the work, and the distance from its source of power, showed the greatest advantages. For the main haulages it was ideal, and when taken underground it obviated the abomination of a running set of ropes in the shaft, or, the alternative, pipes. For secondary haulages electricity had also great advantages. He had found that for large main and tail haulage gears, the liquid type of controller, with reversing switches, was the best. They had carried out an interesting change by arranging an independent system of ventilation for each colliery at Wallsend, whereby an hourly consumption of 366 units had been reduced to 92.83, a saving of 273.17 units, equal for a year to 2,392,940. The application of electricity to fan drives, with the motor connected directly to the fan, was attended with difficulty owing to the speed of ordinary motors being constant; to overcome this, they were installing a 150-H.P. adjustable-speed polyphase induction motor with seven speeds—260, 300, 340, 400, 480, 600, and 800 R.P.M. If successful, this would allow them to run the fan at a speed which was just enough to give an adequate ventilation, and would allow of easy change in speeds to suit the week-ends and holiday arrangements. The pumping and air compressing was almost entirely driven by electricity, as was the machinery for the screens and shops. At present they were using about 1,000 miners' lamps of the C.E.A.G. type, and, although more expensive in first cost and maintenance, these had in use justified themselves; but he considered there was a great future for a good dry-cell miner's lamp.

Mr. NELSON is the agent of the Wallsend and Hebburn Collieries, Ltd.

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electric Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

- 17,396. "Operating water-tight electric switches." E. H. KEELEY. November 26th.
- 17,397. "Mechanical cut-in and out for electrical charging sets." C. L. G. CHAPMAN & E. SMITH. November 26th.
- 17,398. "Electrical connections of electric torches, &c." EFANDEM CO. AND A. H. WILLIAMS. November 26th.
- 17,410. "Electric ignition torch." A. L. LONG & H. SEAL. November 26th.
- 17,416. "Sprocketed tilting trunnions and gear for electric tilting furnaces, &c." J. H. TWIDELL. November 26th.
- 17,426. "Electro-pneumatic braking apparatus." W. V. TURNER. November 26th. (U.S.A., June 10th.)
- 17,441. "Electric cables." W. T. HENLEY'S TELEGRAPH WORKS CO. & H. SAWYER. November 26th.
- 17,450. "Electric switches." G. TUX. November 26th. (Italy, April 4th.)
- 17,493. "Electric hand-lamps." M. EDWARDS. November 27th.
- 17,508. "Insulator." A. E. Y. TRESTRAIL. November 27th.
- 17,511. "Signalling generators." WESTERN ELECTRIC CO. (Western Electric Co., U.S.A.) November 27th.
- 17,517. "Electric heating elements." H. J. DOWSING & DOWSING RADIANT CO. November 27th.
- 17,525. "Electric telephony." P. S. GOMEZ. November 27th.
- 17,529. "Vacuum electric discharge devices." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.) November 27th.
- 17,533. "Lamps for divers." C. DORRILL & A. WIGOSNAM. November 27th.
- 17,590. "Torches for welding and cutting metals, &c." B. CONKLIN. November 28th.

- 17,608. "Automatic telephone systems." AUTOMATIC ELECTRIC CO., AUTOMATIC TELEPHONE MANUFACTURING CO. & A. J. RAY. November 28th.
- 17,612 & 17,628. "Electric furnaces." E. GRAMMONT. November 28th.
- 17,617. "Receiving or detecting apparatus for sound, &c., waves." S. G. BROWN. November 28th.
- 17,648. "Electric switch and dimmer." F. M. T. EVANS. November 29th.
- 17,673. "Electro-magnetic devices, &c." G. FLAISANT. November 29th.
- 17,674. "Spintherometers for use in wireless telegraphy." A. MARINO. November 29th.
- 17,675. "Commutators for dynamos or motors." H. C. H. SMYTH AND TREDELECT ENGINEERING CO. November 29th.
- 17,679. "Electric switches." E. A. NEW. November 29th.
- 17,699. "Electrically-operated riveting, pressing, stamping, &c., machines." E. ADAMSON. November 30th.
- 17,700. "Electric furnaces." J. GUNN, A. HALL & F. MOOBY. November 30th.
- 17,745. "Electric torches." A. FLEMING. November 30th.
- 17,751. "Regulating mechanism for dynamo-electric machines." BRITISH THOMSON-HOUSTON CO. & F. H. CLOUGH. November 30th.
- 17,762. "Submarine signalling apparatus." C. S. BOOKWALTER & F. A. DAUBIN. November 30th.
- 17,769. "Flash lamps." BRITISH EVER-READY CO. & M. GOODFELLOW. November 30th.
- 17,772. "Alternating-current rectifiers." C. J. QUILL. November 30th.
- 17,773. "Automatic signalling arrangements for electric tramways, &c." D. HAMBURG. November 30th.
- 17,775. "Dynamo-electric machines." S. F. BARCLAY & VICKERS, LTD. November 30th.
- 17,776. "Gyro compasses." S. G. BROWN. November 30th.
- 17,788. "Electric switches." A. TURNER & R. H. WILKINSON. December 1st.
- 17,801. "Joints for electric welding on thin material." F. BLOMLEY. December 1st.
- 17,802. "Electrical ignition apparatus for internal-combustion engines." J. H. CHAMBERS & H. LUCAS. December 1st.
- 17,823. "Starting mechanism for magneto of internal-combustion engines." L. JOHNSON & J. T. ROBERTS. December 1st.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1915.

- 16,107. IGNITION AND LIGHTING APPARATUS FOR AUTOMOBILES. Girardeau. November 16th, 1914.

1916.

- 10,882. DYNAMO-ELECTRIC MACHINERY. Electromotors, Ltd., B. Longbottoms and E. Greenhalgh. August 2nd, 1916. (Patent of addition not granted.) (110,916.)
- 11,503. ELECTRIC CABLE CONNECTING BOXES, FUSE SWITCH BOXES, DIVIDING BOXES AND THE LIKE. British Insulated & Helsby Cables, Ltd., and R. W. Blades. August 15th, 1916. (110,919.)
- 15,675. WIRELESS TELEPHONE SYSTEMS. British Thomson-Houston Co. (General Electric Co., U.S.A.) November 2nd, 1916. (110,924.)
- 15,840. SUBMERSIBLE VESSELS. G. F. Myers. November 6th, 1916. (Divided application on 16,600/15.) (110,928.)
- 15,842. SUBMERSIBLE VESSELS. G. F. Myers. November 6th, 1916. (110,929.)
- 15,843. SUBMERSIBLE VESSELS. G. F. Myers. November 6th, 1916. (110,930.)
- 15,867. PRINTING PRESSES. Goss Printing Press Co. of England (Goss Printing Press Co., U.S.A.). November 6th, 1916. (110,932.)
- 15,962. THERMOSTATS. H. H. Grundy. November 7th, 1916. (Addition to 5,311/12.) (110,938.)
- 16,215. SPARKING PLUGS FOR INTERNAL-COMBUSTION ENGINES. H. G. Longford, W. W. Longford & W. A. Clark. November 13th, 1916. (Cognate application, 17,885/16.) (110,950.)
- 16,516. CENTRIFUGAL COMPRESSORS. British Thomson-Houston Co. (General Electric Co., U.S.A.) November 17th, 1916. (110,957.)
- 16,591. TWO-WAY MASTER SWITCHES FOR ACTUATING SETS OF CONTACTOR SWITCHES FOR REVERSING MOTORS OF PLANING MACHINES AND OTHER RECIPROCATING MACHINES. G. Stirk, E. Stirk, R. Stirk & J. G. Stirk. November 20th, 1916. (110,958.)
- 16,990. ELECTRIC TRACTORS. E. C. R. Marks (Mercury Manufacturing Co., U.S.A.). November 27th, 1916. (110,968.)
- 17,111. SOLENOID MOTOR. G. Henwood & J. Lanc. November 29th, 1916. (110,969.)
- 17,598. DEVICE FOR TESTING THE PITCH OF A SCREW. H. W. Pugh & C. H. Vidal. December 7th, 1916. (110,976.)
- 17,981. METHOD OF CONTROLLING AND APPARATUS FOR PRODUCING ELECTRIC ARCS. D. F. Comstock & Technicolor Motion Picture Corporation. December 14th, 1916. (110,982.)

1917.

- 253. WELDING OF TUBES TO PLATES. T. E. Murray. February 18th, 1916. (107,194.)
- 528. ELECTRIC WELDING MACHINES. T. E. Murray. March 8th, 1916. (104,675.)
- 1,285. HEATING DEVICE FOR MOTOR CARS. Jandus Arc Lamp & Electric Co. and A. Denman-Jones. January 25th, 1917. (111,003.)
- 1,482. ELECTRIC DRY CELLS. F. R. Tammadge & F. C. Tammadge. January 30th, 1917. (111,005.)
- 2,383. ANEMOMETERS. South Metropolitan Gas Co., E. V. Evans & J. S. G. Thomas. February 17th, 1917. (111,015.)
- 3,485. ELECTRIC WELDING OR FUSION DEPOSITION OF METALS. Quasi-Arc Co. & L. Tweedde. March 9th, 1917. (111,025.)
- 3,546. APPARATUS FOR TEACHING SIGNALING IN MORSE OR OTHER CODES. F. W. Green. March 10th, 1917. (111,027.)
- 4,555. ENGINE STARTER. V. Bendix. March 29th, 1917. (111,039.)
- 5,028. LIGHT PROJECTION APPARATUS. A. Ames. December 6th, 1916. (Divided application on 17,522/16.) (111,041.)
- 5,244. ENGINE STARTER. F. B. Dehn (Eclipse Machine Co., U.S.A.). April 13th, 1917. (111,042.)
- 8,589. ELECTRIC BATTERIES OR CELLS. I. Cassan. June 15th, 1917. (111,058.)
- 9,405. INTERRUPTING DEVICES FOR THE IGNITION OF INTERNAL-COMBUSTION ENGINES. O. Hurry (R. Bosch). June 29th, 1917. (111,062.)
- 11,065. TELEGRAPH SYSTEMS. Automatic Telephone Manufacturing Co. and H. H. Harrison. August 1st, 1917. (110,730.)
- 11,236. IGNITION DYNAMOS. C. T. Mason. September 15th, 1916. (109,794.)
- 11,358. MEANS FOR CONTROLLING ELECTRIC CIRCUITS. W. O. Kennington. August 7th, 1917. (111,071.)
- 11,878. TELEGRAPH SYSTEMS. Automatic Telephone Manufacturing Co. and H. H. Harrison. August 18th, 1917. (110,733.)
- 12,278. SPARK PLUGS. E. C. R. Marks (La French Power Spark Plug Co.). August 27th, 1917. (111,072.)
- 14,931. PRINTING PRESSES. Goss Printing Press Co. (Goss Printing Press Co., U.S.A.) November 6th, 1916. (Divided application on 15,867/16.) (111,076.)

THE ELECTRICAL REVIEW.

VOL. LXXXI.

DECEMBER 21, 1917.

No. 2,091.

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Telephone Nos.: City 997; Central 4225 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 ls. 6d.; Canada, £1 8s. 10d. (\$5.80). To all other countries, £1 10s.

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THE "ELECTRICAL REVIEW'S"

ELECTRICAL & ALLIED TRADES DIRECTORY (THE RED BOOK),

1917 EDITION.

H. ALABASTER, GATEHOUSE & KEMPE,
4, Ludgate Hill, London, E.C. 4.

THE SPIRIT OF THIS CHRISTMAS.

For the fourth successive year we approach the Christmas festival of Peace and Goodwill with practically the whole world at war. The anticipations of a year ago that by Christmas, 1917, the Christian peoples would be able to celebrate one of the central occasions of their Common Religion in former happiness and content, though subdued the while by hallowed memories of our glorious dead, have not been realised. Victories for the high cause of Freedom and Righteousness have not been wanting, but though the spirit of our race still determines that ultimately the principles for which we fight shall be observed, the crowning victory of all has yet to be won. Along that rugged, bloody, climbing way, and that alone, shall we win the era of Peace and Goodwill for which all the world is now longing and waiting. God grant that soon by the wisdom of sane and experienced statesmanship, by the valour of the Allied Arms, and by the true appreciation in the mind of the people of Germany of the Allied aims, there may be caused to find expression among our enemies the broken spirit of repentance, and the desire to make amends for all the cruel wrong of these terrible years. We may utter such sentiments at the season of the cradled Babe of Bethlehem, of the Holly and the Mistletoe, of Santa Claus, and of renewal of family relationships around a bright fireside, without any sign of weakening of purpose. Sacrifices proudly made, losses bravely born, anxieties manifold but recognised as inevitable, will all have their poignancy and bitterness accentuated as the sweet memories of former Yule-tides cast passingly their spell upon the mind. Such reflections may be indulged in here just long enough for us to utter a word of cheer and encouragement for all of our readers who though brave in heart mingle their laughter with tears. Our Roll of Honour has shown that many who in their earlier days followed electrical pursuits, have made for our Cause the supreme sacrifice, and innumerable others near and dear to readers of these pages, but not directly concerned in electrical life, have "Climbed the Steep Ascent." To such readers, may we be permitted to whisper that these have not died in vain. For them, at least, the Victory has been won. Nobly they played their part in the great world tragedy, and gave a priceless offering to the New Era which we profoundly believe our children will enjoy. Let us be proud that we, with them, have been allowed to pay the price as they have paved the pathway of Freedom with their all.

To those others among our readers who, having passed through the Fire, have returned to home or hospital, no longer fit for active service, but bearing in either mind or body, or in both, marks which will long remain as evidences of duty faithfully done, and to all who, tired with the unceasing work of munition manufacturing, welcome the respite of a few days of rest, we can appropriately repeat the old wish: "A Merry Christmas!" To other readers still in the thick of the fight on many a battlefield; to those on the wintry deep, infested with the pests of evildoers who design to sink at

sight, because, forsooth, they clamour for what they call the Freedom of the Seas; to those who on the wings of flight seek out the enemy or act as our protectors—our hearts go out in fullness of cheer, thankfulness, and sympathy, and we join with them in the hope, so often expressed in their optimistic letters to us, that it may not be long before they come home amid Victory's great rejoicings to take up once again the broken threads of professional and industrial electrical life.

The outlook may not seem to us at home so encouraging as we desire. The realisation of our fond anticipations has not been attained by the Christmas of 1917, and there may be still "a long way to go," but—next Christmas!—we will hope and pray that we may all be at the bench, the power station, and the office again, eagerly co-operating in handling in practice the problems that we have so often discussed in theory—the problems of After-the-War.

"Super" Electricity Supply.

THE report of a Sub-Committee of the Ministry of Reconstruction on the Conservation of Coal, of which we give a summary elsewhere in this issue, is of the first importance to the electricity supply industry. How far it coincides with or overlaps the work of the Board of Trade Committee on Electricity Supply, whose report has not yet seen the light of publicity, we cannot tell, but it is not without significance that some of the members are common to both bodies, and we strongly suspect that the document before us contains very much the same substance as that part of the other which covers the same ground. In any event, it is a noteworthy pronouncement, and while, in the absence of details—for the complete report has not been issued at the time of writing—we are not in a position to discuss its contents at length, there is nevertheless ample material for comment in the recommendations now put forward.

Briefly, the report contemplates the division of the country into 16 districts, each supplied with the whole of its electricity from large "super-power plants," and each under the control of a single authority (as regards generation and primary distribution); the generating stations are to be situated on important waterways, with sites providing for by-product plant and electrochemical works; when these are ready, extensions of local uneconomical stations are to cease, and power will be derived from the main systems; and the appointment of a Board of Electricity Commissioners is recommended, with full powers to deal with the whole question throughout the country. The duties of the Board will include the restriction of uneconomical extensions, the arrangement of equitable terms for the transfer of generating and main distributing systems to the local bodies, standardisation of primary frequency and voltage, and the settlement of the method of control in each area. The last item is pregnant with meaning. "A Parliamentary company working under adequate control as regards limitation of dividends, &c.," is mentioned, together with "other alternatives" which are significantly relegated to an Appendix (which is not before us); in addition, the Sub-Committee is "impressed with the special need for initiative and resource in the management," and says that "the freedom of range and keenness which are distinctive of private enterprise will be found to be in a high degree conducive to the fullest measure of success." It is quite clear, therefore, that the Sub-Committee favours the controlled-company system, though the door is doubtless left open—in the Appendix—for municipal or communistic ownership and management, a system which will certainly be

demanded in some areas. Lastly, it is admitted that in order to get immediate results in the shape of a cheap and efficient power supply, "State assistance in some form may be necessary," as to which we would only say—for "may" read "will." Further particulars of the Sub-Committee's plans—for they appear to be such rather than mere theories—will be awaited with the keenest interest.

Swiss Railways and Electric Traction.

ONE of the economic problems which are engaging increasing attention in Switzerland at the present time relates to the conversion of the steam railways to electric traction. This particular question belongs to those which have become accentuated by the war, and the necessity has arisen for securing economic independence, as far as possible, from supplies of foreign coal in face of the fact that the country merely possesses insignificant and undeveloped natural resources in coal. So far the use of electric traction on the normal gauge railways has been of an extremely limited character. At present, only the Berne-Lötschberg-Simplon and the Burgdorf-Thun lines out of the total mileage of standard network are electrically operated, although the transformation of the St. Gothard Railway has been in hand for some time past. The Federal Railway Administration is now also occupied with a scheme for converting the Scherzigen-Berne and the Brieg-Sitten lines, at an estimated outlay of £388,000, but the desire for further development goes considerably beyond this stage.

The conditions of the war, however, render it very difficult to carry out any large scheme of expansion. Apart from the wish to ensure economy in the consumption of coal, other materials are costly and not easily obtainable, labour is dear, and other obstacles stand in the way. It is, nevertheless, considered that the interests of Switzerland in this matter are so great that the country will be able to overcome the difficulties, although the completion of the work will presumably fall in a period of peace, when the special incentive to an accelerated conversion will no longer exist. The Federal Committee of inquiry, which investigated the subject a few years ago, reached the conclusion that the economy of electric traction is beyond question. In this connection, interested circles now hold that, despite war-time prices, the expenditure on railway transformation during the hostilities would not be so considerable as seriously to prejudice the economy in working which is expected from the change. Some of the water powers required for the purpose have already been acquired by the Federal authorities, and others are under negotiation. In the case of the St. Gothard Railway, the necessary powers have been assured near Goeschenen, Amsteg, and on the Ritorn Lake, but about 500,000 h.p. would be needed for a comprehensive scheme for all the Federal railways; and it is calculated that about 60,000,000 h.p.-hours per annum on the turbine shafts would be required to deal with the increased traffic which would result from the transformation of all the lines.

The financial question is naturally of great importance. It is proposed to raise the money by the issue of bonds, of which considerable numbers will be offered for subscription as occasion may arise. Some idea of the expenditure which will be necessary may be gathered from the fact that the conversion of the St. Gothard Railway alone will involve an outlay of £2,480,000. In the case of the private railways, the question of further conversions is still more difficult than in that of the Federal Railways, as the former are not apparently in a position to raise fresh capital, and it is, therefore, possible that they will seek the financial support of the Cantons and the Federal Council for this purpose.

COMMON SENSE IN ADVERTISING.

By A. J. HOUGH.

THE "hot air" merchants of the world are busy. Matters of vital importance—which will one day have to be dealt with honestly and faithfully—are in some instances becoming so inextricably involved and complicated by masses of contradictory evidence and argument, that the real points at issue are lost in seas of mendacity and sophistry.

In the realm of publicity one can sometimes discern a tendency to bury fundamental truths and commonsense beneath a veneer of grandiloquence and high-sounding phrases. Let us be certain that we do not allow ourselves to become—even to a slight extent—"intoxicated by the exuberance of our own verbosity."

We read and hear much to-day of scientific management, efficiency, and psychology in advertising. Strictly speaking, common sense is necessarily embodied in the practice of these arts. Some of our enthusiasts, however, appear to be obsessed by the idea that the only real evidence of scientific management is the existence of a profusion of charts, card indexes, and printed forms of every description. Even assuming that the last ounce of assistance is squeezed from these admirable business aids, common sense cannot be entirely relegated to the background. Inanimate paper and cardboard, and the strict observance of certain rules and formulae, while conducive to efficiency and success in many directions, are at the best but poor substitutes for the rapid, shrewd, decisive reasoning of intelligence and commonsense. So with abstruse and academic discussions regarding the psychology of advertising. Scientific management, efficiency, and the study of psychology are excellent things in their way, but the glib reiteration of these phrases by pseudo-business experts is not proof that they possess an unfailing panacea for business ills of every description. Common sense remains, perhaps, the most valuable asset which can be possessed by the average business man.

Reading some of the effusions which are written on the subject, one might get the impression that psychology is a kind of occult mystery, and that familiarity with its closely guarded secrets is the only open sesame to success in advertising. It would, perhaps, be more correct and practical to say that psychology, in relation to publicity, is the application of certain ascertained facts and principles in a manner which our accumulated knowledge and experience has shown to be most effective.

It is axiomatic, though somewhat trite, that successful advertising depends to a great extent upon the media selected, the nature of the proposition, and the form in which such proposition is presented. Advertising to sell goods is—to use a familiar analogy—merely salesmanship in black and white.

Some people have a hazy idea that they need only spend a sufficient sum on advertising in order to achieve immediate success. This is not the case. Unless every effort is directed into its proper channel, and the work carried through effectively and with shrewd discrimination, there will be disillusionment and loss.

One of the chief points to be remembered is that every advertisement, immediately it is printed, must enter into antagonistic rivalry with other advertisements in the same paper. This is especially true when small spaces are used. It is not necessary, as some assert, that your advertisement should "kill the man next door." The copy should, however, possess distinctive attention-compelling qualities of the highest degree. Its general form and display should be such as will arrest the eye. Its arguments must be forcible, concise, and convincing.

These conditions probably receive due consideration from the majority of advertisers. There is, however, another aspect which is not so frequently borne in mind. While every endeavour should be used to make the advertisement distinctive, it must not be assumed that it is a good one just because it is conspicuous. There is a vast difference between an advertisement which will bring business and one which will merely attract attention.

Then there is what is sometimes called reminder advertising. How often do we see—especially in the small

provincial papers—fairly large spaces filled with what might be termed memorial cards of the business. This, in most cases, is absolute waste. Such space should be filled with live selling talk, frequently changed. Interesting news and information regarding the goods should be given. A paper which printed the same articles day after day and month after month would not be read. So with an advertisement which is never changed. To spend money on reminder advertising means continual paying out with little prospect of return. If an advertiser can find nothing better to say than the fact that his name is so and so, and his business so and so, it will pay him to get someone to fill his space for him without delay.

Getting results by general publicity is a long and costly operation. Keeping your name before the public is not bad policy when the article can be purchased at any street corner. In spite, however, of all the platitudes we hear from time to time regarding "future investment" and "cumulative effect," there is nothing that can beat immediate results. The quicker advertising expenditure can be recovered, the sooner can the amount be laid out again. Think this out, and decide what you want—whether you wish to have the complacent satisfaction of seeing your name and the nature of your business announced from time to time, or whether you wish to sell the goods. Business or notoriety! A sufficient expenditure in the Press will give you either.

Other copy can frequently be seen which is cleverly written and charming to read, but not convincing. Catchy cleverness sometimes withdraws attention from the goods. Vague generalities—however choice and flowery the language employed—are of little use. Facts and definiteness, in plain and simple words, are more effective. For instance, in literature designed to sell an ordinary wheelbarrow, the words "thoroughly seasoned ash" mean more than "best selected material." Again, "tested to stand a dead weight of 10 cwt." is of more value than "the strongest barrow made." Specific facts are always better than general statements. This is especially true when the article advertised is one which appeals to business men—as distinct from the general public.

The hints which follow, while perhaps they will convey little that is new to the experienced advertiser, may prove useful to some of those whose opportunities for studying the subject are somewhat limited.

Size of Space.—One often hears arguments regarding the most effective size of space. This depends upon a variety of circumstances. There are occasions, however, when the size of the space which is used has really less to do with getting results than the use which is made of the space. Large size in an advertisement, while possessing many advantages, is not by any means the chief desideratum for success.

Headlines.—An attention-arresting headline can be made of great value, especially when it serves as a context to the advertisement, and is developed by the illustration and copy. The headline should be a guide post to the body matter. It should not be too general, nor should it be deceptive. Copy which may otherwise be good in every respect will have little, if any, influence upon people whose attention has been attracted under false pretences.

Illustrations.—Illustrations should be used with a distinct purpose in view. It is not sufficient that they should arrest the attention and stop at that. They should form an integral part of the complete advertisement, and help to tell the story. It is possible to have a picture—in no way related to the goods advertised—which will attract attention because it is in some way novel or bizarre. Such illustrations, however, rarely add anything to the selling qualities of the advertisement. On the other hand, they frequently detract from its pulling power by monopolising attention which might otherwise be given to the copy.

Copy.—When preparing copy, be sparing in the use of italics, and do not have too many lines or words heavily displayed or emphasised in any way. The only result will be that they will work against each other in clamorous competition, and detract from the appeal of the whole. Do not permit overcrowding. An advertisement which is overcrowded is unpleasing in every way, and seldom invites perusal. Someone has said that advertising is picture

painting in words. See that your picture tells the story in a simple, sincere, and convincing manner. Do not use too many styles of type. One style in different sizes, or a few styles artistically related, are best.

Posters.—Posters should, in most instances, serve to fix firmly upon the mind impressions that have already been created, or are being created, by other advertising. While much can sometimes be accomplished by posters alone, they should, speaking generally, be strongly supported by other forms of publicity. Quite as much depends upon the selection of sites as upon the posters themselves. Although little detailed description can be attempted in a poster, the applicability of the goods advertised can sometimes be suggested in a very effective manner.

Handbills.—If handbills are used, they should be of good quality, and be distributed with careful discrimination. 1,000 well-printed pamphlets, enveloped and addressed to selected recipients, will bring more business than 10,000 of poor quality distributed in a haphazard manner.

Distribution of Literature.—Merely to compile a list of names from directories and other sources is not sufficient. The index should be built up carefully and methodically. Some important and far-seeing firms (whose belief in thoroughness has been justified by results) have found it a paying proposition to secure the collaboration of their outside staffs for this purpose. A card is filed in for every firm called upon—if possible, when the first call is made. When received at the head office, the cards for prospective customers are filed in the "live" index. Cards for firms not likely to be of use are marked "Useless," and filed in the "dead" index. The reason why the firm is considered "useless" is always stated on the "dead" card. As both indexes are referred to before a new card is filed, there is no possibility of useless or duplicate names being added to the "live" index. Each card gives particulars regarding the exact nature of the business carried on, the approximate number of hands employed, the goods manufactured by the advertisers which are likely to be required, the name of the person to whom advertising literature should be addressed (if this is allowed), and other information. The cards are filed alphabetically in order of name. They are graded and marked G1, G2, G3, G4, G5, or G6, according to the nature and importance of the business. A capital letter indicates the branch office or district to which the firm belongs—thus "L" denotes London district and "M" Manchester district. Other numbers (written in red and commencing at 10) show the trades classification—i.e., 12 may comprise all engineering trades and 14 all textile trades. With such a system (suitably adapted to meet particular requirements) literature can readily be addressed by young girls to all the firms on the index—to firms likely to be in the market for some particular article—to firms of any selected grades—to any particular trade or class of trades—to the most important or least important of any particular trade or class of trades—to all or any selected grades or trades in any particular district. If neatness and legibility are particularly desired, the letters and figures can be stamped on the cards by rubber stamps. Although full working details of the system cannot be given here, it will be readily appreciated that the adoption of such a scheme gives opportunities for intensive advertising with a minimum of waste. There is no comparison between the results obtained from literature dispatched blindly from a list and that which is guided into the proper hands with intelligence and discrimination.

To sum up, theories upon what may or may not constitute a good advertisement from the critic's point of view are worth careful consideration, but what are wanted for the general mass of people are good, hard, telling, convincing and persuasive facts. Information should be given in plain, straightforward language, without ambiguity or exaggeration. All complex tangle that cannot be easily understood should be strictly avoided. If the article, price, and methods of distribution are right, good advertising will bring results. It is worth while remembering that humanity in the aggregate to some extent resembles sheep and monkeys. Like sheep, they can be driven in flocks, and, like monkeys, they will imitate what they see their neighbours do. Whole neighbourhoods, for instance, will sometimes adopt some special contrivance or article because

some person of importance orders the first one. Certain articles will sometimes become the "fad," and the "fad" ultimately becomes general. A keen judge of human nature can sometimes foresee this result when placing an article upon the market. Unconsciously, it may be, he is a student of psychology.

Successful advertising necessarily involves successful merchandising, and means more than the ability to write interesting advertisements. The goods must be readily obtainable, either direct from the makers or through dealers. If the latter, economical methods of distribution must be arranged.

INSURANCE OF ELECTRICAL MACHINERY.

By C. STUART BUYERS, A.M.I.E.E.

ONE of the results consequent upon the widespread use of electric power has been the formation of electrical departments by many insurance companies whose engineering activities previously were confined to the insurance and inspection of boilers and steam engines.

It may confidently be stated that the number of electric machines insured in this country at the present time exceeds 100,000. These are of all sizes and types, from the diminutive fan motor to the large rolling mill motor or turbo-generator set.

Insurance is the watchword of the twentieth century, and electrical engineers cannot complain that their particular interests have been in any way neglected, there being quite a number of enterprising insurance companies ready to meet any demand which may arise in this direction.

As the usual methods adopted in carrying out the insurance of electric plant may not be generally familiar, the writer proposes to explain on broad lines the underlying principles connected with this rapidly growing business.

On being approached by an insurance agent to consider the question of insuring his electric generators and motors against risk of loss or damage from breakdown, the proprietor or manager of a firm which has adopted electric driving of machinery naturally asks, first of all, what it will cost.

Curiously enough, the premium is charged on what appears at first sight to engineers to be a very unscientific basis. The agent simply requires to ascertain the rated kilowatt output of each generator and the horse-power of each motor, and from this data he is able to submit an estimate of the annual premium and the sum for which each machine will be insured. No details, such as voltage, speed, nature of drive, whether continuous or alternating current are required in the first instance, as the premium is based on the output alone.

The thought arises at once, that surely if this is the case, the owner of a low-tension or low-speed plant must be penalised to the benefit of the owner of a high-tension or high-speed installation. Practice proves, however, that such reasoning is fallacious; in fact, high-tension electrical machinery is a better insurance risk than low-tension, for two reasons—firstly, because the manufacturer pays greater relative attention to the insulating materials used and lengths of creepage paths allowed; and, secondly, because the fact that a machine is operated by high-tension current ensures that it will be properly installed and maintained by the user.

The premium is based on a sliding scale, which has the effect of diminishing the ratio of premium/indemnity as the size, or, to be more strictly accurate, the value of the machine increases. This is sound finance, as the cost of inspection and management is practically independent of the size of the insured item, and remains constant, the risk being the only variable.

Should the agent prove successful in having his quotation accepted, the next step taken is to have the plant carefully inspected by an electrical engineer-surveyor whose business it is to take full details and to report to his employers the condition of the plant, making special note of any circumstances likely to lead to breakdown. If the

surveyor's report is satisfactory on the whole, the policy of insurance is issued, and a detailed report on the condition of the plant, stating any suggested improvements, is sent to the owners. On the other hand, if any serious defects are noticed, such as heavy overloading or the working of open-type motors in exposed, and wet situations, &c., the policy will be deferred until the working conditions have been made satisfactory.

In extreme cases where, due to lack of attention or to adverse conditions of working, the plant is subject to frequent breakdown, the majority of insurance companies will decline to accept the risk.

Experience fully proves that in electrical machinery it is not the design or manufacture of a motor that determines the breakdown risk, but the conditions of working.

The report of a skilful and experienced surveyor is of great value to the possessor of electric machinery, as it enables him to form an accurate estimate of the way the plant is being looked after, and whether suitable steps are being taken to maintain it in efficient condition.

The first inspection is followed by further ones at intervals of about three months, and after each inspection a fresh report is submitted giving details of improvements or defects noticed since the previous examination.

Many insured firms consider the reports to be the most valuable feature connected with their policy, and although they have no breakdowns over a number of years, they continue to insure without any feeling that the amount expended in premiums could have been better utilised.

There is no doubt that a wide-awake surveyor can often prevent a serious breakdown by detecting a hitherto unobserved crack in a casting or by pointing out a defect in the insulation revealed by his portable testing instrument.

On more than one occasion the writer has detected unnoticed faults or flaws in machines working under the supervision of well-trained engineers, and it is without question a fact that fault detecting is largely a matter of experience in breakdown and repair work. A surveyor coming fresh on to a plant is more likely to notice something abnormal than the engineer-in-charge, who usually sees the machines six days a week. This may sound paradoxical, but consider, for example, an oil-cooled transformer. The load on this may have been gradually increasing due to extensions, or the transformer may have been changed to a new and out-of-the-way position with less ventilation. In either case the temperature will rise; and, even if the rise be above safe limits, it is very improbable that a charge-engineer who had been supervising it for a number of years without experiencing the slightest trouble, would notice that the heating was more than it had been previously.

Any excessive heating would, however, at once be noticed by an outside person who had had experience in the working of transformers.

It is not always realised that inspection is carried out solely with a view to prevent breakdowns and to assist the owners to maintain their plant in such efficient condition that the number of breakdowns or accidents will be reduced to the lowest limits.

When a firm allows its electric installation to get into a neglected and unreliable condition, and then insures it against breakdown, it may take the insurance company several years to have patched-up armatures gradually re-wound as they burn out, and to get the owners to alter unsuitable drives, thus turning a bad risk into a good one.

An actual case to illustrate this may prove of interest. A firm of engineers decided to insure their electric motors, numbering some 65, six years ago. This D.C. plant, with motors varying in size from 5 H.P. to 50 H.P., when taken over by the insurance company was considered a doubtful risk, as the motors were of an old type, and they had been frequently repaired in a temporary manner in order to keep them working.

The breakdown experience proved to be as follows:—

1st Year	...	...	...	12 motors broke down.
2nd "	...	...	...	13 motors broke down.
3rd "	...	...	...	11 motors broke down.
4th "	...	...	...	11 motors broke down.
5th "	...	...	...	9 motors broke down.
6th "	...	...	...	5 motors broke down.

During the first three years it was found necessary to

rewind a number of armatures, and the risk was an unremunerative one, but the second three years, in spite of severe work imposed by war conditions, showed a considerable reduction in the amount paid in claims, and it may safely be stated that the plant is in better condition to-day than it was six years ago.

(To be concluded).

THE GOVERNMENT AND FOREIGN TRADE.

THE fascinating history of the birth, growth, and development of British foreign trade contains much to make us proud of the initiative and foresight, daring and enterprise, of our forbears. The pioneering achievements of very early trading days will never lose their romantic character. There was nothing of the ugly spirit of modern methods of penetration, for there were no competitors of any kind. Even down to five and twenty years ago we were able to carry on large transactions practically without let or hindrance in various markets of the world. International trading rivalry was then only a mild and more or less friendly thing compared to what it became—first gradually and then ever-increasingly—in the following years, as other nations developed their manufacturing resources and became envious of our reputation and our success. The efforts of large trading concerns and the enterprise and initiative of private commercial firms secured a great name for British manufactures and for the rectitude of British commerce and commercial men. We knew how our reputation had been established, and securing abundant trade, we were too content, and left the way open for those who designed to weaken our hold, and who introduced all sorts of enemy methods, some skilful and efficient, others mean and base, to that end. The story of their success is well known to traders to-day; three and a-half years of terrible war have brought the facts out into the light of day until even the man in the street knows something of it, though, strangely enough, the lesson has not yet been fully learned by numbers of politicians, judging from the discussion at Westminster on the second reading of the Non-Ferrous Metals Bill.

The foreign trading situation has undergone an entire change since those romantic early days, and while no one can say to-day what developments may take place therein consequent upon the terms of Peace and our new commercial relations with allied peoples, it is perfectly obvious that isolated and individual efforts will be at a great disadvantage for ever hereafter. It is also equally obvious to most of us by now, that while Government control of certain trades must continue for several years there must be Government encouragement of trade too. No coming Government will be able to exist for long unless it sets its face fixedly against obstructing industry and commerce, and abandons anything in the nature of a policy of apathy toward trade and traders. Lessons learned in the tribulation of warfare have to be carried into very definite practical policy, encouraging those who aim at developing our international trade, and bringing to British factories unlimited work for British workers.

Whatever may be the designs of present enemies for after the war—designs which we have it in our power seriously to check by reason of the Allied control of raw material, and the other advantages accruing to us from our Empire resources and from present Allied relationships—we shall require all the assistance that Governments can legitimately render, in order that our position may be secured against such attacks as the disclosures of recent years reveal. Manufacturers and traders will need to bring up their own efforts, individual and collective, to the highest possible pitch of perfection, and we believe that by the employment of scientific method in organisation and production, they will succeed, if they can secure reasonable and intelligent co-operation from the workers, whose prosperity is linked up with their own. But the co-operation of the Government is as essential as is that of the workers, and we are glad to welcome the signs that those now at the helm intend that it shall be given, and given effectively.

The need for Governmental encouragement of trade

is no new theme in these pages. We have offered our criticisms of its obstructive policies in the past, and when we have observed indications of the desire to do well, we have not omitted to say so. Therefore, to-day we welcome quite heartily the measures that are being developed by the new Joint Trade Intelligence Department of the Foreign Office and the Board of Trade for co-operating with the manufacturers and traders of the kingdom. Sir Arthur Steel Maitland, M.P., the Head of the new Department, has in hand a task of the utmost difficulty in evolving something like decent order out of chaos. Infinitely easier would he have found it if he had been instructed to start an entirely new Department for fostering British Trade abroad; but the circumstances preclude any such simple operation. What he has to do is to piece together parts of several departments, and the measure of his success in building up a strong and effective organisation will be the measure of goodwill displayed by those departments. The new Department includes the Commercial Department of the Board of Trade, which, useful as it has been within its limited capacity in the past, may be made a far greater help, and the War Trade Intelligence Department of the Foreign Office will also form a most important section of the new organisation. The operations of the War Trade Department in connection with war-time problems have been larger and more effective than is generally understood. It has had much to do with economic questions which will be of the utmost importance in connection with Peace negotiations and our general proceedings after the war. Then those who have been dealing during more than three years with the Lists of Enemy Firms here and all over the world will not have completed their work when the war ends, for the weeding out of enemy concerns must be followed with a constructive policy of facilitating the introduction of friendly in place of enemy businesses. Therefore, we shall be bringing together, as soon as it can be arranged, the Commercial Intelligence Branch of the B. of T., the War Trade Intelligence Department (though obviously its war work, being still incomplete, it cannot be transferred at once), the Foreign Trade Department of the Foreign Office, and the Consular Service and Consular Department of the Foreign Office. There will be two sections of the New Department:—(1) The Overseas Division organised in geographical sub-sections; (2) the United Kingdom Division sub-divided according to trades and industry.

It is hoped that by means of thorough co-operation between all concerned, co-operation which will in due course be facilitated by greater convenience in respect of departmental housing, any piece of business or information that can be turned to good account by British finance and industry will be taken full advantage of, and will redound to the common good. An efficient Advisory Committee will be set up consisting of live and experienced men from the worlds of finance, manufacturing, commerce, labour, and so forth, and a special effort is to be made to secure the distribution of information among the industries at Home and to ensure publicity in foreign countries respecting British manufacturing and trade.

There has been some feeling exhibited by merchants who are fearful that the new Department has designs for their elimination. These fears originated from the urgent appeals that were made to manufacturers to organise themselves into co-operative bodies so as to secure better results abroad. We have recently referred to this subject in some detail. Sir A. Steel Maitland sees well enough that after the war Germany will be out to do a great thing in the matter of penetration, and while we do not want to adopt the same method, we must meet it somehow, and we can only do so by co-operation amongst ourselves. He holds, as we do, that export associations in industry are desirable, but that such action would not eliminate the merchant. Of course, we cannot eliminate the merchant if we could, and, as a matter of fact, we would not if we could, for he has a most important place to fill in economic activity; but the lessons of the past are not easily forgotten, and if we learn one thing more than another from those who study the course of British and foreign trade competition, it is that co-operation between our manufacturers is absolutely essential on many grounds: if we are going to retain, to regain, and hold much of our former trade, and to develop additional business. Adaptability is a matter of

first importance in meeting the needs of foreign customers, and our adaptability will be facilitated by a policy of co-operation amongst our manufacturers. But why cannot the merchant enter into the co-operative group? Why should he suspect those who desire to strengthen our industries of seeking to work out his elimination?

(To be concluded.)

THE METRIC SYSTEM.

It was hoped that the discussion which took place at the INSTITUTION OF ELECTRICAL ENGINEERS on Thursday, last week, would strike a new note, and prove of direct assistance towards bringing the subject into concrete form, by dealing with it from the practical workshop point of view. Unfortunately hopes were not realised: the debate was certainly interesting, and at times entertaining, but with few exceptions speakers confined their remarks to the merits of the rival systems, and while the trend of opinion was unquestionably in favour of the adoption of the metric system, but little information was gained as to the difficulties to be anticipated and the methods by which they might be overcome. The same applies to the two short papers which prefaced the opening of the discussion; both were of undoubted merit, but both covered ground which has been pretty well beaten in the past, and consisted very largely of descriptive material. On the whole, therefore, the meeting did not carry the matter much further than before, and for that reason we look upon it as somewhat disappointing. On the other hand, too much should not be expected of a discussion of this type, lasting some two hours and necessarily conducted on haphazard lines. Apparently no progress can be hoped for without a properly constituted commission of inquiry, before which each witness will be examined in an orderly fashion, and will be subject to cross-examination. The great importance of the question fully justifies the initiation of such an inquiry, we do not say "even in war time," but more particularly and precisely because we are at war, and now is the time to arrive at a decision in the matter, in readiness for prompt and effective action the moment the conditions permit of it.

MR. LL. B. ATKINSON, in his paper entitled "The 'Pros and Cons' of the Metric System," endeavoured to define clearly the real issues that formed the subject-matter of the discussion which has been in progress for 30 years, and offered some suggestions towards reconciling conflicting views, while treating the question impartially. The author, however, at the outset expressed his preference for a decimal system of coinage, and the metric system of weights and measures as the legal standards for the Empire. He had often been surprised at the lack of definite ideas on the subject in the minds of authorities on this question, and for clearness he divided the points at issue under three heads—the question of decimalisation of moneys, weights, and measures; the question of the actual magnitudes involved; and the question of policy. He then detailed and discussed the three systems—British, metric, and C.G.S.—which he regarded as relevant, laying stress on the fact that in the British system there was no standard of mass, and that the British tables were based almost entirely upon the use of 2 or powers of 2 as multipliers, whilst the other two systems proceeded by multiples of 10. While the decimal system was essential to the use of calculating machines, slide rules, &c., he thought that the great majority of the population did not employ such aids, and were unable to use decimals in calculations. Referring to the magnitudes of units, he had no doubt that the pound and the half-kilo weight were best suited for the mass of the population, and the ton and hundredweight or 50 kg. for wholesale purposes. The foot and centimetre were useful units; the $\frac{1}{16}$ th inch and the mil were better than the millimetre and $\frac{1}{10}$ th mm. He thought the direct relation between the metric units of mass and volume of little practical value, but concluded that as regarded the magnitudes of units, the advantages of the rival systems were fairly balanced. On the question of policy, Mr. Atkinson considered that the vast bulk of the people had no direct interest in international trading, which concerned

only the merchants and engineers, and said there was a widespread feeling that the moment was inopportune for adopting the metric system. He thought there would be little difficulty in decimalising the coinage, but preferred the florin to the pound as the ruling coin of account. With regard to the unit of weight, he advocated the adoption of a new pound equal to half a kilogram, which would enable existing multiples of a pound to be retained almost unaltered, until they fell out of use. If the gallon were made equal to 10 of the new pounds it would be of 5 litres capacity, and the way would be clear for the eventual adoption of the metric units of volume, by which time the metric units of length would have become largely used. Mr. Atkinson concluded in favour of the adoption of decimalised currency, the new pound and gallon, and an educational campaign leading up to the compulsory use of a complete decimalised system—the metric system of weights and measures—a programme which might be realised in ten years.

MR. A. J. STUBBS read a paper entitled "A Case for the Adoption of the Metric System (and Decimal Coinage) by Great Britain," in which he outlined the history and described the constitution of the metric system, comparing it with the "chaos which we call our system," very greatly to the disadvantage of the latter. Referring to proposals to modify the British units without adopting the metric system, he held that the only practical way of mending our present system was to end it, and proceeded to illustrate the advantages of the metric system derived from its scientific basis, the simplification of calculations and the dimensions of drawings, the applicability of the decimal calculator, economy of time in education, and uniformity of international and other relations. The author then dealt with the disadvantages entailed by a change of system, referring to the extended use of English conventional standards of size, tonnage, &c., the cost of the change, which he regarded as exaggerated in importance and in many cases fanciful, the loss of mental and manual facility bound up with existing practice, the correction of drawings, the scales of maps, &c. Admitting that there would be appreciable inconvenience to the community during the transitional stage, Mr. Stubbs held that it would be felt less in the immediate future than at any later period, because our ordinary standards had been upset by the war, and great numbers of men returning from France would be familiar with the French units. The voluntary adoption of the metric system had been proved to be impracticable; compulsory measures were essential. He concluded with the suggestion that the loss of time and waste of money involved by delay should be curtailed by putting the change in hand at once.

DISCUSSION.

The PRESIDENT, in the course of a few remarks, pointed out that they had to consider whether the electrical industry would benefit, or the reverse, by adopting the system. It was argued that it would facilitate export business with metric countries, and if this argument were sound, it was equally true that it would facilitate the business of such countries in our markets which used British measures. He thought that only manufacturers who were in touch with the question could decide this matter. The Institution must make up its mind and decide one way or the other; the system would never be voluntarily adopted, and therefore compulsion would be necessary.

MR. HARRY ALCOCK, who opened the discussion, said he heartily agreed with the general findings of Mr. Stubbs's paper; as to Mr. Atkinson's contribution, he regarded it more in sorrow than in anger. Mr. Atkinson talked about dismissing all fanciful considerations, and then proceeded to invent hundreds of them. He (the speaker) advocated a universal system, as a nation could only survive by its trade with other nations, and we must make it easy for others to deal with us. He did not accept the inference of Mr. Atkinson that the export trade interested a small number of people; we were all interested, and it was a national duty to widen our industrial connections. Which system was to be the universal one? The British system was hopeless, and we must either consider its improvement or adopt a better one. He pointed out that a House of Commons Committee in 1870, after considering the above matter, came to the conclusion that it would be as difficult to adapt our own system as to adopt a new one, and our trade at that time was nothing compared to our present trade. Our manufacturers considered their own convenience, not the national advantage, and this accounted for the passive attitude of the manufacturer. He

reminded them that in 1870 the Germans adopted the metric system used by the French, who were their opponents, because of its advantages. It was probable that there would be a period of reorganisation after the war, when the metric system could be adopted.

MR. W. H. MASSIE said he was born, and lived for 30 years, in a country where the metric system was in use, and then came to England, and for 13 years had to learn English measures. He subsequently returned to a metrical country for two years, and, although he agreed that the metric system was simple, he, personally, had a preference for the English measure which he used. No doubt the metric system was preferred by the scientist, but it did not affect an ordinary workman like him. However, he was absolutely neutral in his attitude.

Commander BOWEN, F.N., expressed his appreciation of the papers, which dealt with the question from different points of view. The question of policy in education was most important; he had often pitied the young Briton who found a difficulty in remembering so many figures, and had to use a ready reckoner. Decimalisation and "metricalisation" were totally different; if the British system could be decimalised it would probably be better to use such a system, but it had been shown that this would probably be as difficult as adopting the metric system. He urged that it was the business of the technical man to lead the practical man, whose business interests were limited to his own affairs.

Major PLAISANT said that he was in this country last year to purchase enormous quantities of wire, &c., and had to translate the schedule into British weights and measures; he believed that we might have saved a year of war if the metric system had been in use here. At Peking, with the Boxer Expedition, he was at the entrance of the Imperial Palace, and witnessed a conversation between his Chinese attendant and a Japanese sentry; neither understood the dialect of the other, but they had no difficulty in communicating with one another in writing. In the same way, the metric system was a universal language, and would facilitate intercourse between the nations, whereas the British system formed a kind of veil between the French and British. Even in a savage country he had found the decimal system in use and understood by the natives. He compared the existing conditions with the confusion of tongues at the building of the Tower of Babel, and illustrated the difficulties due to the difference of units. If our soldiers had known the metric system, much loss of time might have been avoided.

MR. ROGER SMITH said Mr. Atkinson very properly referred to the effect of the change on the 90 per cent. of people who calculated mentally. The mechanical engineer would welcome the change. The French had had some 77 years of compulsory use of the metric system, yet in the provinces they were still able to use their old weights, &c., adapted to the new system, and he felt sure that the English would also be able to do so.

Commander BRISTOW pointed out that the magneto industry had been founded during the war under the aegis of the Government, and all dimensions were standardised in millimetres; some 300,000 magnetos had been made, and the factories might as well be in metric countries as far as drawings and dimensions were concerned. In regard to our export trade, statistics showed that 281,000 tons of machinery were sent to English-system countries, and 203,000 tons to metric countries; it might be hazardous to do anything to affect our tonnage to the former unless they would come into line in regard to system. We did twice as much cycle business with English-system countries, and nearly the same proportion in scientific instrument exports. Taking the whole of these exports, the proportion was 800 to English-system countries and 600 to metric countries, so that the trade with the latter was not so preponderant as the number of such countries might suggest. To illustrate the impossibility of remembering the diverse systems of weights and measures in use in this country, he mentioned that an inquiry as to the number of "caraways in a featherweight," made to an official "weights and measures" department had been treated quite seriously.

MR. D. ADAMSON considered that the question of coinage should not have been introduced. The sovereign was not comparable with the inch, yet the decimalisers would retain the former while abandoning the latter older measure. They must guard against discontinuity in work; the change over to the metric system would involve throwing over everything established by Whitworth. The textile machinery industry was unanimously opposed to the metric system, largely because its adoption would affect continuity of output, due to the disorganisation of the supply of new parts to old machinery. Incidentally, he mentioned that the German machinists had adopted a range of only 50 metrical sizes of tools, as against the 150 different sizes which British makers had for the same range of work. It would not be such a small matter to renew all these tools as might be supposed; he doubted whether they would be able to sell cheaper, and thought it would be a mistake to compel people to adopt the metric system.

MR. E. C. BARTON said he thought that Australia would very soon be a metric country; they were only waiting for England to move in the matter. He strongly urged that this was not a case for studying individual interest; they must consider the national interest. Experience showed that

the jewellery trade, although opposed to the metric carat before its adoption, were its supporters immediately after. The Germans had without trouble abandoned their old coinage for metric coinage. The English system was illogical, and confused a man from his school days; he was logical before he went to school.

Mr. H. M. HOBART said he had long felt depressed by the lack of progress in this subject; the conditions were no more encouraging in America than here. It seemed to him that one dare not contemplate what would happen if the metric system was not adopted within 10 years. He had been a believer in that system for many years, but as an engineer was compelled to use the English system, in order to be understood, and for this reason collective effort was necessary to bring about the introduction of the metric system. He did not see any hope of being free from the handicap for the next generation unless they proceeded actively by collective effort. Habit was a predominant factor; not our own, but other's habits. The young men of both England and America were strongly in favour of the metric system, but the old men were the obstacle.

Captain D. H. KENNEDY recalled a discussion on the subject 16 or 17 years ago by the Institution; he considered it a serious reproach that nothing definite had been done as yet. Although he was neutral in his attitude to the metric system before the war, he now felt that the change should be compulsory. It was a remorseless state of mind which would compel our children to adopt the British system just because we used it. The more mental muddle caused to a child the less was the mental energy available for the things that really matter in life.

Mr. H. ROTTENBURG pointed out that the obstacle to change arose from the fact that the older people while in a position to say whether a change should occur, had not the mental suppleness to arrive at a decision on the matter. The younger generation had a right to be consulted. The question was whether the great thinking mass of the people would benefit by the introduction of the metric system. He, the speaker, felt that the transition stage would lead to endless trouble, but if a broad view of the matter were possible, differences of opinion would disappear.

Owing to the brief time at their disposal, the authors decided to communicate their replies to the *Journal*.

NATIONAL ELECTRICITY SUPPLY.

A BOARD OF ELECTRICITY COMMISSIONERS.

AN interim report of the Coal Conservation Sub-Committee of the Ministry of Reconstruction (abstracted in *The Times* of Friday last) deals with the extent to which conservation of coal could effect economy in the production of motive power with the expansion of industry which should result in the way of new manufactures from the proper use of coal so saved, and with the steps necessary to attain these objects. The members of the Sub-Committee were:—Mr. Charles H. Merz, Prof. W. A. Bone, Mr. Guy Calthrop, Mr. John Kemp, Sir R. A. S. Redmayne, and Mr. Charles P. Sparks. It will be remembered that a Board of Trade Committee is also dealing with the problem of electric power supply.

It is pointed out in the report that the coal consumption involved in the production of motive power in the United Kingdom amounts at present to 80,000,000 tons a year. In the industrial reorganisation which must take place on the termination of the war the further development of power is of great importance, and large quantities will be required for the development and carrying on of new processes not at present undertaken in this country. The present use of motive power per employé is only about half that in the United States, and it is only by largely increasing the amount of power used in industry (by two or more times) that the average output per head (and, as a consequence, the wages of the individual) can be increased. The pre-war earning power, or wages, of each individual, was far too low.

Power can be most efficiently applied to industry by the medium of electricity, and, technically and economically, electrical energy can be best provided by a comprehensive system. Power production in large plants, with generating machines of 50,000 h.p. or more, will not only be far more economical than in a large number of smaller plants, but will ultimately involve great economies of capital by securing a better load and a more effective use of the plant. With such super-plants, if suitably situated on large sites, it would be possible—so far as it might be found economical—to extract by-products from the coal before using it as fuel. The super-plants would feed into the main trunk distributing system, which must be laid down throughout the country, and which would collect any waste power available, wherever situated, and deliver it where it could be profitably used. It would also, by saving the cost of transport, make it commercially possible to bring to the surface much coal that is at present wasted and left in the pits, but which, under the new conditions, would be turned into electrical energy at or near the pithead.

Where power supply in the United Kingdom dealt with on a comprehensive basis and advantage taken of the most modern engineering developments, the saving in coal throughout the country would in the near future amount to 55,000,000 tons

annually on the present output of manufactured products, apart from the possible saving on domestic coal consumption. If the coal so saved were used for the production of further power, it would be possible to generate continuously not less than 15,000,000 h.p., which would more than compensate for the absence of large water-powers in this country, and admit of the manufacture here of many products which at present are made only in America and on the Continent.

The Committee regards it as essential that the present inefficient system of over 600 districts should be superseded by a comprehensive system in which Great Britain is divided into some 16 districts, in each of which there should be one authority dealing with all the generation and main distribution. Centres or sites suitable for electric generating purposes should at once be chosen on important waterways as the future main centres of supply for each of these large districts. The sites should be as large as possible, having in view the land available in suitable localities, and should have ample water and transport facilities. Land is required not only for the power stations themselves—which for the sake of security and safety would have to be suitably sub-divided, and not all contained in one building—but also for the processes involved in the extraction of by-products from the coal, where such extraction is found to be justified. It is also required for the development of electrochemical processes, which can be most conveniently carried on close to the power plant. Plans should be prepared for the construction immediately after the war on these sites of the first instalment of these large super-power plants, and once these plants were in existence it would be possible for existing authorities, without being left in the lurch, to stop extensions of their own uneconomical stations, and to arrange to take their power from the main system.

To carry out this policy a Board of Electricity Commissioners should be appointed, with full power to deal with the electricity supply situation throughout the country. Among other things they should have power:—

1. To stop the extension or multiplication of uneconomical stations for public supply.

2. To arrange for the handing over, on equitable terms, of the generation, transmission, and main distribution system in each of the areas into which the country is to be divided to a new electricity body appointed for that area.

3. To standardise for each area the frequency and voltage of the main transmission and distribution system.

4. To settle for each area whether such body should consist of a Parliamentary company working under adequate control as regards limitation of dividends, &c., or of one of other alternatives set out in an appendix to the report.

With regard to these alternative types of electric power organisations, the Sub-Committee is impressed with the special need for initiative and resource in the management of the business of power supply, and is of the opinion that the freedom of range and keenness which are distinctive of private enterprise will be found to be in a high degree conducive to the fullest measure of success. The Sub-Committee considers that if the nation is to get immediately an efficient power supply, and is to take advantage of the temporary lull in manufacturing output immediately after the war, State assistance in some form may be necessary.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

An Institution of Electrical Station Engineers.

In reference to the letter in the *ELECTRICAL REVIEW* of the 30th ult., from the assistant technical officers of the Sunderland Corporation Electricity Department, I have been instructed by this branch to forward you a copy of a letter which has been sent to Mr. Healy, of Battersea, on the subject of the proposed Institution of Electricity Supply Engineers. You are at liberty to insert the same in your next issue should you so desire, and we shall esteem it a favour if you can do so, as we think it deals with a question of urgent importance.

J. W. Thomas.

Hon. Sec., Manchester Branch,

Association of Electrical Station Engineers.

Manchester, December 14th, 1917.

ASSOCIATION OF ELECTRICAL STATION ENGINEERS.

MANCHESTER BRANCH.

H. W. Healy, Esq.,

Battersea Borough Council Electricity Works,
Battersea.

Re The Institution of Electricity Supply Engineers.

Dear Sir,—At a general meeting of the Manchester Branch of the A.E.S.E. the recent correspondence on the proposed Institution of Electricity Supply Engineers was discussed. The members were in entire agreement with the engineers of Sunderland in their expression of sympathy with the aims of the technical officers in London, as indicated at the meeting held in Hammersmith.

There is little doubt that the state of affairs in the provinces is similar to that in London, and, recognising this, we

in the Manchester district are making strenuous efforts to place the question of status, efficiency, &c., on a sounder basis.

Whist certainly welcoming the advent of such a prospective institution, and being anxious to assist in the establishment of such on a national basis, we would suggest that the task of reconstruction be undertaken by means of and through the already existing Association of Electrical Station Engineers. This Association has already a large membership in the provinces; in Manchester and district we have in a short space of time enrolled upwards of 100 engineers holding responsible positions in electrical supply undertakings, and the task of organising would be greatly simplified if its machinery was made use of, and the danger of overlapping organisations would be avoided.

Moreover, we are of the opinion that the time is now ripe for the broadening of the basis of the A.E.S.E. In the great engineering centres, such as Manchester and Newcastle, there are many capable engineers holding responsible staff appointments in large engineering works, who are desirous of joining an organisation adapted to their needs and status. We have had numerous applications from such, and we are firmly convinced that these men would, if admitted into the ranks of the reconstructed A.E.S.E., at once be a credit and a source of strength.

We would suggest, therefore, that the engineers in Newcastle, and Sunderland, and other districts associate themselves with the A.E.S.E., and assist in the formation of an Association of Electrical and Mechanical Engineers which will embrace engineers holding responsible positions both in supply undertakings and engineering works.

The suggestion may appear to be a very wide one, and to some may be open to the criticism that the interests of supply engineers will be relegated to the background. But such a possibility could be prevented by allowing them a section of their own, by means of which they could safeguard those interests with which they were most particularly concerned, and the same would apply to other sections of the engineering profession, whilst on the broader issues affecting the profession as a whole, there would be a common programme and united effort in place of the overlapping and division which at present threaten to make many of our efforts fruitless.

We should be glad if you would bring the above points before your Committee.—Yours faithfully,

J. W. THOMAS, *Hon. Sec.*

[So far as we are in a position to judge, the proposals of the Reconstitution Committee and the sense of the meeting held last week were entirely in harmony with those put forward in the foregoing letter.—EDS. *ELEC. REV.*]

Prohibited Imports.

In your issue of December 14th there is a letter, signed "L. G. Hawkins," upon the above subject, in which he appeals to lovers of fair play for assistance and advice.

His difficulty appears to be that in these days of world-war, he is not allowed to import electrically-heated American novelties. One quite realises his disappointment, but surely it is not difficult to see that it would be grossly unfair to allow these imports to take place, whilst English manufacturers in the same line of business are hopelessly restricted in their use of material and labour.

The pathetic plea of coal- and labour-saving devices is not very impressive to those in the trade. The only coal-saving devices worth any consideration in these days are large cooking installations and electric fires, neither of which were imported from America, but which have developed here during the last three years to a remarkable extent.

It is to be hoped that those shopkeepers to whom Mr. Hawkins appeals for help will, while thinking of their own small losses, also think of the stupendous difficulties under which English manufacturers now labour, and will keep their help and sympathy for those who under great disadvantages loyally carried out the demands made upon them by none too sympathetic Government Departments, to the practical exclusion of civil business.

T. Birkett,

*Manager, Heating and Fittings Dept.,
Simplex Conduits, Ltd.*

Birmingham, December 15th, 1917.

Regarding the letter from Mr. Hawkins, of the Hotpoint Co., *re* above, I agree with him that it seems unfair that while other American goods, less essential to our needs in these times, should be allowed to come into this country, the "Hotpoint" goods are prohibited; of the large range of appliances they have already placed upon the market, there is not the least doubt that the majority are indeed real "labour savers," and if these facts were placed before the Imports Department in the shape of a petition, signed by the leading electricity corporations, wholesale factors, &c., surely the matter would receive the consideration that it is entitled to. Would it not be possible for the Hotpoint Co., in the event of a permit being refused for the complete articles, to make an application to import the necessary parts and have them mounted here, with the view that after the war an English company could be formed, and the whole of their appliances, upon similar lines, turned out in this country, thus creating a new field wherein lies great scope? Or are

we to lie idle, and become a dumping ground for American goods in a similar manner to that in which we allowed Germany to dump her electrical goods here in pre-war days? The matter is one that would require careful handling, and, also, is a big problem for whatever Government we may have in power after the war, there is no disputing the fact that the electrical cooking and heating business has a tremendous future before it. Shall we rise to the occasion? Meanwhile, get the prohibition ban removed, and keep an eye on the future.

A. E. I.

December 17th, 1917.

The E.T.U. or the A.E.S.E.?

I am desired by the Marylebone Branch to state, in reply to "Fuzzed Engineer," that whether belonging to outside firms are not eligible for membership in this Union, so this branch is free from the trouble apprehended by your correspondent. It is difficult to state on-hand the precise terms of a policy, but the effort made to bring about a substantial improvement in the conditions of the generating and distributing staffs of the power stations, whether privately or municipally owned, and the effort made with a view to securing a base rate for London and Greater London should be a sufficient indication to workmen and engineers alike that this Trade Union is proceeding along sound lines. The Marylebone Branch of the N.A.U.E. are of opinion that many of the difficulties they have encountered during the progress of negotiations with the various authorities would not have occurred had the station engineers stood firmly with the men. One engineer told one of our members that he went in by the front door and signed for salary, while the workmen went in by a side door and drew wages, and the only privilege he got was that of drawing 10s. a week less. The engineers are, not contented, but still they hold aloof from the wages staff, and suffer accordingly.

The extremely high cost of living affects all alike, and the Branch submit that the following calculation has never been proved wrong:—

An engineer earns two guineas per week; he pays 10s. a week rent; in pre-war days that left 32s. for necessities. Suppose, for argument's sake, he bought 16 lb. of tea at 2s.; to-day he still requires 16 lb. of tea, but since he has to pay 4s. for it, he must get 32s. from somewhere to meet the difference. His salary and bonus should, therefore, be equal to 74s. per week. It was stated in the Branch that lamp oil costs 2½d. per pint, candles 10d. per lb., bootlaces 6d. per pair, firewood 1d. per bundle, and so on *ad infinitum*. These unconsidered household necessities are part and parcel of our everyday life, and it is fashionable for Cabinet Ministers to omit all reference to these things in their speeches. If an engineer is still in receipt of a low salary, the task of maintaining the semblance of a decent existence must be unconscionably hard.

The Branch would advise the station engineers to work out their salaries on the poverty line of pre-war days, viz., 30s. per week. Taking 6s. for rent, there would be left 24s.; add the sum now required to make up the purchasing power under present conditions, 24s., the total salary received would therefore be 54s. This 54s. represents the poverty line to-day, and the Marylebone Branch of the N.A.U.E. would like to know how many station engineers are on or below this line. If 6s. be added for rent in their case, £3 per week stands as the poverty line for the educated craftsman of to-day, for it is quite obvious that the engineer would not live in the crowded areas where rents are cheap, and the surroundings not particularly nice.

The problem of how to bring home these hard facts to the authorities is still engaging the attention of the Branch, and it is hoped that the station engineers will accord us a little more support than they have done hitherto.

J. Vincent,

Branch Secretary.

*National Amalgamated Union of Engineers,
Firemen, Mechanics and Electrical Workers.*

London, N.W., December 15th, 1917.

The Functions of a Borough Electrical Engineer.

Having an overdue account which I was unable to collect. I tried to collect it through the medium of the local County Court. During the hearing of the case, much to my astonishment, although he knew absolutely nothing of the case, nor what I have expended in time, labour, and material, Mr. McInnes, the borough electrical engineer, appeared to give evidence in favour of defendant, and, owing to what he said, I was awarded only half the amount of my account, the whole of which I have since had to pay out in court fees and other expenses connected with the case.

The Judge was as much surprised as myself at the appearance of the borough electrical engineer, and he put this question to him: "Are you the borough electrical engineer?" The reply was, "Yes." "And what," said the Judge, "are you doing mixed up in this case?" The reply was this: "Defendant is a consumer, and I have to look after his interest." But he omitted to say that I, also, am a large consumer, and, according to his own statement, it is his busi-

ness to study my interest as well as that of defendant, but this he neglected to do.

The following is a correct statement of my account, the whole of which I have lost through the unjustifiable interference of the borough electrical engineer:—

Amount of my account for work done and material supplied, £4 12s. Cost of time, labour, and material, £3 13s., thus showing a profit of 19s. Amount awarded by the court, £2 12s. Expenses for court fees, &c., £2 17s. 6d. So, as you can readily see, I have not only lost the full amount of my account, but have also had to pay out 5s. 6d. more than the court awarded me.

Is not this a case of precedent created by the official in question? For I can hardly believe that Corporations allow their highly-paid servants to waste valuable public time in private matters which do not concern them or the public. And I draw your attention to the case, Sir, because, in my opinion, it seems outrageous that a public servant should be allowed to take sides in private business matters and assist one ratepayer to the detriment of another. Thanking you in anticipation for giving the matter publicity.

H. Brand.

Gravesend, December 17th, 1917.

The Efficiencies of Lighting Systems.

I should like to criticise the article in the REVIEW of December 7th on "Modern Arc Lamps and Incandescent Lamps" as being very misleading in the study of the relative efficiencies of the different systems of lighting, and not helpful in the propaganda of scientific illumination.

Undue prominence is given to semi-indirect lighting at the expense of the direct method, and are lighting against both.

The two outstanding features of the article are:—First, the author's method of rating lamps, and, secondly, the unfair example of direct lighting.

In the third paragraph of the article the author states that "When used in a suitable fitting the 'half-watt' lamp consumes 0.55 to 0.9 watt per c.p.," and then, as a footnote, says: "Here and hereafter reference is to *mean lower hemispherical British candle-power* unless otherwise stated."

I can only take it that this method of rating was quoted to make are lamps appear in a more favourable light.

The correct output of a lamp is its total output, i.e., *mean spherical candle-power* or *lumens* (which is the *mean spherical candle-power* $\times 4\pi$), and only by this rating can two sources be compared. The illuminating result of the sources is another question, and depends upon the distribution, which, again, depends upon the equipment used.

Further on in the article the author states that the "half-watt" lamp emits practically equal quantities of light upwards and downwards, which is so; therefore, on the author's working, the third paragraph could have read that the "half-watt" lamp consumes 0.55 to 0.9 watt per *mean spherical candle-power*, and on this working I should like to hear from the author his figures on the arc lamps, quoted in M.S.C.P., as arc lamps notoriously give their light in one hemisphere only.

The next point to which I desire to draw attention is the statement that "semi-indirect lighting is cheaper than direct lighting" (or for practical purposes equally cheap) where half-watt lamps are used, and the ceiling is white.

I am more or less in agreement with the author, if one uses the type of direct unit which he quotes, viz., a 300-watt lamp in an opal globe, but is this a fair and efficient unit for comparison?

In the first place, the term "opal globe" is very ambiguous; there are different kinds of opal, pot or flashed, dense or light in density. The writer has tested commercial opal globes which have varied in absorption to the extent of 30 per cent.

I am not familiar with the "Kandem" semi-indirect fitting quoted, but it is fairly safe to assume it is an opal bowl.

Now let us consider the units together. For the direct unit the lamp is totally enclosed in an opal globe, and in the semi-indirect, an opal hemisphere or bowl is used.

Opal has the property of diffusing the light equally over its whole area, therefore, in the case of the direct lighting, 50 per cent. of the light is in the upper hemisphere, and 50 per cent. in the lower. A portion of this upper 50 per cent. is, as the author remarks, reflected down by the reflector, after passing through the opal envelope, which entails certain losses, and is again passed through the opal globe and further weakened, the resultant illumination thereby being considerably reduced.

On the other hand, the semi-indirect unit being open on the top, the light in the upper hemisphere only has to stand the loss, due to the reflection from the white ceiling, and from this comparison the author states that *semi-indirect lighting is cheaper than direct lighting*.

I consider that the totally-enclosed unit is as much semi-indirect, or at least semi-direct, as the bowl with an open top, and it certainly should not have been quoted as an efficient direct unit.

The proper comparison should have been with the most efficient type of open reflector against the most efficient of the semi-indirect and indirect systems, when the author will find that semi-indirect lighting is 40 per cent., and indirect

lighting 82.5 per cent. dearer than direct lighting, given identical conditions to obtain the same foot-candle illumination per watt consumption.

E. Stroud,

Lieutenant, R.N.V.R.

Wimbledon, December 18th, 1917.

NOTES FROM CANADA.

(FROM OUR SPECIAL CORRESPONDENT.)

Owing to the immense demands for power for the manufacture of munitions in Ontario, it is becoming increasingly difficult for the great power companies at Niagara Falls to cope with the situation.

Sir Henry L. Drayton, who is chairman of the Dominion Railway Board, was commissioned a short time ago to report on the quantity of power developed at Niagara Falls and the proportion of this power which is exported to the United States. Still more recently, this gentleman has been appointed Power Controller by the Dominion Government, and in that capacity will investigate the entire power situation, particularly as regards quantities actually used and required by Canada, and quantities exported to the U.S. not only at Niagara, but at other points.

It has been proposed in certain quarters that Canada, needing all the power at present being developed in the country, should stop all export at once, but this would result in international complications, the more so as, while Canada claims that the power is required here for the manufacture of munitions, the counter claim in the U.S. would be that it is practically all being used for that very purpose there at the present time, and therefore there would be, of course, no gain to the cause of the Allies.

So far as Ontario is concerned, the United States could easily put the screw on in retaliation by reducing or stopping the export of coal, and seeing that this Province has no coal of its own at all, the plight of the people in such a case during the severe winters experienced here can be imagined. It is, however, not in the least likely that either country will take any step tending to irritate the other. The U.S. has just appointed a Commission of two men, Col. Keller, of Washington, and R. J. Bulkeley, of Cleveland, who will co-operate with Sir Henry Drayton regarding all electric-power matters as between the two countries.

Besides power for electric motors in the numerous shell factories at present in operation, a number of electric furnaces for steel making and other purposes has been erected since the beginning of the war in various parts of Ontario, the largest of these installations undoubtedly being one in Toronto, where 10 six-ton furnaces of the Héroult type have been installed; several of these are now in operation, and when all are working there will be a power demand of about 15,000 kw., which is about one-third of the demand of the entire city of Toronto.

The city just referred to is having a taste of war limitations just now, as the street lamps are not put on till 6 p.m., which means that everything is in complete darkness for 15 or 20 minutes each evening—this is to reduce the peak until the factories, offices, &c., begin to close. The citizens have also recently been appealed to by the Toronto Hydro-Electric Commissioners to assist in keeping down the peak by using as few lights, electrical appliances, &c., as possible between the hours of 4.30 p.m. and 6 p.m. Owing to the fact that all the electric power available is generated in hydro-electric plants, there is no object in reducing the actual power consumption, as there is no question of saving coal involved, as in England; the only thing that matters is to reduce the peak.

Like other countries, Canada is taking an interest in scientific research work to an extent that would have been impossible before war broke out. Some considerable time ago a Research Commission was appointed by the Dominion Government, and investigations are being carried on regarding the utilisation of the vast lignite beds of the Western Provinces, the fixation of atmospheric nitrogen for war, agricultural, and other purposes, and many other matters. The Regina Scientific Research Association not long ago proposed that the Dominion Government should be urged to provide \$2,500,000 annually for five years, to be divided among the various Provinces for research work; suggestions were made as to how the money might best be spent.

Iron and Steel Trade Combination.—It is stated in the Times that arrangements have been provisionally made for the amalgamation of the following iron and steel companies:—Steel, Peck & Tozer, Phoenix Special Steel Works, Rotherham; Samuel Fox & Co., Stockbridge and Sheffield; the Frodingham Iron and Steel Co., Scunthorpe, Lincolnshire; and the Workington Iron and Steel Co., West Cumberland. A new company will acquire the entire assets of these companies. The capital of the companies involved amounts to about £1,000,000.

THE PROPERTIES OF ELECTROLYTIC COPPER—MODULUS OF ELASTICITY.*

By B. WELBOURN, M.I.E.E.

IN an address to the Manchester Local Section, the author referred to independent tests made in the National Physical Laboratory, and by Mr. W. B. Woodhouse, to determine the modulus of elasticity of solid hard-drawn copper conductors, and suggested that an all-round value of 18,000,000 might be adopted in future. Other published values are as follows :—

	Solid wires.	Stranded wires.
Verband Deutscher Elektrotechniker ...	18,500,000	—
Kapper (German)	19,000,000	11,400,000
Coombs (American)	16,000,000	12,000,000

In order to get actual values under working conditions, tests were made on an experimental span of about 150 ft., and special precautions were taken to prevent movement or bending of the terminal posts. The sizes of conductors used were as follows :—

0.025 sq. in. =	7/0 068 in. bare hard-drawn copper strand.
0.05 " " =	7/0 097 in. " " "
0.10 " " =	19/0 083 in. " " "
0.25 " " =	37/0 092 in. " " "

These were standard E.S.C. strands taken from conductors made for overhead transmission lines, and not specially manufactured. Each test was made as follows :—

The points of suspension of the experimental span were so arranged as to be level, and the supports quite rigid. The span length under test was pulled up to about 6 in. dip (i.e., just under half the breaking stress) and left for two hours to allow the strand to settle down. The strand was then let out to approximately 12 in. dip (i.e., about one-fifth of the breaking stress) and the dip d_1 at the centre of the span was measured. The span length was then loaded with an extra length of the same size of strand, this being bound to the first strand by means of a lapping of string, and the new dip d was measured. This was practically equivalent to loading the strand with its own weight of ice distributed evenly along its length. The measurements were made in still air and at the same temperature.

On removing the extra length of strand, the original strand returned to dip d_1 , showing that the strand had not slipped at the terminations and that it had not been strained beyond the limit of proportionality. The weight of the binding string was taken into account in working out the modulus.

From these results the modulus was calculated by the formula due to Prof. Alfred Still, namely—

$$w_1/d_1 - w/d = 64 (d_1^2 - d^2) M A/3 l^4$$

- where w_1 = weight per ft. of unloaded strand (lb.).
- w = " " loaded strand (lb.).
- d_1 = dip in ft. for w_1 .
- d = dip in ft. for w .
- M = modulus in lb. per sq. in.
- A = cross-section of strand in sq. in.
- l = length of span in ft.

Repeat tests were made, and the same results were obtained in every case. The values obtained were as follows :—

	0.025" (7/0 068")	0.05" (7/0 097")	0.10" (19/0 083")	0.25" (37/0 092")
A	0.025	0.05	0.10	0.25
w_1	0.09967	0.2027	0.404	0.967
w	0.2035	0.4097	0.8124	1.937
d_1	1.0	0.8333	1.00	0.666
d	1.526	1.3645	1.583	1.177
l	143.42	144.42	150.42	141.42
M (in millions) ...	20.11	19.84	17.36	15.46

It will be noticed that the modulus decreases as the number of wires in the strand increases, i.e., the modulus of a strand apparently depends on the number of wires composing it.

From the above considerations the following may be taken as suitable working figures :—

7-strand cable	20,000,000 lb. per sq. in.
19-strand "	17,500,000 "
37-strand "	15,500,000 "

The terminal posts are not stiff enough to permit of tests on 61- and 91-strand conductors, which are, however, seldom used except on short low-pressure lines with short spans, and their modulus is not of much importance. A consideration of the above figures, when plotted on a curve, suggests, however, that the following values might be taken for them :—

61-strand	14,000,000
91-strand	12,500,000

As a result of this experimental work with long spans, the author wishes to modify his earlier recommendation of 18,000,000 for solid wire, which was chiefly based on the work at the National Physical Laboratory on quite short lengths of wire. The further work now reported confirms Mr. Woodhouse's result of 20,000,000 for working conditions, and this is the value which should be adopted when designing transmission lines.

* Abstract, from the *Journal* of the INSTITUTION OF ELECTRICAL ENGINEERS.

LEGAL.

BESSANT v. STEVENS.

SITTING at Lewes at the Sussex Assizes on December 11th, Mr. Justice Bray commenced the hearing of this action, in which plaintiff, an electrical engineer of Eastbourne, sued defendant, an Eastbourne builder, for the recovery of £522 for goods supplied and work done. The opening statement by plaintiff's counsel was to the effect that the issue had been reduced to a short and intelligible one. There was no question of amount, but simply whether or not defendant was liable. The real question was whether the work was done by plaintiff on the order of the defendant, or whether the real persons liable to the plaintiff were a company of which the defendant was chairman, and over the whole of the assets of which he had a debenture. As reported in the *Sussex Daily News*, it was stated that plaintiff was aware of the building of a cinema at Seaside, but he knew nothing about a company when he undertook the electrical equipment of the theatre on the order of defendant, for whom he had done a lot of work previously. That was the work for which plaintiff was now suing. The accounts had always been rendered to defendant, and it was not until some time later that any suggestion about that was made. Plaintiff had agreed to take 100 shares in the Cinema Co. a part payment of his account, and subsequently, on the suggestion of defendant, plaintiff became a director of the company. On finding that defendant had included plaintiff's account in a memorandum of the general liabilities of the company, plaintiff protested that he had done the work on the order of defendant and looked to him for payment, but suggested an arrangement for payment by the company, provided defendant gave his personal undertaking to pay in the event of the company making default. Upon this defendant repudiated personal liability, and said the debt was that of the company.

PLAINTIFF, who was called in support of counsel's opening, said he had been doing business with defendant for about 25 years, and thousands of pounds had passed between them. When defendant was building the cinema in February, 1914, he had a conversation with witness, in which he asked him to go in for fitting it up with the electrical equipment, as it was a good thing and he ought to be in it. Witness told him he had no money to lock up in cinemas, but he sent his electrician to report on the requirements. Correspondence ensued, and then defendant gave him a verbal order for the work. On his telling defendant he wanted money, and that he must make some arrangement to let him have it, defendant said he had none. Witness then suggested that he should draw on defendant for £100 by bills, and he agreed. When, however, the bills reached him he noticed that those witness had drawn up had been substituted by two others drawn by defendant and signed by the directors of the cinema company, the name of which was the Eastbourne Picture House, Ltd. The bills were eventually returned dishonoured. After becoming a director of the company in 1915, on defendant's suggestion, witness was asked at a meeting of the company whom he looked to for the payment of his account. He replied that he looked to defendant, as he always had done, and he objected to it appearing in a memorandum of the company's liabilities.

The hearing was adjourned.

THE SPEED OF AN ELECTRIC MOTOR-VEHICLE.

BEFORE Mr. Justice Coleridge, in the King's Bench Division, on Wednesday, last week, an action was heard in which Mr. John Leinweher, of 106, Brook Road, Kensington, sued Messrs. Brown and Polson, Ltd., of 6, Bouverie Street, E.C., to recover damages for the death of his son. He was knocked down and killed by the defendant's electric motor-lorry, owing, it was alleged, to the driver failing to keep a proper look-out, and also driving carelessly.

Mr. J. A. Hawke, K.C., appeared, with Mr. P. B. Moile, for the plaintiff, and Mr. Harold Brandou was counsel for the defence.

The driver of the electric motor-lorry said the lad cut right across him, and, although he jammed on his brakes, he could not avoid the accident. There could be no question of his going at an excessive speed, as the electricity would not allow him to do so.

COUNSEL expressed surprise, and the witness explained that these electric motors were charged overnight to go 50 miles in the day, with a top speed of 10 miles an hour; they could not do more. Towards the end of the day—and this was 5.30 in the afternoon—the charge got weak, and he could not possibly have been going more than 7 miles an hour.

COUNSEL said it would have to be accepted that he was not going at too great a pace, but he had never heard of it before.

The JUDGE said it was news to him.

The jury found for the defendant, and judgment was entered accordingly, with costs.

NEWCASTLE-UPON-TYNE CORPORATION v. MARSHALL.

AT Newcastle-upon-Tyne County Court, on the 11th inst., before Judge Greenwell, an action was brought by Newcastle-upon-Tyne Corporation against Private Frederick Marshall, Royal Flying Corps, to recover damages in respect to damage to two tramcars caused, it was alleged, by defendant having negligently driven a military motor-lorry in New Bridge Street, in the city. The sum claimed was £60 15s. 6d. There was a counter-claim by the Secretary of State for War against the Corporation for damage to the motor-lorry alleged to be due to the negligent driving of the tramcars, and £58 19s. 5d. was claimed. His Honour gave judgment for the Corporation in both instances.

SOLDIERS' TRAMWAY FARES.

By a decision of the West Riding Magistrates sitting at Wakefield, on Friday, the point was settled that soldiers as such were not entitled to travel on tramcars as ordinary workmen at the half-fare rate. The case was that of the Yorkshire (W.R.) Electric Tramway Co. against Robert Brown, a corporal guarding prisoners in the Lofthouse Park German Prisoners' Camp.

NEWCASTLE-UPON-TYNE CORPORATION v. SLATER.

At Newcastle-upon-Tyne County Court, on the 12th inst., the City Corporation sued Lance-Corporal J. Slater, A.S.C., for £1 18s. 6d., for damage to one of the tramcars caused by the alleged negligence of the defendant when driving a motor-lorry in Scotswood Road. His HONOUR gave judgment for the plaintiffs, with costs.

BREACH OF LIGHTING REGULATIONS.

At the Bury County Police Court, last week, Ernest Turner, electric wireman, was summoned for a breach of the lighting restriction order on the premises of the Lancashire Power Co., at Ramsbottom. He admitted responsibility, and was fined 10s.

WAR ITEMS.

Part-time National Service.—We cordially welcome the announcement that Sir Auckland Geddes, the Minister of National Service, has appointed a committee to go exhaustively into the question of part-time labour. Large numbers of men and women who are not able to join the fighting forces or to engage for whole-time service in the manufacture of munitions or in work on the land, would, we believe, be glad to render assistance if only a properly organised scheme for utilising their services in their own district in duty which they could be assured would be of service to the State, were put before them. In these days, when the demand for man and woman power is so pressing, it should be possible to so re-organise present efforts of the kind as to increase their efficiency in the gross, and at the same time to secure a certain measure of help from exempted men and from thousands over military age who are unfit for actual military service. We are entirely in sympathy with those who would like to see pressure brought to bear upon capable men and young idling women to make some contribution of service to the National cause. So far as is practicable everybody ought to be doing something, according to their health and abilities, to assist. Extension of the Military Service Acts and measures of Industrial Conscription are admittedly undesirable but if as a result of this inquiry means can be found for securing the fullest use on work of National importance of all forms of part-time work and for assuring co-operation of voluntary bodies which are in a position to undertake the effective organisation and administration of part-time schemes, the setting up of the committee will be amply justified. Exactly what ground is to be covered is not stated, but we presume that the voluntary work performed by the Volunteers, the Special Police, the Red Cross men and women, the canteen workers, the week-end agricultural and munition workers, is all included in the inquiry.

The amount of work that has been rendered by these classes of part-time workers in the aggregate must make a magnificent showing, but how much greater it might be! It is conceivable that some of the present overlapping and waste of labour even among existing workers might be avoided and that by a better organisation of their services men might be released for whole-time pressing National labour on shipbuilding or for the fighting forces, that the staff necessary for compulsory rationing might be found, and that in various other ways the public might be assisted in carrying the increasing burdens of very trying days. We believe that the committee will find it possible to produce a scheme which will ensure a far more satisfactory response and co-operation than could ever have been reasonably expected from those appeals which we all received and those stupid processions of the early months of the present year.

Control of Steel Supplies.—The Order of the Minister of Munitions dated Nov. 20th, 1916, as to control of steel supplies has been amended. The effect of the revision is shown by the following corrected reprint of Clause I. The italicised words are now deleted and the words in parentheses are added:—

"No order for steel made by the Open Hearth or Bessemer (or electric) process other than *Shell Discard Quality* shall be accepted for manufacture and no such steel shall be manufactured unless the purpose for which the steel is required is approved."

Clause 7 now reads as follows:—"No steel shall be manufactured for any order below Class B"—the words "*other than Shell Discard Quality*" being omitted.

The original order will be found in the *Board of Trade Journal* for Nov. 23rd, 1916.

Scrap Steel Collection.—Mr. W. Davie, Glasgow, Scrap Superintendent in Scotland under the Ministry of Munitions, on Friday addressed a largely attended meeting, at which Lord Provost Taggart presided, and emphasised the importance of as much scrap metal as possible being collected for munition-making purposes. It was agreed to organise a scheme in Aberdeen and district. The Lord Provost mentioned that the new electric steel works to be started in Aberdeen in a few weeks should get the first chance of any material available, and it was suggested that another factory might be started in Aberdeen to deal with material that might be forwarded from towns and villages in the North of Scotland—a suggestion which was received with hearty applause.

Shortage of Coal in Bohemia.—A Reuter dispatch from Zurich states that the electrical works at Kolin, Bohemia, have been closed down through lack of coal, with disastrous results to the whole of the surrounding country. Fourteen towns and 35 village communities are without light. Eight sugar refineries, eleven large mills, fifteen engineering works, the railway works and numerous other industrial establishments are all obliged to stop work.

Exemption Applications.—The Dartford Rural Tribunal has granted six months' exemption to A. G. Phillips (C3), electrician, of Darenth.

The County Appeal Court heard seven appeals by the Rotherham Corporation Tramways Department for motor-men, conductors and a mechanic. It was stated that it had been found practically impossible to obtain substitutes to replace even the ordinary leakage of men leaving for more remunerative occupations, let alone for military purposes. If more men were taken it would seriously interfere with the 50 special munition cars run daily. In 1914 9,800,000 passengers were carried, and now the rate was 20 millions. Before the war there were 50 motor-men, 50 conductors and 35 cars; now there were 77 motor-men, 78 conductors (two of whom were men) and 58 cars. Four of the men were ordered to report for service on Jan. 15th, and the others were given open exemption until the end of March.

A firm of electrical engineers at Gloucester opposed a military review of the exemption held by a qualified electrician (40, Grade 2). The firm said that a large number of employees had enlisted and that this man was the only qualified one left in the business. The appeal was disallowed, and the exemption allowed to continue in force.

At Gloucester, a firm of electricians appealed for the retention of an electrician, the only general-service man in their employ. The Tribunal granted exemption until March 7th, and advised the employers to obtain a protection card.

At Axbridge, the Winscombe Electric Supply Co. appealed for E. E. Hill (42, C1), engine driver at the supply station. It was explained that owing to the depleted staff the man now had to perform many duties which hitherto had not been included in his work, and that fact made him more indispensable than he had previously been. The Military Representative did not oppose the appeal, and conditional exemption was conceded.

At Eastbourne, Mr. Bessant, electrical engineer, appealed for S. O. Hoad (42, C3), electrician, and 12 weeks' exemption were granted.

A dealer in electrical goods (31, B2), who appealed at Wigan, stated that he had three brothers serving in France, and he was granted exemption until April 1st.

BUSINESS NOTES.

Calendars for 1918.—From HUDSON'S ELECTRICAL ENGINEERING CO., LTD., of Park Row, Leeds, we have received a wall calendar with monthly sheets for 1918. The upper half of each sheet has a half-tone view of some city of note at home or abroad.

Plant for Disposal.—Manchester Electricity Committee has for sale one 350-H.P. Willans engine, coupled to a 220-kw. Electrical Co.'s generator; three Yates & Thom A.E.G. 1,500-kw. engine alternators; Maidstone Electricity Committee invites tenders for one 150-kw. Peache-Westinghouse D.C. set, 160-550 volts, together with switchgear; Leeds electricity department invites offers for a quantity of surplus plant, including engines, alternators, and condensing plant. Full particulars of these items are given in our advertising pages to-day.

Catalogues and Lists.—STONEBRIDGE ELECTRICAL CO., LTD., 72, Windmill Road, Hampton Hill, Middlesex.—Illustrated price list giving details of their electric heaters.

QUEAD, LTD., 17-57, Marylebone Lane, Oxford Street, W.—Eight-page pamphlet giving illustrated particulars and prices (with a 10 per cent. advance) of "Quead" electric fires.

MESSRS. COLE, MARCHANT & MORLEY, LTD., Prospect Foundry, Wakefield Road, Bradford.—Twenty-page, illustrated catalogue giving full matter relating to their vertical steam engines for superheated or saturated steam, also brief particulars and half-tone views of a number of installations for which they have been supplied, including electric supply, textile and flour mill, rolling mill, and pumping work.

Liquidations.—**BRITISH HIGH POWER GAS ENGINE CO., LTD.**—Winding up voluntarily. Mr. F. G. Palin, liquidator. Meeting of creditors December 21st.

EDISON MANUFACTURING CO., LTD.—Winding up voluntarily. Mr. A. F. Wagner, 161, Wardour Street, W. 1, director and manager of Thomas A. Edison, Ltd., is liquidator. Meeting of creditors December 28th.

NATIONAL ALLOYS, LTD.—Winding up voluntarily. Mr. A. Hodgkinson, 22, Queen Street, E.C., liquidator.

INVICTA ENGINEERING CO., LTD.—Meeting January 15th, at 27, Chancery Lane, W.C., to hear an account of the winding up. Liquidator, Mr. F. C. Harper.

Trade Announcement.—**MESSRS. R. W. BLACKWELL AND CO., LTD.**, have removed to 36, Emperor's Gate, South Kensington, London, S.W. 7, their offices having been requisitioned by Government.

Book Notices.—*Journal of the Institution of Electrical Engineers.* Vol. LVI, No. 269. December, 1917. London: E. and F. N. Spon, Ltd. Price 7s.—This issue contains the presidential address by Mr. C. H. Wordingham, inaugural addresses by Capt. O. T. O'Kelly Webber and Messrs. W. Lang, A. W. Marshall, R. H. Fletcher, C. J. Beaver, A. Page and S. T. Allen, a paper on "The Properties of Electrolytic Copper—Modulus of Elasticity," by Mr. B. Welbourn, and the thirteenth list of members on military service.

The sixth number of the *Journal of the British Science Guild* has now been issued. Copies, price 6d. each, may be obtained on application to the Secretary, British Science Guild, 199, Piccadilly, London, W. 1.

Telephone Troubles. By W. H. Hyde. London: S. Rentell & Co., Ltd. Price 7d. net.—This is the eighteenth edition of this handy little work, which covers both magneto and common-battery systems, detailing the symptoms and nature of faults and explaining the diagnosis and method of rectifying them. A good deal of information is also given regarding the apparatus used, with numerous diagrams. Hitherto the booklet has related mainly to telephone practice in America, where it originated, but in view of the demand in this country it has been revised to bring it into accordance with English practice, and printed in this country. After the war it will be further improved with this object in view, and we would suggest that it should be extended to cover intercommunication telephones, &c., if possible.

Following on the special issue of the *Illustrated London News* dealing with the work of the Royal Flying Corps, recently noticed here, a companion issue has been published illustrating "the Work and Training of the Royal Naval Air Service," with an introduction by the First Lord of the Admiralty, Sir Eric Geddes. The whole issue is printed in photogravure, and reaches the highest standard of reproduction, while the subjects of the illustrations, which constitute practically the whole of the issue, are of surpassing interest. They include a number of views of wireless telegraph sets, and operators learning to use them; and we note that the aircraft not only send, but are also able to receive, messages whilst flying. The issue deserves the highest commendation, covering as it does every branch of R.N.A.S. activity, and admirably illustrates the excellent work of the Service. It may be obtained from the offices of the *Illustrated London News*, price 2s. 6d. net.

L.C.C. Electrical Contract Conditions.—**RETENTION MONIES.**—The General Purposes Committee of the L.C.C. this week recommended the Council to amend its Standing Order No. 295 (d) (i) respecting payments for contracts for machinery. Under the original Order payments have been made as follows:—

50 per cent. of the contract price, less the provision money for extras, on delivery of the machinery.

25 per cent. after erection.

15 per cent. after the trial or testing of the machinery.

Balance after the expiration of the prescribed period of maintenance (usually 12 months).

"For some time past manufacturers of electrical machinery have been willing to enter into contracts with the Council only on condition that payments were made in accordance with the payments clause included in the Model Conditions of the Institution of Electrical Engineers, and most of the recent contracts entered into for electrical machinery required for the tramways department have provided accordingly."

The Highways Committee states that this clause has been accepted or acquiesced in by other public authorities, and that it would adequately safeguard the Council's interests. In these circumstances, and having regard to the decision of manufacturers only to enter into contracts based on this clause, the Highways Committee suggests that the Order should be so amended that the I.E.E. model payments clause may be included in contracts for electrical machinery. The General Purposes Committee concurring in the suggestion, recommends that the following be substituted for paragraph (d) (i) of Standing Order No. 295:—

(1) In contracts for machinery other than penstocks and machinery which has to be erected under similar conditions—80 per cent. of the contract value of the plant from time to time delivered, or work executed on the site; 10 per cent. one month after the plant is taken over, and 10 per cent. after the expiration of 12 months, provided that—

1. Should minor defects arise which would not affect the commercial use of the plant, only such part of the retention money shall be retained as represents the cost of making good such defects.

2. If the contractor is prevented (a) from delivering plant from causes for which the purchaser is responsible, or (b) from erecting plant already delivered, owing to causes for which he is not responsible—

80 per cent. of the value of such plant is to be paid for after notification that plant is ready for delivery or for erection; and

If such delay exceeds two months, one-half of the retention money is to be then paid, and the remainder at the expiration of 15 months from the date of the above notification; and such payment of retention money is to be reduced by an amount to be agreed upon to cover the cost of delivery, erection and maintenance.

France.—A new company has lately been formed at Levallois-Perret, Paris, with a capital of £10,000, and the title *La Société des Etablissements Esselbé*, to manufacture magnetos, and engine-starting and car-lighting sets for motor vehicles.

LIGHTING AND POWER NOTES.

Ashton-under-Lyne.—**PRICE INCREASE.**—The Electricity Committee has decided to increase the charges for energy from the end of the present quarter, as follows:—Lighting, 15 per cent.; d.c. power, 15 per cent.; A.C. power, '06d. per unit. The Council has approved the increase.

Beckenham.—**PRICE INCREASE.**—The U.D.C. has decided to increase the charge for lighting, from December 25th, to the maximum allowable under the order, viz., 8d. per unit; and the charge for power and heating by 3d. per unit, as from the Christmas quarter.

Bedford.—**PRICE INCREASE.**—In order to meet increased expenses, the T.C. has advanced the price of energy for lighting to 6d. per unit, instead of 5½d., plus 10 per cent.; for heating, to 1½d. per unit, and, for power it has fixed a sliding scale:—First 500 units, 2d. per unit; second 500, 1½d.; beyond, 1½d., with a minimum charge of 5s. per quarter. All accounts, except where the coal clause applies, are subject to 2½ per cent. discount.

Bexhill.—A financial statement of the working of the Corporation electricity undertaking for six months ending September compares very favourably with the result for the corresponding period of the previous year. The Committee has decided that no new main extensions shall be laid, and no new house services without special consent.

Brimington.—**E.L. PROPOSAL.**—A public company, on co-operative lines, is to be formed, with a capital of £2,000, for the purpose of establishing electricity works in the parish.

Carlisle.—**PRICE INCREASE.**—The charges for energy have been advanced by the T.C. by a further 10 per cent., making a total increase on pre-war rates of 20 per cent.

Colchester.—**STREET LIGHTING.**—The T.C. has decided to pay 10 per cent. extra for electricity for public lighting for the New Year.

Colne.—**PRICE INCREASE.**—The Corporation has decided, in view of the increased cost of coal, to adopt a flat rate of 5½d. per unit for electricity for lighting purposes, an increase of 3d. For power purposes there will be an increase of one-eighth of a penny per unit.

Darlington.—**PRICE INCREASE.**—The T.C. has increased the price of electricity for power by 1½d. per unit.

Dublin.—**WAGES.**—At its meeting on the 15th ult., the Electricity Supply Committee recommended the Council to grant the members of the technical staff of the Corporation electricity supply the award of the Committee on Production, which had been already granted to the tradesmen and fitters working under the technical staff's supervision. A motion in favour of the recommendation came before the Corporation, but it was rejected in favour of an amendment proposed by Councillor P. T. Daly that the matter be referred to a Special Committee for report as to what Trade Union the men were connected with.

The technical staff have intimated to the Lord Mayor that they wish the matter to be submitted to immediate arbitration. They point out that some of their number have not received any increased remuneration since the war began, except a 5s. war bonus granted generally to Corporation employees and officials. It is requested that the arbitration shall take place before 4 p.m. on Monday next.

Glasgow.—**PLANT EXTENSIONS.**—The electrical engineer has reported additional requests for supplies of energy amounting to 28,000 h.p., and urges the necessity of ordering additional generating plant for the Dalmarnock station.

The Committee has recommended negotiations for a second 15,000-kw. Westinghouse turbo-alternator or larger set.

Glossop.—**STREET LIGHTING.**—The T.C. has accepted the offer of the Urban Electric Supply Co., Ltd., for the maintenance of 15 street lamps for a year at £51 6s., and for the maintenance of four fountain lamps at £8 8s.

Grangemouth.—At a meeting of the T.C., last week, a letter was read from the Scottish Central Electric Power Co., requesting permission to erect an emergency overhead low-tension three-phase line through the streets to the granary. It appeared that the authorities concerned had decided to install electric light owing to the fire danger arising from so much wood. It was agreed to grant the permission requested during the pleasure of the Council.

Grimsby.—PRICE INCREASE, WAGES, &c.—The Electric Lighting Committee has decided to recommend an increase of 15 per cent. in the charges for electricity.

An increased war bonus is to be granted to all members of the electricity staff: all male employees over 18 are to receive a sum which, together with any advance in wages since August, 1914, shall not exceed 15s. per week, the increase to date from August 1st last, also an additional 5s. from February 1st, 1918; those under 18 years of age will receive a war bonus of 7s. 6d.

Hull.—PRICE INCREASE.—The T.C. has increased, as from January 1st, the price of current for lighting by $\frac{1}{4}$ d. per unit, and for all other purposes by $1\frac{1}{2}$ per cent. on the existing charges.

Ipswich.—PRICE INCREASE.—The T.C. has further increased the price of current for ordinary lighting from $5\frac{1}{4}$ d. to 6d. per unit, the rateable value tariff from an increase of $33\frac{1}{3}$ per cent. to an increase of 50 per cent., and the heating and cooking tariff from an increase of $33\frac{1}{3}$ per cent. to an increase of 50 per cent. from the beginning of the March quarter, 1918.

The chief electrical engineer (Mr. Ayton) has appealed to all private consumers to reduce their lighting, &c., as much as possible from sunset to 6.30 p.m. on all evenings except Sunday and Wednesday, as not only is there a great demand for electric power, but the varying quality of the coal now supplied makes it difficult to maintain steam pressure at the required figure.

Kendal.—STREET LIGHTING.—The T.C. has accepted the tender of the electricity department for public lighting at Waterside at £45; the Gas Committee tendered at £46 6s.

London.—HACKNEY.—The Electricity Committee reports that the electricity supply undertaking is developing much more rapidly than was anticipated. Daily maximum loads are now being experienced reaching between 7,000 and 8,000 kW.; the total plant installed, including the whole of the machinery, has a capacity of 12,200 kW., but the largest set is 5,000 kW., and in the event of the temporary failure of this set, they would be left with only 7,200 kW.—that is to say, 3,000 kW. of alternating current and 4,200 D.C. plant. The position is really worse than these figures show, because requirements of alternating current exceed 3,000 kW., and it is not possible to deal satisfactorily with the transmission of the 4,200-kw. D.C. along the low pressure feeder mains. A recent failure of the 5,000-kw. set led to curtailing the supply to large consumers. The Committee is advised that it would be taking an undue risk if it delayed the installation of additional plant, and has therefore instructed the borough electrical engineer to find out what plant is more or less under construction for stock and which can be delivered in time for next winter's maximum load, and he is now considering offers from Messrs. Willans & Robinson, the British Thomson-Houston Co., Messrs. Fraser & Chalmers, Messrs. C. A. Parsons & Co., and the British Westinghouse Co. for plant, and from Messrs. Ferranti for switchgear. The Committee is to be authorised to place the necessary orders for the work up to £40,000. With reference to the necessary extension of steam-raising plant, a loan of £28,000 is to be raised, to be expended as follows:—Messrs. Babcock and Wilcox's tender, £25,140; water-softening plant estimate, £600; wages, contingencies, insurance, inspection, &c., £2,260.

Newport (Mon.).—YEAR'S WORKING.—The annual report of the Corporation electricity undertaking for the year ended March 31st last shows that the receipts amounted to £54,125 and the working expenditure to £32,092, leaving a gross profit of £22,033, which was rather more than the previous year's figure of £20,935. Allowing for accrued interest, &c., and deducting interest and sinking fund charges, war allowances, and other items, there remained a deficit of £273 as compared with a deficit of £933 in 1915-16. The energy sold for all purposes amounted to 6,383,801 units, compared with 5,015,074 in 1915-16. The maximum load was 3,268 kW. and the load factor 22.3 per cent.; 3½ lb. of coal were used per unit generated. The total all-in costs per unit sold was 2.11d., and the average price obtained 2.10d. per unit. The coal cost per unit generated was 338d.

Rathmines (Dublin).—A threatened strike of the Council's employees on a wages demand led to a notice being issued last Friday that it might be found necessary to discontinue the supply of electrical current. Fortunately, however, an arrangement was come to by which the Council is in future to pay the standard rates observed by other Councils in Co. Dublin.

Sligo.—ASYLUM LIGHTING.—In a discussion at the committee as to the lighting of the asylum, Mr. Scott, architect, said they could not at present install electricity, but Mr. Cregan pointed out that installations had been made in neighbouring towns.

Slathwaite.—PROV. ORDER.—The T.D.C. has received a communication from the Huddersfield T.C. that the B. of T. would not allow the Corporation's application for a prov. order for electric lighting for Slathwaite to proceed in the ensuing session, owing to the political situation.

Swinton and Pendlebury.—PRICE INCREASE.—At a meeting of the T.C. last week it was announced that the price of current to consumers would be increased by 5 per cent.

Windsor.—PRICE INCREASE.—On the ground that the application is justified, the T.C. has consented to the Electrical Installation Co., Ltd., charging 81 per unit for electricity supplied, subject to the matter being re-considered at the end of one year.

TRAMWAY AND RAILWAY NOTES.

Clitheroe.—The R.D.C. has approved of a proposal to construct a light railway from Longridge to Hellifield. It was stated that the line would cross the Council's road six times, and it was proposed to have four level crossings. It is expected that the line will be of great benefit to the district, as it will relieve the road traffic considerably.

Glasgow.—At its last meeting, the Tramways Committee had under consideration the position of the Corporation tramway undertaking and other tramway undertakings in Scotland in relation to the Tramway Committee recently appointed by the B. of T., along with a letter from the Paisley District Tramway Co., and has resolved to protest against the constitution of that Committee, on the ground that Scottish tramway undertakings are not represented by any person resident in Scotland, or familiar with the working conditions of these undertakings, and to ask for the appointment of a Scottish representative. The Committee appointed a Special Sub-Committee to take steps, in conjunction with other tramway undertakings in Scotland, with a view to bringing pressure to bear upon the B. of T. to have Scottish tramway undertakings represented on the Committee.

ACCIDENT.—Colonel Pringle, Chief Inspector to the B. of T., conducted an inquiry, on December 13th, into the circumstances attending the tramway accident the previous week, in which three persons were fatally injured and about 40 persons were hurt. Evidence given by tramway officials was to the effect that on the track at the point where the accident took place—a curve at the entrance to Queen's Park—a safe speed would have been five to six miles per hour. Above that speed there would be a tendency for the car to leave the track. There was no B. of T. stop before the curve, but there was a Corporation stop immediately after the curve; the track was in good condition. The driver of the car, a youth of 16 years and 5 months, said he was driving car 157 on the day of the accident for the first time. He did not think that the road at that point was sufficiently lighted, and the result was that he was on the curve before he was actually aware. Approaching the curve he had fed up to full power, and immediately switched the power off. He applied the hand-brake about 20 yards from the curve, but as it had apparently no effect, he released it, and then applied the magnetic brake. Witness gave it three notches, but as it, too, appeared to have no effect, he applied the magnetic brake to the full notch. Half way round the curve the two inner front wheels raised and the outer wheels left the track, and the car ran across the roadway and turned over. On the curve the car was going about four miles an hour. He thought the accident was due to the high speed of the car. Mr. Lachlan Mackinnon, the traffic superintendent, said the Government had offered to send them 105 men back from the Army in return for a similar number of men fit for military purposes. The Tramways Department had kept their side of the bargain, but, up to the present, they had received only six men from the Army. Three great essentials in a motorman were physique, intelligence and temperament, and while they did not get the physique in the lads they were employing as motormen they got intelligence. Temperament, however, was a matter in which they had to make their selection. It was only within the last few months that they had experimented with lads. The Tramways Department was badly hit by the abolition of the leaving certificate in October. Since then they had lost 64 men and 47 women, all skilled drivers, and although they had 800 women trained as drivers, only 258 were working. It required a particular type of woman for driving. The discipline in the service was not so good as it was before the war, and he attributed that to the ease with which people could leave their employment and obtain work elsewhere, and also to the lack of sufficient supervision, there being now only some 50 per cent. of the pre-war number of inspectors on duty. Colonel Pringle indicated that he would give his report later.

Lancashire.—CHRISTMAS DAY SERVICES.—The Burnley Corporation tramway employees have decided in favour of ceasing work on Christmas Day; a similar decision has been given by the Bolton tramway men.

London.—L.C.C. STAFF REORGANISATION.—The Highways Committee has considered the report on the electrical branch of the Council's tramways by the Special Sub-Committee on Tramway Organisation, and has submitted proposals for the appointment of an assistant electrical engineer at a salary of £600 per annum, rising to £800; also a senior technical assistant at £350 a year, rising to £500. The Committee is informed that in comparison with the large power station at Manchester, the Greenwich power station is understaffed, and recommends the appointment of an assistant power-station engineer at a salary of £400, rising to £500 a year; also that the position of senior charge engineer be abolished, and that an engineer with the designation of repairs superintendent be appointed to take charge of the whole of the repair work, at £300, rising to £400 a year; also that an additional charge shift engineer be appointed at £250 a year, rising to £300, and that the fixed staff of the Tramway Department be increased by two sub-station superintendents at £250 per annum, rising to £350; two sub-station repairs inspectors at £200, rising to £250 a year. The additional expenditure involved by the proposals is estimated at £1,655, and ultimately £2,905 a year, and the Committee is satisfied that economies in working costs will outweigh the additional expenditure.

The Highways Committee reports that the various concessions to traffic employees indicated by the recent award of the Court of Arbitration will cost £21,000 for the remainder of the year and

£40,000 in 1918-19. The Committee proposes to re-issue the tramway map and guide, and recommends the expenditure of £1,500 on publicity matters during the remainder of the year.

Newport (Mon.).—YEAR'S WORKING.—During the year ended March 31st last the Corporation tramways carried 11,456,530 passengers and ran 910,020 car-miles, these figures comparing with 10,017,515 passengers and 921,133 car-miles in the previous year. The total income amounted to £50,935, and the working expenses to £31,993, leaving a gross profit of £18,942, as compared with £14,679 in the previous year; after meeting income-tax and sinking-fund charges, there remained a net profit of £8,611, as compared with £5,409 for 1915-16.

Sunderland.—The T.C. has decided that no cars shall run on Christmas Day, and that the day shall be granted as a full holiday for all employees, but without pay.

Weston-super-Mare.—The promoters of the Weston-super-Mare Junction Light Railway have applied to the B. of T. for an extension of time until December 31st, 1918, for the completion of the unconstructed light railway authorised by the Order of 1910.

Wharfedale.—**RAILLESS TRACTION.**—A Conference of representatives of the local Councils of Otley, Gwiseley, Burley-in-Wharfedale and Menston, at Otley, last week, decided to approach by interview Mr. Daggett, acting manager of the Leeds Corporation Tramways, with a view to obtaining better facilities on the Wharfedale railless traction system run by the Leeds undertaking.

Wigan.—**ACCIDENT.**—On Saturday last a car started away from the Pemberton terminus, without the driver, and ran away down a steep gradient, finally leaving the metals and wrecking a house. A lady passenger was killed and three persons were injured, one being in the house.

TELEGRAPH AND TELEPHONE NOTES.

Spain.—It is reported from Madrid that the Spanish Naval Authorities have decided to proceed at once with the fitting of all naval vessels of over 500 tons with wireless telegraph apparatus.

Storm Damage.—Considerable damage to telegraph and telephone wires by weight of snow was done during Sunday and Monday last, when there was heavy snow and high wind in the West Riding. At Yeadon there was some trouble, owing to telegraph poles and wires having been blown down and weighted so far to one side as to be nearly touching the tramway trolley-wires. Railway traffic was held up for a time between Low Moor and Cleckheaton, owing to telegraph poles and wires being brought down over the permanent way. Many wires were down on the bleak hills surrounding Bradford.

Women for Wireless Work.—Well-educated women are wanted immediately for training on urgent Government work in connection with wireless apparatus. Candidates must be between 18 and 40 years of age, and prepared to pass a medical examination. Preference will be given to women with scientific training up to the London Intermediate Standard and some knowledge of practical physics. The course of instruction will be given in the Electrical Laboratories at the Polytechnic, Regent Street, and will last for about six weeks. During this period a weekly maintenance allowance of 25s. is payable. Further particulars can be had from the Director, Training Section, Ministry of Munitions, 6, Whitehall Gardens, S.W. 1.—*Daily Chronicle*.

CONTRACTS OPEN AND CLOSED.

OPEN.

Argentina.—February 23rd, 1918. Rosario Municipality. Establishment of telephone service within the municipal radius. Conditions on application.

Bolton.—January 15th. Electricity Committee. One 7,500-kw. turbo-alternator with condensing plant. See "Official Notices" December 7th.

Keighley.—January 9th. Electricity Department. Induced draught plant. See "Official Notices" to-day.

Spain.—Tenders have lately been invited by the municipal authorities of Cassa de la Selva (Province of Gerona) for the concession for the electric lighting of the town during a period of five years.

Tipperary.—January 11th. New battery for the Union electric lighting plant. See "Official Notices" to-day.

CLOSED.

Glasgow.—The Electricity Committee has accepted the following tenders in connection with the new generating station at Dalnarnock:

Steel work, &c., for roof over turbine house, beams for covering of water culverts, covering of pump chambers, and crane and transporter rails. Redpath, Brown & Co., Ltd. £10,885.
Two travelling cranes: Vaughan Crane Co., Darlington. £5,056 and £1,542 respectively.
Two 1,500-kw. transformers: Ferranti, Ltd. £4,236.

London.—**STEPNEY.**—Electricity Committee. Tenders recommended:

One 1,000-kw. rotary converter. Bruce Peebles & Co., Ltd. £3,580.
Water softening plant. W. Bady. £26.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, December 22nd. At 8 p.m. At 31 Victoria Street, S.W. 1. Paper on "Water Circulation in Boilers," by Mr. H. Josling.

Friday, December 21st. At 31, Victoria Street. At 8 p.m. Paper on "Some out-of-the-way Engineering Jobs," by Mr. R. H. Parsons.

Royal Institution of Great Britain.—Saturday, December 29th. At 3 p.m. At Albemarle Street, Piccadilly, W. 1. Christmas Lecture, "Our Useful Servants: (1) Magnetism and Electricity." Tuesday, January 1st, (1) "Electricity and Electric Currents," by Prof. J. A. Fleming, F.R.S.

OUR HALF-YEARLY INDEX.

As it is necessary to effect every possible economy in paper consumption, the Index to Vol. 81 of the ELECTRICAL REVIEW, which will be printed in the course of a few weeks, will be supplied only to those who, through the post, specially apply for it. To such it will be supplied for 3d. post free. Any reader or advertiser at Home or Abroad who requires a copy for binding, or for other purposes, is asked to make application therefor promptly to: The Publisher, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

NOTES.

Foreign Trade.—**NOVEMBER FIGURES.**—The official returns of imports and exports during last month contain the following electrical and machinery figures:—

		November, 1917.	Inc. or dec.	11 months, 1917, Inc. or dec.
IMPORTS.				
Electrical goods	...	123,067	— 10,581	— 224,830
Machinery	...	1,029,510	+ 101,241	+ 701,048
EXPORTS.				
Electrical goods	...	209,217	— 100,552	— 1,104,535
Machinery	...	1,472,375	— 417,056	— 369,732

Birmingham Corporation Electrical Employees.—With reference to the note in our last issue on the threatened strike of E.T.U. members in Birmingham Corporation Electric Supply Department, we have pleasure in printing the following important statement which was published in a Birmingham newspaper, on December 10th, bearing the signature of Mr. P. J. Burgess, the hon. secretary of the Midland Electric Power Supply Engineers' Association:—

"In view of the public statement made by Mr. Beardmore on behalf of the Electrical Trades Union that the shift engineers at the generating stations of the Birmingham Corporation Electric Supply Department are coming out on strike if the Electrical Trades Union demands are not acceded to, I beg to state that all the shift engineers are members of the Midland Electric Power Supply Engineers' Association, and Mr. Beardmore has no authority for his statement. I should like to take this opportunity of saying that these methods do not appeal to the members of this Association, and I should be glad if you would give this letter equal prominence with that of Mr. Beardmore's pronouncement."

Workmen's Brains.—At a conference of the City Livery Companies on Reconstruction, Dr. Addison said it was important that craftsmen should be induced to apply their brains and energy to inventions and new adaptations. For that they must be secured and protected in the rights and benefits which would legitimately follow the adoption of their ideas. All manner of ingenious suggestions had been made by foremen and craftsmen during the war. Emergency might have produced the suggestions, but at the back of men's minds there seemed to be a timidity lest, having promoted something useful, they would not get anything out of it. That must be guarded against if in the future they were to make the best of the minds and experience of the skilled craftsmen of the country.—*Daily Chronicle*.

The Ramsay Memorial.—The hon. treasurers of the Ramsay Memorial Fund have now received donations or promises amounting to £25,011, out of the £100,000 at which they aim. A co-operating Committee in Glasgow, Sir William Ramsay's birth-place, has already raised nearly £2,000. Branches have been formed also in Australia, Canada, India, New Zealand, the United States of America, Chile, Denmark, France, Holland, Italy, Japan, Norway, and Switzerland.

The fund will be devoted to Chemical Research Fellowships and a Laboratory of Engineering Chemistry. The hon. treasurers are Lord Glenconner and Prof. J. Norman Collie, University College, London, W.C. 1.—*The Times*.

An Air Inventions Committee.—Under the direction of Lord Rothermere, an Air Inventions Committee has been set up, and will be in operation immediately. The Committee is as follows:—Mr. Horace Darwin, chairman; Major-General Luck, vice-chairman; Sir Dugald Clerk, Sir Richard Glazebrook, Prof. H. L. Callendar, Prof. C. H. Lees, Prof. J. E. Petavel, Mr. L. Baird, Lieut.-Commander Wimpey, R.N.V.R., Major G. I. Taylor, R.F.C., Capt. B. M. Jones, R.F.C., Capt. A. V. Hill (Munitions Inventions Department), Mr. J. P. Millington, and Mr. F. W. Lancaster.

The functions of the Committee will mainly be to investigate all inventions submitted to it, and to develop and put into operation as soon as possible any invention which at all promises to add to the efficiency of aircraft. Communications regarding inventions or ideas should be forwarded to the Air Inventions Committee, No. 2, Clement's Inn, W.C. 2.—*Daily Telegraph*.

Prospects for Electrical Engineers in India.—In the course of an address given by the Electrical Engineer, North-Western Railway, to apprentices on the occasion of the opening of electrical classes which have been lately started, reference was made to the careers which were open to them when their apprenticeship with the railway was completed. Their chief object immediately at the end of their apprenticeship should be rather to enlarge their experience and increase their knowledge than to settle down on the railway on works which would teach them nothing and lead to very little except the chance of a vacancy in one of the few positions worth having after a number of years. The Electrical Engineer's advice to them all, therefore, was to look for employment outside the railway when the time came. Those who were able to arrange it were recommended to proceed to England for a short course of training at the close of their apprenticeship: it was worth making a considerable sacrifice to spend a little time in a country where the very latest and most up-to-date methods were in use.

They would be more useful in India at the close of their training than in England, and would be worth far more money on their return to India. The railways were always extending their electrical works; some had their own power stations, and their shops were electrically driven. On any railway, however, there were not likely to be more than two or three positions which were well paid, or which should be looked on as a permanency by any one with ambition.

The various electricity supply undertakings in India had increased in number considerably during late years, and were likely to continue doing so as time went on. There were various jobs—such as shift engineers and chargemen—to be obtained on these; but they were like similar appointments on the railway, not worth having, and would only give experience which they already possessed. There was no reason, however, why any of them should not aspire to the managership of, at all events, the smaller of such undertakings, or the position of chief assistant of the larger ones.

Very few of the larger collieries in Bengal were now without their electrical installations, on which, in many cases, the whole working of the colliery depended. The working of these installations was so important, therefore, that most collieries of importance could afford an electrical engineer, who was fairly well paid, and, in many cases, an assistant, who had always the possibility of stepping into his place, either temporarily or permanently. Electrical engineers of mills very rarely held positions of any importance, unless the mills were worked electrically; and, even then, they were only in the position of shift engineers.

There were various Government appointments in the different Provinces. Under the Electricity Act, there had to be electric inspectors appointed in all the larger Provinces, who had rather special duties, requiring common sense rather than deep electrical knowledge, and in several cases these officers were also electrical engineers to their respective Governments, and had charge of all the Government electrical works in the Province. There was no reason why they should not qualify themselves for any of these appointments. In larger Provinces these officers usually had assistants who were fairly well paid, and these were the positions which they should endeavour to obtain, to qualify for the better position of chief, later on.

Many of the native States had their own Electrical Engineers, and some were well-paid appointments. These had certain disadvantages, but the possibilities of lucrative employment in the native States were certainly increasing, and in a State such as Mysore the positions obtainable were comparable with the best which might be looked for in British India.

In many ways the most attractive of all positions filled by electrical engineers in India were those to be filled in commercial electrical engineering. Their possibilities, financially, were far greater than those of any of the positions previously enumerated. All the posts open to the electrical engineers in India which had been mentioned had limitations as far as salary to be earned was concerned: in commercial life there was no limit to what a man

might earn or make. It was the only career in which a competent man could demand and obtain his own value.

The greatest merit a man could have was that of doing his work as cheaply as possible, bearing in mind, however, that this cheapness was always secondary to doing first-class work.

It was competition that made really commercial engineers so valuable to their employers. In competition the firm who could carry out work cheapest (always understood that it was first-class work) would always win, and this was the secret of success of great firms in the world to-day. The firm who could carry out work cheapest would always have the best employes, and these employes could make themselves so indispensable that they could determine their own salaries.

To qualify for, and obtain, such positions as were worth having, let them never be satisfied with any work which was mechanical, or entailed the same duties day after day. These positions were never paid well, because they required little brain work; it was brain work which was paid for all the world over.

They should use their brains as much as possible, because it was only by constant use that brains were developed, and take every opportunity of improving their minds in every possible way.

When they came to the end of their apprenticeship, experience and further knowledge was what they required, to enable them to qualify for better paid positions later on. Let them not, therefore, stay in any job when they had learnt all there was to learn in it, unless they saw a further opening enabling them to learn more, which it would lead to.—*Indian Engineering*.

Educational.—**EAST LONDON COLLEGE** (University of London).—A preliminary course is being commenced in Science and Engineering for young men between 17 and 18 years of age desirous of entering the Royal Air Service. The course includes aeronautics, physics, electrical engineering, applied mechanics and engineering drawing, and aeroplane engines.

Sterling Football.—The Sterling Athletic and Social Club (Sterling Telephone and Electric Co., Ltd.) have finished the first half of the season undefeated, with a record of seven games won out of eight, one being drawn, and scoring 36 goals to 6. On Saturday last, after a grand game, they defeated the undefeated and smart Ipswich Ladies by 3 goals to nil.

A collection at the Sterling Works, Dagenham, on behalf of the Overseas Club Tobacco Fund realised over £35. Mr. Guy Burney, the managing director (who, with Mr. Chas. E. Sherwood and Mr. E. Cholerton, headed the list), has written a letter of congratulation to the subscribers and collectors upon the result.

The I.E.E. and the Non-Ferrous Metals Bill.—The Council of the Institution of Electrical Engineers has passed the following resolution, which has been transmitted to Sir Albert Stanley:—"That the Council of the Institution of Electrical Engineers welcomes the Non-Ferrous Metals Bill, approves its principles, and congratulates the President of the Board of Trade on its introduction. The Council, representing an Institution whose members are interested so widely in the supply of non-ferrous metals, unanimously supports this measure designed to keep the control of the supply of these essential metals in British hands."

Electrolytic Zinc in Utah.—The process used by the Judge Mining and Smelting Co., Park City, Utah, for the production of electrolytic zinc is briefly outlined by Mr. C. A. Hansen in the recent annual report of the company. The zinc concentrates produced at the company's concentrator contain some lead and silver. They are treated first in a Wedge roasting furnace. The roasted ore is then leached by agitation with an 8 per cent. sulphuric acid solution in Deveroux tanks. The leach-tank product is discharged to classifiers for the removal of the coarse insoluble material. The solution and fine suspended solids which flow from the classifier are treated in a Dorr thickener, the underflow from which is sent to an Oliver filter. The coarse and fine solids thus recovered from the classifier and filter are sold to lead smelters for the recovery of lead and silver.

The leach liquor contains impurities in the form of copper and cadmium which are dissolved from the ore, and these are removed before the zinc is recovered. The removal of impurities is accomplished by passing the liquor through tube mills filled with zinc shot on which the copper and other metals are precipitated in spongy form. The solution flowing from the tube mills is filtered, and is then ready for treatment in the electrolytic cells.

The cell room contains 120 cells arranged in two groups of 60 each. Each group is served by a generator delivering 5,000 amperes at 250 volts. Each cell carries 12 aluminium disks, 5 ft. in diameter, mounted on a rotating shaft. Alternating with the aluminium cathodes are 13 lead anodes, which are supported independently of the shaft. Zinc is deposited on the rotating cathodes, and in the course of about three weeks each cell of 12 disks collects about 5,000 lb. of zinc. The loaded shaft is removed, the zinc stripped, and the shaft reassembled for return to the cell. The electrolytic zinc is melted, cast into cakes, and marketed. The electrolyte is again used in leaching roasted ore.—*Met. and Chem. Engineering*.

Lighting Restrictions in America.—According to a Renter dispatch from Washington, the Fuel Administration has decreed that "lightless nights" are to be observed once a week, not only for the purpose of saving coal, but also "to provide startling and visual evidence that the United States is engaged in the conduct of the greatest of world wars."

A Steel Patent Revoked.—In the Chancery Division, on Monday, Mr. Justice Younger delivered his reserved judgment in the matter of the petition by Arthur Balfour & Co., Ltd., Darnley Steel Works, Sheffield, for the revocation of Letters Patent No. 27,838 of 1912, granted to Stahlwerk Becker A.G., of Krefeld Willich, Germany, in respect of an invention for an improved high-speed tool steel. The petition was based upon the ground of prior user and want of novelty. The invention consisted in the addition of cobalt up to 15 per cent. to the other ingredients of high-speed steel, and petitioners said they had been in the habit of using cobalt for at least 12 months prior to the date of the patent. Counsel said the invention was one of vast importance, and revolutionized the production of this class of steel. The respondents were the German patentees, and Darwin & Milner, Ltd., of Commercial Street, Sheffield, who claimed to be the licensees under the patent.

His Lordship said the sole question he had to determine was whether the objections to the validity of the patent had been established, and he came to the conclusion that they had. He, therefore, made an order revoking the patent, but granted a stay for six weeks, in order that the patentee in Germany might be communicated with.—*Financial Times*.

The Non-Ferrous Metal Industry Bill.—This Bill was before the House of Commons in Committee, on Tuesday. There was a good deal of discussion on an amendment which sought to limit the application of the Bill so that only persons suspected of enemy association would be obliged to apply for a Board of Trade licence, but the amendment was rejected by 148 votes to 80. Sir A. Stanley said that the sole object of the Bill was to secure that those engaged in the metal industry were not under German control, and, in order to effect that, everybody in the trade must apply for a licence. Another amendment sought to make the licence inoperative for six months after the end of the war, as the Government had absolute control over the metal industry, and would continue to have such control for such time. Sir A. Stanley said they must take steps to secure the break up of the German combination, so far as concerned this country. The effect of the amendment would be that we might be, during the difficult period following peace, unable to meet the demand for metal, while the German combination would be ready to resume operations. Mr. Runoiman agreed that whatever steps were to be taken must be taken at the earliest possible moment. The amendment was rejected by 165 votes against 68.

An Electric Steel Furnace on the Witwatersrand.—In the *South African Journal of Industries*, Prof. G. H. Stanley, of the South African School of Mines and Technology, gives particulars of the manufacture in Johannesburg of steel shoes and dies for stamp batteries. Prior to the outbreak of war all such material was imported, and of these particular articles about 7,500 tons per year are used for renewals. Without them it would be impossible for the milling of gold ore to continue, and, consequently, the difficulty of importation, as the result of the war, became a matter of grave concern. Moreover, they are made of high-grade steel and by highly skilled workmen, and both the material and the men are required to-day for other purposes. The enhanced price—£35 per ton, as against the pre-war price of £18 10s., has converted a somewhat doubtful proposition into an extremely attractive one. A Committee of the Chemical, Metallurgical and Mining Society, the Institute of Engineers, and the Institute of Electrical Engineers, was constituted to inquire and report on the possibility of local production, and, as a result, the Chamber of Mines, through the Witwatersrand Co-operative Smelting Works, Ltd., furnished the necessary capital, estimated at £5,000, and appointed a Committee of technical men to carry out the scheme. The erection of the plant was commenced in May of last year, and current was switched on on September 3rd, 1916. The total production to the end of July, 1917, was 360 tons. The furnace adopted is an electric induction furnace of the Kjellin type, several reasons contributing to its selection; all the material and machinery required were available in the country for the construction of a furnace of a useful size, the material available for melting—worn and discarded shoes and dies—required no refining, but merely melting and casting, electric heat would cost much less than that from coke, and no electrodes, which would have to be imported, were required. Up to 600 amperes at 250 volts is used in the primary coil, inducing about 30,000 amperes in the metal. The electric current available direct from the mains of the Victoria Falls and Transvaal Power Co. was not suitable, being at 2,000 volts, three-phase, 50 cycles. This is transformed for the furnace by a rotary transformer set consisting of a motor coupled to two generators, all being adapted from other purposes by Prof. Buchanan by means of considerable alteration and re-winding, to give single-phase current up to 600 amperes, at 12 cycles. The furnace is built of South African fire-brick of special shape, lined with calcined magnesite, obtained, in the first place, from Maléane, and used first as a source of carbon dioxide for mineral water manufacture. The imperfectly calcined material resulting is then burnt at a high temperature in a special gas-fired furnace, mixed with clay and heric acid and wetted, and rammed into place round a wooden template. The scrap metal, already heated to redness in a coal-fired reverberatory furnace, is charged in little by little till the furnace is fully charged with molten steel, which takes about six hours, after which for an hour or so, the metal is allowed to get hotter and "kill," during which it becomes to some extent purified, and certain dissolved gases are expelled. During melting, oxidation is prevented, as far as possible, by keeping the molten bath covered with charcoal; nevertheless, some silicon and manganese are lost, and, to replace these, a calculated amount of pure pig-iron and manganese steel scrap is added

at the end. Finally, slag is skimmed off, and the metal is tapped out into a vessel in front provided with a lever-operated clay-stoppered outlet below, from which the molten steel flows into the moulds, which—mounted on wheeled carriages—are run underneath. The moulds used are made of thick cast-iron, in two sections, hooped together, and provided with rammed sand tops—these being dried in a stove heated by the same fire as the pre-heating reverberatory before mentioned. After solidification, the casting head and fins are trimmed off, and every shoe and die produced is weighed and numbered. Usually between 1,900 and 2,000 lb. of castings are obtained per heat, and the production for July was 73 tons. The imported shoes and dies are forged in manufacture, and the local ones are merely cast to the desired shape. The users—the co-operating mines—keep records of their performance in comparison with the imported, and the result is satisfactory, in some cases the local having an even longer life than the imported ones. In spite of high costs of labour and other items, the plant operates very profitably.

Legal.—OSRAM-ROBERTSON LAMP WORKS v. ELECTRICAL ENGINEERING AND EQUIPMENT CO.—Mr. Hunter Gray, on Tuesday, applied to Mr. Justice Eve for his approval of the minutes of agreement arranged between the Osram-Robertson Lamp Works and the Electrical Engineering and Equipment Co., Ltd.

His Lordship: I take it that everything is in order?

Mr. Hunter Gray: Yes, my Lord.

His Lordship: Very well then.

ATTORNEY-GENERAL v. THE METROPOLITAN BOROUGH OF HACKNEY.—In the Court of Appeal, on Tuesday, judgment was delivered dismissing the appeal in this case, with costs. We shall report the judgment in our next issue.

Volunteer Notes.—COUNTY OF LONDON VOLUNTEER ENGINEERS (FIELD COMPANIES).—Headquarters, Balderton Street, Oxford Street, W. 1.

Orders for the week, by Lieut.-Colonel C.B. Clay, V.D., commanding:—

Officer for the Week.—Second Lieut. E. A. Ullmann.

Christmas Holidays.—Headquarters and the Range will be closed from the 22nd to the 28th, both inclusive.

Saturday, December 29th.—Commandant's Parade at Headquarters, 2.45 p.m., for Route March and Drill. Uniform to be worn.

A, B, and C men are reminded that one route march per month is compulsory.

(By order) MACLEOD YEARSLEY, Capt. and Adjutant.

National Insurance (Part II) (Munition Workers) Act, 1916.—The following are further decisions of the Umpire. Contributions are payable in respect of:—

2,399 X. Charge-room attendants employed wholly or mainly by way of manual labour in connection with any insured trade or munitions work.

2,404 X. Workmen engaged wholly or mainly in making leather parts of cycle and motor-cycle saddles.

2,406 X. Workmen employed wholly or mainly in the workshops of local authorities and engaged in painting iron seats, street orderly bins, or other metal goods.

Appointments Vacant.—Armature winder, for the Oldham Corporation tramways; charge engineers, for the Derby Corporation Electricity Department; Head of the Department of Electrical Engineering and Physics, for the Victoria Jubilee Technical Institute, Bombay (700 Rs.); shift engineer (52s. 6d.+) for the Maidstone Corporation Electricity Department. See our advertisement pages to-day.

Institution and Lecture Notes.—Institution of Mechanical Engineers.—On Friday last a paper was read on "The Use of Soap Films in Solving Torsion Problems," by Messrs. A. A. Griffith and G. I. Taylor. The authors point out that the equations which represent the torsion of an elastic bar of any uniform cross-section are identical in form with those which represent the displacement of a soap film due to slight pressure, when stretched over a hole in a flat plate, of the same shape as the cross-section of the bar, and show how this fact can be applied to the solution of technical problems, very many of which are not amenable to analytical treatment. The method is most ingenious, and is admirably handled by the authors; it will, no doubt, prove of immense value in practice.

Institution of Electrical Engineers.—In the December issue of the *Journal* it is announced that Prof. A. Righi, of Bologna University, has been elected an Honorary Member of the Institution, and that the Committee of the Privy Council for Scientific and Industrial Research has made a further grant of £670 to the Institution towards the cost of the research into the properties of insulating oils. A list of 10 of the Committees appointed by the Council for 1917-18 is given, including also 11 Sub-Committees and Panels in connection with the Research Committee. The Committees on "Ship Electrical Equipment" and "Wiring Rules" include a number of representatives appointed by other societies. The eighth Roll of Honour comprises seven names, and the eighth list of Military Honours awarded is given, with the thirteenth list of members on military service.

Royal Institution.—On Thursday next Dr. J. A. Fleming will give the first of his course of Christmas lectures on "Our Useful Servants: Magnetism and Electricity," dealing with magnets and the magnetic compass. On Saturday he will take up the subject of electricity and electric currents.

The Faraday Society.—A general discussion on "The Setting of Cements and Plasters" will be held on Monday, January, 14th, 1918, at 5.30—7 and 8.30—10.30 in the Rooms of the Royal Society of Arts, John Street, Adelphi, London, W.C. 2.

Electrically Heated Beds.—A warm bed is the most important matter for a patient suffering from pneumonia. If the aim is to maintain an even temperature, it is obvious that any system of intermittent heating is very unsuitable for the purpose; at best with the rubber hot-water bottle the bed temperature is a constantly fluctuating quantity. Various efforts have been made to solve the problem by the use of a continuous electric current passed through suitable resistance, but these have failed for the most part in not providing for the wear and tear inseparable from bed-using and bed-making. A successful solution has now been reached by Mr. H. J. Gauvain at the Treloar Cripples' Hospital, Alton, where two wards are supplied with electric mattresses which have proved both safe and convenient in practice even when a child is the occupant of the bed. The mattress does not differ in appearance from any other except that a flexible wire enters it at the head end through a terminal, which is flush with the surface and therefore not exposed to injury. The resistance wire is insulated by glass beads in flexible metallic tubing incorporated in the substance of the mattress. The mattress is differentially heated, and the heating element is so disposed that the maximum warmth is generated at the foot end, less in the middle, and none at all at the head end. This distribution of heat is maintained in whatever position the mattress is turned, either from head to foot or side to side. The wires are connected with a switchboard on the wall at the head of a bed, which contains a variable resistance, so that the current can be graduated to any required extent. It is so arranged that when the current is full on, the temperature of the bed is raised 25° to 30° F. above that which would obtain apart from the heating, and this has been found in practice to meet the needs of the small cripples, many of whom are fastened on splints which do not allow of the close contact of the bed clothes. A fuse prevents the passage of any current exceeding this amount. Several of the usual difficulties have thus been met; the temperature of the mattress cannot rise to any dangerous degree, the tubing is so flexible that the mattress can be shaken or rolled up, and the resistance wire is waterproof in the spiral metallic tubing, so that no short-circuiting results, even if the mattress is wetted. The mattress may be sterilised in the ordinary way. The system is equally applicable whether the bed be in or out of doors. The saving of time at the Cripples' Hospital amounts to an aggregate of three hours a day in each ward where the electric mattress has replaced the filling of hot-water bottles, while inasmuch as the current required for maximum heating is only half an ampere at 110 volts, the total expenditure for energy of 200 or more beds would be by no means prohibitive. We believe that the general adoption of a similar appliance in hospitals and infirmaries would save much time and relieve the nursing staff of a tiresome routine. Electrically heated beds have already been found of advantage in the treatment of shock at field hospitals, and for military purposes it will be seen that the current required may be instantly supplied from a portable dynamo driven by a motor lorry or car attached to a field hospital. This is of especial importance in circumstances where water for hot-water bottles is not readily available and the means of heating the water required is limited.—*Lancet*.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station and Tramway Officials.—The General Purposes Committee of the Stepney B.C. recommends that at the meeting of the Council in March next the following resolution be considered and determined, viz.:—That Mr. F. Tait be transferred to Class I of the Council's Grading Scheme as from January 1st, 1918, at a salary of £312 10s. per annum, rising by annual increments of £12 10s. to £400 per annum.

Buxton T.C. has appointed Mr. AUCHER BISHOP, of Maidenhead, as assistant electrical engineer, at a salary of £150 a year.

Mr. PHILLIPS, borough electrical engineer at Bedford, having accepted a commission in the R.F.C., the T.C. has appointed Mr. H. B. JENKINS acting borough electrical engineer at £275 a year, and Mr. R. J. BLAICH as consulting engineer at the same salary.

The Manchester Tramways Committee has given its approval to the transfer of the services of its general manager, Mr. J. M. McEHOY, from the Admiralty to the Board of Trade, to serve upon the new committee of tramway experts. This was recently set up by the Board. The Admiralty reserves the right to call upon Mr. McEHOY for special services in connection with the department with which he has been connected since the beginning of the present year, and will also return to Manchester from time to time to deal with important matters connected with the tramways under its jurisdiction.

The Leeds C.C. Highway Committee recommends that Mr. J. P. WILSON, second-class assistant, be promoted to the position of senior electrical assistant (electrical branch) in 1918, at a salary of £350 per annum, and that Mr. J. B. WOOD, senior charge engineer at the same station, be promoted to be assistant power-station engineer at £400 per annum, rising to £500; that Mr. H. J. COOPER be appointed charge-shift engineer at Green-

wich power station at £250 a year, rising to £300; that Mr. R. S. GOOD, second-class assistant, be promoted to be sub-station superintendent in the tramways department (electrical branch) at £250 a year, rising to £350; that Mr. N. H. THOMAS, third-class assistant, become sub-station superintendent in the tramways department (electrical branch) at £250, rising to £350.

Stoke Newington B.C. General Purposes Committee recommends that Mr. H. LARGE, acting borough electrical engineer, be granted an addition of £20 to his present salary of £180 per annum, and £25 further on account of honorarium for his services as acting engineer, the latter to be paid in March next. The Committee also recommends increases varying from 2s. 6d. to 5s. per week to other members of the staff of the electricity department, and that, subject to the consent of the L.G.B., such of the officers and servants in the aforesaid department now on active service as are married men, and not holding commission rank, be granted a war bonus equal to that which would have become payable to them if they had continued to discharge their civil duties in the Council's employ.

General.—Mr. FRANK K. COOKE, who has rendered service for some 30 years with the Unbreakable Pulley & Mill Gearing Co., Ltd., has found it necessary, owing to illness, to sever his connection with the company. During the lengthy period mentioned he was secretary of the company for 23 years, enjoying the most happy relationship with them.

Stepney B.C. Electricity Committee has re-elected Councillor H. R. BARGE and Councillor W. F. BATE Chairman and Vice-Chairman respectively for the ensuing year.

Mr. H. SHAPE, on his retirement from the position of local secretary of the Tramway Workers' Association, has been presented with a gold watch by the employees of the Burnley Corporation tramways department, in which he was formerly employed.

It is announced in the Press that Sir JOHN WOLFE BARRY, owing to advanced age, has decided to relinquish his position as chairman of the Eastern & Associated Telegraph Companies, over which for many years he has presided, but those companies will continue to have the benefit of his services on their respective boards. Sir John Denison-Pender has been elected chairman.

Roll of Honour.—Captain F. B. F. HAIGREAVES, of St. Anne's, who is officially reported missing, was chief accountant to the Blackpool & Fleetwood Tramroad Co. at Bispham.

Second-Lieutenant C. L. MACDONNELL, Gloucestershire Regiment, killed in action on October 9th, 1917, was in the employ of the Bradford Corporation electricity department.

Lance-Corporal H. P. ARNOLD, R.E., who has fallen in action, was employed at the Rugby works of the B.T.H. Co.

Rifleman W. BROOKS, who was with Messrs. Johnson and Phillips, Ltd., of Charlton, S.E., is reported missing.

Private C. T. YEWEN, Queen's Royal West Surrey Regiment, who has been killed in action, was with Messrs. Creed, Bille & Co., of Croydon.

Private E. COOPER, of the Royal Welsh Regiment, who has been killed in action, was employed by the British Westinghouse Co. at Trafford Park.

The Mayor of Heywood last week publicly presented the D.C.M. to Sergeant THOMAS FEARING, East Lancs. Regiment. The award was made for conspicuous services at Gallipoli. Sergeant Fearing was mains foreman in the Bury Corporation electricity department.

Private G. W. LAMB, King's Shropshire Regiment, killed in action, was employed by the British Westinghouse Co. at Trafford Park.

Staff-Sergeant FRED WOODS, A.S.C., awarded the Military Medal, was a mechanical and electrical engineer in the employ of his father, Mr. J. Woods, Blackpool.

Private G. LEWIS, R.O.Y.L.I., who has been killed in action, was employed by Messrs. Hirsts, electrical engineers, Dewsbury.

Second-Lieutenant P. N. CUNNINGHAM, who has been killed, was the younger son of Mr. W. Cunningham, a director of the Etna Iron & Steel Co., Motherwell. Just before joining the Army he had taken his diploma in electrical engineering at the Glasgow Technical College.

Corporal H. FOSHER, formerly employed by the Newcastle Electric Supply Co., is in hospital wounded.

Obituary.—Mr. H. A. C. SAUNDERS.—We regret to record the death, which took place on December 8th, at his residence at Highbury New Park, N., of Mr. H. A. C. Saunders, late electrician-in-chief to the Eastern Telegraph Co., aged 85 years. The interment took place at Brompton Cemetery last Saturday.

Mr. E. MATHESON.—The death has taken place, at Dartmouth, of Mr. Edwin Matheson, aged 79. He was for many years an alderman on the Leeds City Council, and had been the chairman of the Electricity Committee and the Leeds Chamber of Commerce. He was also a member of the Inst.C.E. and of the Iron and Steel Institute, at one time being a managing director of the Farnley Iron Co.

Mr. W. JOHNSON.—The death took place suddenly, on December 8th, of Mr. Wm. Johnson, of Messrs. Wm. Johnson and Co., electrical contractors, of Sheffield. He was in his 74th year, and is described as one of the pioneers of the electrical industry in the city.

NEW COMPANIES REGISTERED.

Inventions (Manchester), Ltd. (119,111).—Private company. Registered December 11th. Capital, £3,000 in £1 shares. To acquire any patents, inventions, &c. The subscribers (each with one share) are:—M. H. Goldstone, Sampson Works, Salford, Manchester, electrical engineer; H. O. Farrell, 91, Sowerby Street, Moss Side, Manchester, electrical engineer. The first directors are:—M. H. Goldstone, H. O. Farrell, and J. Lightfoot. Registered office: 29, Princess Street, Manchester.

Surbiton Contract Co., Ltd. (149,128).—Private company. Registered December 13th. Capital, £40,000 in £1 shares. To enter into an agreement with Callender's Cable & Construction Co., Ltd., and to carry on the business of electricians, electrical and mechanical engineers, &c., also to carry out experiments and operations with a view to applying all or any part of the company's processes or preparations to the insulation of cables and wires, the prevention of corrosion, rust, or damp in articles exposed to water or air, &c. The subscribers (each with one share) are:—Th. Petersen, Hamilton House, Victoria Embankment, E.C., electrical engineer; F. E. Gripper, 11, Tophill Street, S.W., electrical engineer. The first directors are:—Thos. O. Callender, Theodor Petersen, Francis E. Gripper, and John C. Wigham (all British by birth). Qualification: One share. Remuneration as fixed by the company. Registered office: Electricity Works, Ewell Road, Surbiton.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Rapid Distillation & Power Co., Ltd.—Charge on company's interest in certain freehold land and premises at Barking, and in certain stock, plant, &c., dated November 27th, 1917, to secure all moneys which may be paid by W. G. Morden and C. W. Small under a guarantee of certain bank drafts.

Oriental Telephone & Electric Co., Ltd.—Satisfaction to the extent of £750 on December 4th, 1917, of £200,000 debenture stock secured by trust deed of 1905 and supplemental deed of 1907.

Telephone Co. of Egypt, Ltd.—Satisfaction to the extent of £1,597 on December 4th, 1917, of £200,000 debenture stock secured by trust deed of 1904 and three supplemental deeds.

CITY NOTES.

Mr. A. W. TAIT, presiding at the annual meeting on December 13th, said that the progress of the company during the last five years was undoubtedly satisfactory. After referring to the difficulties of the past few years, he said that one of the most important and progressive departments of their manufactures was that of steam turbines and turbo-blowers, and the orders which they had obtained for these during the year were decidedly satisfactory. He mentioned last year that the company had built turbines of over 5,000 kw. capacity, and that still larger units were being prepared. It was a tribute to the company's design and sound manufacture that they had secured an order for one of two of the largest turbine units for operation in this country. In these days of necessity for consolidation and efficiency in manufacture, the whole trend was for concentration in the development of electrical energy, so that industry might be supplied at as cheap a rate as possible. A committee appointed by the Government were looking closely into this matter with a view to centralising the power generation of the country in order to assist industrial development, and as the outcome of this there would be great scope for the steam turbine, particularly in the larger units. It was the intention of the directors to participate in this development, and to get their fair share of the business which would undoubtedly be available. The dry-gas cleaning plants which the company had manufactured and erected for important iron-works throughout the country had given every satisfaction. Developments in this department were encouraging, particularly in these days when the value of by-products was so closely studied. There was a wide field for plants manufactured under the patents held by the company, and, in addition to the orders which were on their books, there were large orders which were only held up owing to the present shortage of materials. The conveyor department was a growing business. The merchandise business in South Africa had been excellent. The trading in Australia, Canada, and at other branches had been necessarily restricted. Their office at Petrograd still remained open, but no new work was being undertaken at the moment.

Companies Struck Off the Register.—The following companies have been struck off the register, and are accordingly dissolved:—

Adjustable Cover & Boiler Block Co., Ltd.
Forced Lubrication Co., Ltd.
South African Engineer Co., Ltd.

F. Reddaway & Co., Ltd.—Dividend, 6 per cent. on the ordinary and preference shares for the year. £6,220 is put to depreciation, and £2,854 is carried forward.

British Westinghouse Electric & Manufacturing Co., Ltd.—The numbers have been advertised of 79 debentures of £100 each (6 per cent. prior lien) which have been drawn for redemption at par on January 1st, 1918.

Napier-Kimber, Ltd.—At the annual meeting, held on 6th inst., it was stated that the turnover for the year ended August 31st last showed a considerable increase, which was reflected in the profits, and after allowing for payment of debenture interest, depreciation of stock, bonus to staff, &c., a dividend of 10 per cent., free of income tax, is paid on the ordinary shares, and £957 is carried forward. A considerable increase in capital in the near future is contemplated, when Treasury sanction has been obtained, in order to deal with expanding business.

Ferranti, Ltd.—The annual meeting will be held on December 28th, at Basildon House, E.C., but the directors are unable to submit the accounts for the year ended June 30th, 1917, as several important matters in connection with Government contracts are not yet settled. The accounts will be submitted later.

Eastern Extension, Australasia & China Telegraph Co., Ltd.—Third quarterly interim dividend of 3s. per share, free of income-tax, in respect of profits for the year ending December 31st.

Manila Electric Railroad & Lighting Corporation.—Dividend of \$1.50 per share on the common stock for the quarter ending December 31st.

Automatic Telephone Manufacturing Co., Ltd.—The preference share and transfer books are closed until 25th inst., for the purpose of preparing the dividend warrants on the 6 per cent. cumulative preference shares for the half-year.

Anglo-Argentine Tramway Co., Ltd.—The directors have postponed the consideration of the payment of the dividend on the first preference shares until the accounts for the year are received.

STOCKS AND SHARES.

TUESDAY EVENING.

Stock EXCHANGE markets have dropped into a jog-trot condition, in which the prevailing factors are, as before, the issue of War Bonds and the news from abroad. The latter would have been less disappointing had it not been for the success previously achieved at Cambrai, with the subsequent ringing of joy-bells. The disappointment is reflected, so far as the Stock Exchange is concerned, in a slowing-down of business and a moderate set-back in prices, although in any case the latter was pretty sure to have come about as a natural sequel to the great push on behalf of the War Bonds.

The various transport markets, steam and electrical, lean to the down grade. Undergrounds are not in much worse state than they were, except that the sentiment for them is perhaps more chilly than it was before. The Underground Co.'s Income Bonds have fallen $\frac{1}{2}$ in spite of the demand that is arising again for investments the dividends on which are paid free of tax. The recent speech of the Chancellor of the Exchequer, forecasting heavier taxation in the New Year, has revived the quest for tax-free securities, and on the present basis of 81, the Underground Income Bonds return practically 5 per cent. net, assuming that the previous 4 per cent. rate is maintained. The bonds, of course, are entitled to 6 per cent., which they received a year or two ago, but the rate had to be cut in consequence of the increase in taxation, and with the fall in dividends came a corresponding reduction in price. The 5 per cent. clear, which is the present yield, is the equivalent of 6 $\frac{1}{2}$ per cent., less tax, and this is attracting a little notice from investors who are not afraid of home railway stocks.

Anglo-Argentine Tramway First Preference have again fallen back, this time to 23, there being some pressure to sell the shares on behalf of a deceased account. Whether this be the true reason or not, the market is certainly dull, and the price is now within 5s. of that of the Second Preference, which have received no dividend since December, 1915. The 5 per cent. debenture stock is steady at 65 $\frac{1}{2}$. Brazilian Traction keep about 46, and the preference at 90, the latter being recently ex dividend. Mexican Bonds of all kinds remain flat. Further falls have taken place in the bonds of the Mexico Tramways, the Mexican Light and Power, and the Pachuca Companies. In reply to inquiries as to why these should be so especially weak at the present time, authorities in the market aver that there was no particular reason why quotations should have been hoisted some time ago, and that those who bought the bonds at that time are now sick of waiting for the recovery which does not come, and are anxious to get out at practically give-away prices. The common shares of the Mexico Tramways are down to 32 $\frac{1}{2}$, and the company's bonds, both Firsts and Seconds, are exactly the same price. There is something ironical in the bonds and the common shares all footing the same line. Mexican Light & Power common are nominally 22 $\frac{1}{2}$, but shares changed hands a few days ago at 19 $\frac{1}{2}$. The preferred have fallen to 29, the 5 per cent. First Mortgage Bonds to 32 $\frac{1}{2}$, and the Seconds to 23 $\frac{1}{2}$, while Pachuca bonds are quoted at 30. The last transaction marked in the latter was at 40 $\frac{1}{2}$ a month ago, although the deposit receipts changed hands last Thursday at 33. British Electric Traction remain dull, the ordinary stock at 32 $\frac{1}{2}$, the preference

at 72½ x.d., while the First and Second Debentures are quoted 76½ and 65 respectively.

The cable market keeps good, and business is marked regularly in Eastern Telegraph Ordinary stock at 150 and over. Eastern Extensions changed hands freely between 14½ and a shade over 15. Westerns keep strong at 15½ x.d., and the Globe shares of both classes are also good. There has been a little activity in the Marconi shares, where the parents are dull at 3 1/16, while Americans, after going back to 23s., braced up to 23s. 6d. Marconi Marines remain about the firmest of the group at 2 9/16 middle. There is nothing fresh to report in the telephone group, save ½ decline in Orientals, lowering the price to 3.

Electric lighting issues are a little irregular, a rise in Metropolitan preference being off-set by falls in Westminster and Charing Cross preference. There seems to be some doubt felt as to maintenance of the 1916 dividends. Edisons rallied to 24s. Electric Constructions eased off to 1½. General Electric ordinary are 5s. down.

Rubber shares are weak on heavy selling of shares in a few of the leading companies. After dipping to 2s. 2½d. per lb., the raw product recovered to 2s. 4½d., but this failed to have any stimulating effect upon prices of shares, and there is a general heaviness throughout the list, holders of rubber shares asking, with some asperity, why the price of their commodity should be about the only thing which has fallen during the war, while everything else has risen so materially. The iron and steel list is also a trifle lower, from which it would appear that the provinces are finding other channels for the use of their money, and amongst the mining markets, tin shares are a trifle easier, notwithstanding a rise in the price of the metal to about £306 per ton.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES						
	Dividend	Price				
	1915. 1916.	Dec 17, 1917.	Rise or fall this week.	Yield p.o.		
Brompton Ordinary	10 9	64	—	26 18 6		
Charing Cross Ordinary ..	5 5	4	— ½	6 5 0		
do. do. 4½ Pref. ..	44 44	83	—	6 13 4		
Chelsea	4 8	23	—	5 9 1		
City of London	8 8	134	—	6 0 9		
do. do. 6 per cent. Pref. ..	6 8	104	—	6 18 6		
County of London	7 7	11	—	6 7 9		
do. do. 6 per cent. Pref. ..	8 8	104	—	5 18 5		
Kensington Ordinary	7 6	68	—	6 11 7		
London Electric	8 Nil	1	—	Nil		
do. do. 6 per cent. Pref. ..	8 4	34	—	5 6 8		
Metropolitan	8 8	84	—	4 12 4		
do. do. 4½ per cent. Pref. ..	44 44	84	+ ½	6 13 4		
St. James' and Pall Mall ..	8 8	7	—	6 14 6		
South London	6 6	3	—	6 13 4		
South Metropolitan Pref. ..	7 7	21½	—	8 10 6		
Westminster Ordinary	7 7	63	— ½	6 9 8		

TELEGRAPHS AND TELEPHONES.						
	Dividend	Price				
	1915. 1916.	Dec 17, 1917.	Rise or fall this week.	Yield p.o.		
Anglo-Am. Tel. Pref.	6 8	95½	— ½	6 5 0		
do. Def.	83/8 14	282	—	8 8 4		
Chile Telephone	8 8	7½	—	5 11 4		
Cuba Sub. Ord.	5 7	94	—	7 11 4		
Eastern Extension	8 8	15	—	5 6 8		
Eastern Tel. Ord.	8 8	1504	—	5 6 4		
Globe Tel. and T. Ord. ..	7 7	13½ x.d.	—	5 1 10		
do. Pref.	8 8	101 x.d.	—	6 17 1		
Great Northern Tel.	22 24	37	+ 1	6 9 6		
Indo-European	13 13	52½	—	6 3 10		
Marconi	10 15	3½	— ½	4 17 10		
Oriental Telephone Ord. ..	10 10	8	— ½	3 6 8		
United R. Plate Tel.	8 8	6½	—	5 17 6		
West India and Pan	8d. 6d.	1½	—	4 9 6		
Western Telegraph	7 8	15½	—	5 6 0		

HOME RAILS.						
	Dividend	Price				
	1915. 1916.	Dec 17, 1917.	Rise or fall this week.	Yield p.o.		
Central London, Ord. Assented	4 4	604	—	6 12		
Metropolitan	1 1	21½	— ½	4 11 0		
do. District	Nil Nil	164	—	Nil		
Underground Electric Ordinary	Nil Nil	13	— ½	Nil		
do. do. "A"	Nil Nil	5½	— 6d.	Nil		
do. do. Income	8 4	81	— ½	4 18 9		

FOREIGN TRAMS, &c.						
	Dividend	Price				
	1915. 1916.	Dec 17, 1917.	Rise or fall this week.	Yield p.o.		
Adelaide Sup. 8 per cent. Pref.	8 8	44	—	8 8 1		
Anglo-Arg. Trams, First Pref.	54 54	24	— ½	10 0 0		
do. do. 2nd Pref. ..	54 54	24	—	7 10 3		
do. do. 5 Deb. ..	6 5	66½	—	—		
Brazil Traction	4 4	46	—	—		
Bombay Electric Pref.	8 8	42	—	6 4 9		
British Columbia Elec. Rly. P.fce.	5 5	4½	—	11 15 4		
do. do. Preferred ..	Nil Nil	30	—	Nil		
do. do. Deferred ..	Nil Nil	28	—	Nil		
do. do. Deb. ..	44 44	54	—	7 6 7		
Mexico Trams 5 per cent. Bonds	Nil Nil	82½	— 2	Nil		
do. do. 6 per cent. Bonds	Nil Nil	3½	— 1	Nil		
Mexican Light Common	Nil Nil	224	—	Nil		
do. do. Pref.	Nil Nil	29	— 2	Nil		
do. do. 1st Bonds ..	Nil Nil	324	— 2	—		

MANUFACTURING COMPANIES						
	Dividend	Price				
	1915. 1916.	Dec 17, 1917.	Rise or fall this week.	Yield p.o.		
Babcock & Wilcox	15 15	3½	—	4 14 1		
British Aluminium Ord. ..	7 10	12	—	6 13 1		
British Insulated Ord. ..	174 20	8	—	6 13 4		
British Westinghouse Pref. ..	74 74	21½	—	5 11 4		
Callenders	20 20	144	—	6 18 0		
do. 5 Pref.	5 5	14	—	6 1 9		
Cassiter-Kellner	22 20	24½	—	5 17 8		
Edison Swan, fully paid ..	— —	24	—	Nil		
do. do. 4 per cent. Deb	4 4	7½	—	5 6 0		
Electric Construction	74 74	14	— ½	6 13 4		
Gen. Elec. Pref.	8 8	104	—	5 14 3		
do. Ord.	10 10	144	— ½	5 1 3		
Henley	25 25	10½	—	7 11 8		
do. 4½ Pref.	14 14	4	—	5 12 2		
India-Rubber	10 10	114	—	6 15 7		
Telegraph Ccn.	20 20	414	—	5 15 7		

* Dividends paid free of income-tax.

MARKET QUOTATIONS.

IT should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, December 19th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/6	..
a Ammoniac Sal	per ton	£75	..
a Ammonia, Murate (large crystal)	"	£58	..
a Bisulphide of Carbon	"	£23	..
a Borax	"	£38	..
a Copper Sulphate	"	£66	..
a Potash, Chlorate	per lb.	2/6	..
a Perchlorate	"	2/-	..
a Shellac	per cwt.	£18	10/- inc.
a Sulphate of Magnesia	per ton	£18	..
a Sulphur, Sublimed Flowers ..	"	£35	..
a Lump	"	£25	..
a Soda, Chlorate	per lb.	10½d.	..
a Crystals	per ton	120/-	..
a Sodium Bichromate, casks ..	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2" to 12" basis)	per lb.	..	..
c " Tubes (solid drawn) ..	"	..	..
c " Wire, basis .. ..	"	..	..
c Copper Tubes (solid drawn) ..	"	1/6½ to 1/7½	½d. inc.
g " Bars (best selected) ..	per ton	£147	..
g " Sheet	"	£147	..
g " Rod	"	£125	..
d " (Electrolytic) Bars ..	"	£152	..
d " " Sheets	"	£133	..
d " " Wire Rode	"	1/3½	..
d " " H.C. Wire	per lb.	3/-	..
f Ebonite Rod	"	2/6	..
f " Sheet	"	2/3	..
n German Silver Wire	"	6/10	..
h Gutta-percha, fine	"	2 5½	..
h India-rubber, Para fine ..	"	Nom.	..
i Iron Pig (Cleveland warrants) ..	per ton	£42	..
l " Wire, galv. No. 8, P.O. qual.	"	..	..
g Lead, English Pig	"	Nom.	..
g Mercury	per bot.	6d. to 8/-	..
e Mica (in original cases) small ..	per lb.	8/6 to 6/-	..
e " " " medium	"	7/6 to 14/- & up.	..
e " " " large	"	1/84	..
d Silicon Bronze Wire	per lb.	..	..
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	"	4/-	2d. inc.
n " Wire, Nos. 1 to 16	per lb.	..	..

Quotations supplied by—

a G. Boor & Co.	g James & Shakespeare.
c Thos. Bolton & Sons, Ltd.	h Edward Tilt & Co.
d Frederick Smith & Co.	i Bolling & Lowe.
e F. Wiggins & Sons.	l Richard Johnson & Nephew, Ltd.
f India-Rubber, Gutta-Percha and	n P. Ormiston & Sons.
Telegraph Works Co., Ltd.	r W. F. Dennis & Co.

Industrial Reconstruction Council.—The first meeting of this Council was held on Tuesday, December 11th, at the Holborn Restaurant. The chair was occupied by the President, Sir Wilfrid Stokes, K.B.E., and the draft Constitution submitted by the Provisional Committee was approved and adopted. Mr. Ben Tillett, M.P., emphasised the need for a propagandist body which would help to remove the distrust of Labour and the contempt of Capital. The need of the future was not only efficiency of Labour but efficiency of Capital. He was glad to associate himself with a body which had for its object the education of all parties in the real position of industry. Mr. Ernest Benn, in presenting to the meeting the report of the Provisional Committee, laid stress on the single purpose of the new Council. It was a propagandist body, and its battle-cry was "Self-Government for Industry." Mr. Benn gave a brief sketch of the present chaotic condition of industry. Much of the trouble had inevitably arisen from the state of War, but much also was the result of ever-increasing interference by a central bureaucratic Government. The only way by which this nation could work out her industrial salvation was to establish within each trade a self-governing body representative of all those engaged in that trade, charged with the duty of maintaining and developing it in the national interest. The membership of the Industrial Reconstruction Council was open to all sections of the community of whatever shade of opinion, the only qualification being a genuine desire to promote the doctrine of industrial self-Government. The Council would start immediately upon a great campaign throughout the country and in every trade; on the one hand seeking public interest in the vital problems of industry, and on the other encouraging the representatives of the trade themselves to meet together to take concerted action for the full development of their industries. Mr. Emil Davies, speaking of the Whitley Report, emphasised the fact that the Government had now for the first time distinctly laid it down that Labour was no longer a chattel. This idea was fundamental. There was a great need for some body like the Industrial Reconstruction Council which would popularise the principles embodied in the Report. Miss Mona Wilson, as a member of the Whitley Committee, supported the establishment of the Council as a propagandist body. It was extremely important that Capital and Labour should understand what a very wide field was open to the Whitley Councils if set up in all industries, and how necessary they were as representative bodies with whom the Government could negotiate in all matters affecting Labour, commerce and industry.

ELECTRICAL COOKING AS APPLIED TO LARGE KITCHENS.

By W. A. GILLOTT, A.M.I.E.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS.)

Owing to the favourable tariffs now in force in most districts, electrical cooking in large kitchens is now a sound commercial proposition. In new premises, where it is pro-

so fitted that it is practically impossible for steam to penetrate through to the insulation. On well designed apparatus solid type connections are employed, and where a connection is required from, say, a hot-plate to the terminal chamber, the wiring may be run in solid drawn tubes direct from the hot-plate case to the terminal box, this being fitted well up and away from any position likely to be affected by liquids boiling over. By this method, flexible metallic tubing is dispensed with, thereby removing a weak link.

All elements except the grills should be connected in series-parallel, and where possible they should be so arranged that after the cooking has thoroughly commenced, they can be switched to "low," and provide sufficient heat to complete the operation. Under these conditions, the elements are running at quarter load most of the time, with the result that they have a much longer life than if parallel elements were employed throughout.

On apparatus where the heating elements are clamped under pressure, such as hot-plates, water boilers, stock pots, steamers, &c., the pressure plates should be made of strengthened cast iron in preference to wrought iron, in order to prevent them from buckling, and causing uneven bearing surface on the element. The element should cover as much surface as possible, as concentration of heat on apparatus of this class is likely to cause premature failures. On apparatus where the loading is comparatively high, it is advisable to employ cast iron or steel bottoms in place of copper. Instances have occurred in the author's experience where the adoption of cast-iron and steel bottoms on large boiling units has overcome the trouble of premature failures.

Quick Service and Efficiency.—In laying out a cooking scheme for a large kitchen, it is essential to arrange the apparatus so that the chef can supervise the cooking with a minimum of effort. By a judicious classification of apparatus, such as grouping all roasting

and oven work in one section, vegetable and pudding steaming, &c., in another, and toasting, egg-poaching, and tea-making in another, it is possible considerably to increase the efficiency of the kitchen, inasmuch as quicker service is given, and a possibly smaller kitchen staff required. In restaurant work, where special attention must be given to ensure quick service, it is often necessary to provide special apparatus to deal with some classes of food which are required at a moment's notice.

Where large quantities of water are required for tea-making, the author recommends that the water be raised to a tem-

perature to run the kitchens on up-to-date and efficient lines, electricity is usually employed. The words "large kitchens" apply more particularly to the class of kitchen met with in restaurants and in works or other large business premises, when staff-feeding is required for a large number of employés. In Newcastle-upon-Tyne there are several such institutions depending entirely upon electricity for cooking. The author considers the future of this branch of electrical industry to depend, first, upon close co-operation between the supply company's engineer and the manufacturer, and, secondly, upon the interchange of ideas and experiences between different supply companies and municipal engineers who have the plant actually running on their own mains. The figures given in the paper have been obtained under ordinary working conditions, and in some cases without the knowledge of the cook using the apparatus. They can therefore be taken as a basis for similar installations working under somewhat similar conditions.

In drawing up a scheme for cooking in large kitchens, the essential items are: (1) Reliability, (2) quick service, (3) efficiency.

Reliability.—Under this item the question of electrical distribution from the service cables is as important as the electrical work on the apparatus itself. At a restaurant where there are serveries on different floors, quite apart from the kitchen, especially where the total loading of the apparatus in the serveries is appreciable, two pairs of cables should be brought from the service, which on large installations should be the main distributing centre, to each servery and kitchen. In each kitchen or servery these cables should terminate in a double-pole switch of ample size and single-pole fuses of the replaceable pattern, and connections be provided to supply through branch single-pole fuses to the various pieces of apparatus, each of which should be controlled by a double-pole switch adjacent to the same.

The apparatus itself must be of solid construction, and designed to stand hard and continuous wear, and be efficiently earthed. All switches and fuses must be fixed on a separate board within easy reach of the chef, and each section of the apparatus should be fitted with a switch, fuse, and indicator. The internal wiring of the apparatus must be

perature of approximately 160 deg. F. by means of a coke boiler or live steam, the final boiling being carried out in self-contained electric urns. The author usually fixes urns in banks of two, each supplied with hot water through a hand-fed valve, and arranged so that as one is being emptied, the other is boiling up ready for use. By this method, one is always in a position to meet a "rush on teas." In some cafés, toast is often in great demand. By using suitable

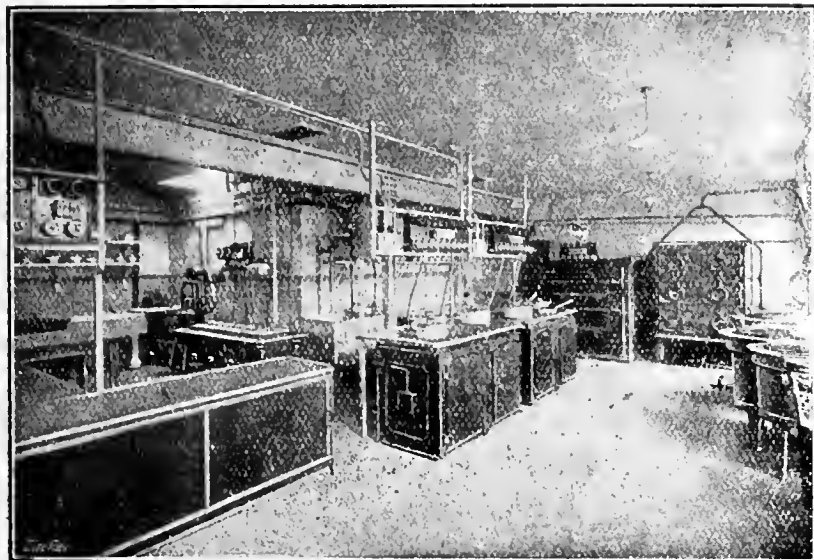


FIG. 1. MAIN KITCHEN, INSTALLATION "A."



FIG. 2.—MAIN KITCHEN, INSTALLATION "A"

racks, several pieces of bread can be toasted at one time. At the installation under Item "A," 2,000 pieces of toast can be supplied in one hour.

Plate and dish warming is a very necessary item, especially in restaurants. This becomes very important on installations such as "A" below, where dining rooms are on several floors. Hot cupboard for this class of work should be lagged, as they are called upon to work several hours a day, and, by conserving the heat, running costs are kept down. The

hot-plates are used, the loading should not exceed 20 watts per sq. in. for an 8-in. plate.

(To be concluded.)

DISCUSSION IN LONDON.

The author, in concluding the reading of his paper, said he had obtained information with regard to over 400 cooking installations of this type in this country, with a total connected load of 22,000 kW., and these were supplying 130,000 meals per day; 80 per cent. of this equipment had been put in during the last three years. In the Newcastle area they had proposals at the moment for approximately 4,000 kW. of cooking plant to supply 22,000 meals per day. He went on to urge the necessity of effective co-operation between the supply authorities and the manufacturers, who had done most of the work up to the present, suggesting the necessity for a representative committee to develop this special branch of business.

Mr. A. F. BERRY, in opening the discussion, said the cost figures given might be expected in an area where exceedingly cheap power was obtainable. Many features in the installations reminded him of coal and gas practice. With big ovens it was usual to cook all kinds of meat at the same time, and this explained the similarity of "restaurant taste" in meats. The author showed that five persons were served per kW. installed, but he had found it possible to deal with 10 persons per kW. if he had independent hot-water heating. He also found as a result of continuous observation in restaurant practice that such cooking could be done on .25 unit per person; he did not want them to think that .5 unit per person, as mentioned by the author, was necessary. There was no real necessity for big ovens; big joints cooked less efficiently than smaller ones in smaller ovens. In his own works canteen exactly 4 oz. of meat (including bone) per head was used; the Food Controller allowed 5 oz., and Government specifications for apparatus allowed for 8 oz. per head, though the actual result in practice was not usually ascertained.

Mr. SOWERBY, speaking as a user of one of the installations

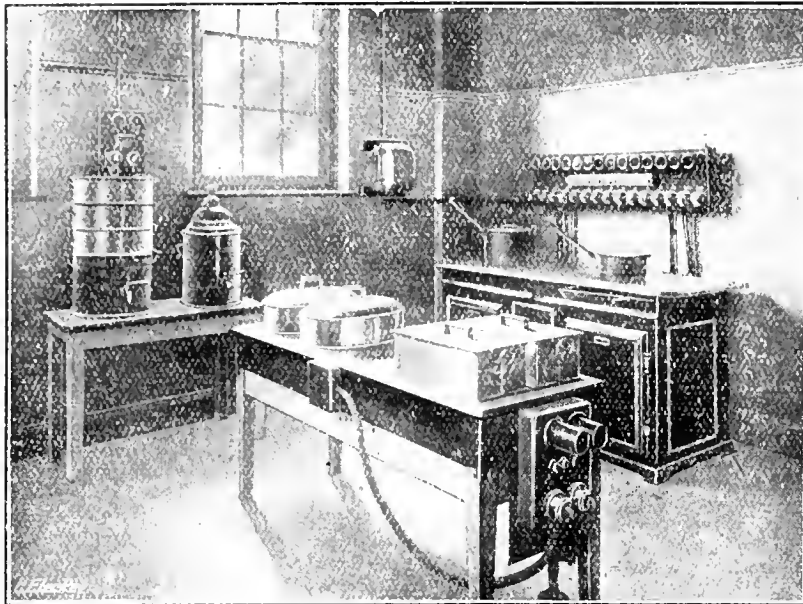


FIG. 3.—KITCHEN, INSTALLATION "C."

question of keeping food hot is also a very important item, and in restaurants this has to be carried out in an entirely different manner from that adopted in staff-feeding establishments, where the meals are usually provided at a specified time each day.

When specifying the essential items in large-kitchen practice, efficiency was placed third. The author is convinced that the "man who pays the bill" would prefer to pay a

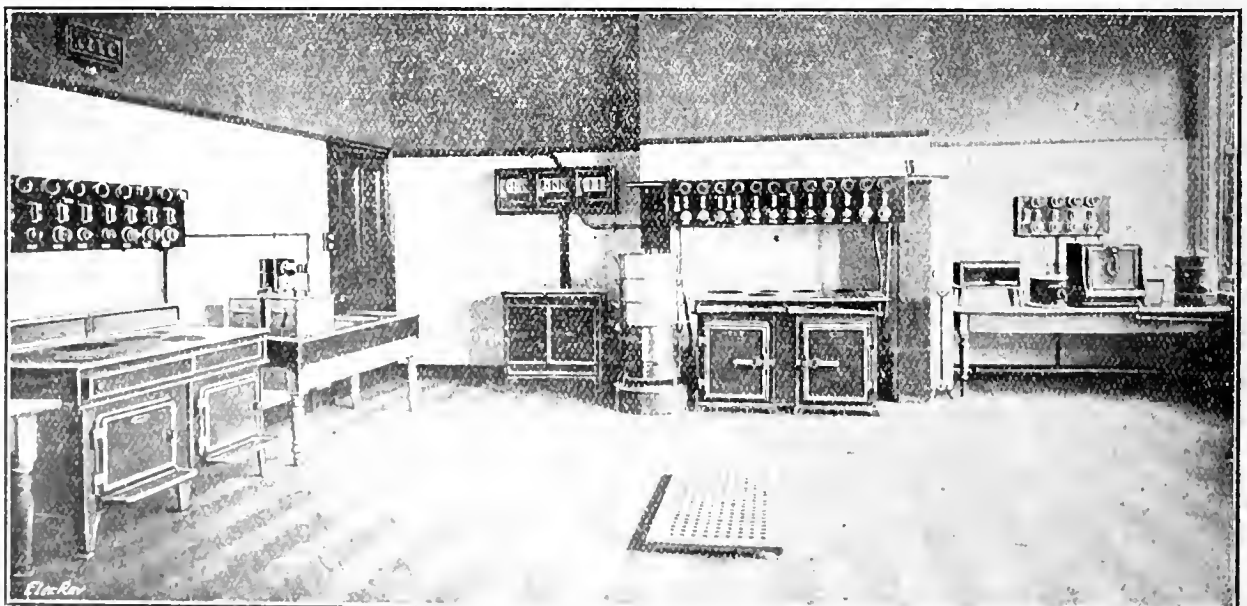


FIG. 4.—KITCHEN, INSTALLATION "D."

little more for cooking, knowing that he is getting this returned in reliability. It is not a serious thing, for instance, if a restaurant or hotel kitchen were built up from scratch with a meal coming to a breakfast covered by endeavouring to extract the highest possible efficiency from a piece of apparatus at the expense of reliability.

Upon referring to the schedules of installations, it will be noticed that the number of hot-plates has been kept low, and several pieces of self-contained apparatus have been provided. This is more practical than cooking in utensils on hot plates. This increases the initial cost, but it is money well spent, and the policy should be adopted wherever possible. Where

described in the paper, said he had had experience of gas cooking, and knew the cost. Their experience with an electric cooking installation originally intended to serve 1,200 people, and now catering for double the number, was most satisfactory, and the figures of the estimate had been improved upon. The saving in meat on the Food Controller's figure was not necessarily a saving due to the installation, as in their case they had not reached the Controller's figures in the past. The sanitary condition of their kitchen had been specially commended, and was due entirely to the ease of operation. Their grill trade had gone up to four times its amount before the use of the electric grill. He warned them

not to under-estimate their requirements for electric cooking, as the trade always increased, and this must be allowed for. Despite the efforts of the Job's comforters, even of the electrical persuasion, they were quite satisfied with the result.

Mr. H. J. CLARKE said he had the oversight of a plant catering for 5,000 meals a day, by means of two installations. He had never regretted having adopted electric cooking, and the energy consumption per meal—no electricity being used for water heating—was very low, being in November .15 unit per meal. The installation was a novel one, on the American Cafeteria principle, using electrically-heated shelves from which the customer served himself. With the second installation they supplied 400 meals per day during the first week, but this had increased up to 2,500 meals per day for some weeks past.

Mr. C. J. NOBBS said running and maintenance cost should receive prior consideration; initial cost was effected by the conditions of installation at the moment. Looking at the author's A and B installations, the former used .29 unit and the latter .5 unit per person, but A was a restaurant and B was a canteen. If an accurate analysis of the total weight of food were made (including all water) it would form a unit basis; B took three times the energy for water heating. If they took 1,500 lb. food for A and 680 lb. food for B, and allowed for water-heating units, they found .94 lb. per unit cooked by A, and 1.38 lb. for B; the difference was explained by the conditions in the two cases. Certain steamers in the A installation were operated by steam, whereas B was entirely electric, and allowance must be made for the steam heating in the comparison. It was necessary to know maintenance costs for gas and steam apparatus with accuracy. He found that the maintenance on electric installation A worked out at $\frac{1}{2}$ per cent. of the capital cost, and on installation B at $\frac{1}{4}$ per cent., but if similar types of apparatus had been used in each case, and the net cost of installation taken, he estimated that the comparative figures would be A $\frac{1}{4}$ per cent., and B $\frac{1}{4}$ per cent. At a hotel with 400 beds electric heating maintenance cost about £100 per annum, which tended to show an additional advantage for the electrical method. In the case of his firm, apart from domestic work, about 12,000 kw. of heavy electric cooking plant had been sent out in three years.

Mr. BRAZIL said the author was right in putting reliability first; he felt that the contact difficulty was all against the hot-plate. He described certain experiments relating to element construction, as a result of which he found that a fire-clay element could be made with 140 watts loading per inch of length, as against only 64 watts with a mica element; the former element had stood up well, but it took 4 mins. to get to a proper heat. The manufacturer must consider the question of making apparatus suitable for 400 volts, and so overcoming balancing troubles.

Mr. GRESLEY was interested in the possibility of using electric cooking on railway dining-cars, where it was difficult to avoid using gas, despite the representations of the Board of Trade. The kitchen on a diner measured 14 ft. by 6 ft., and often dealt with 100 five-course meals at one sitting. Such a car weighed 40 tons, and he asked what extra weight would be required, and what arrangements would be required to keep the apparatus working when the train was standing.

Mr. F. H. WILLIAMS agreed that the future of the business depended largely on the co-operation of the manufacturer and central station. All the essential items mentioned by the author were equally important, but efficiency often took second place on account of first cost. The running and maintenance costs were always more important than the initial cost. He quoted various figures to show that specially-built apparatus was more efficient. As regarded running cost, a staff kitchen supplying 80 breakfasts, 480 dinners, 480 teas, and 12 suppers for five days a week, with breakfasts and suppers on the sixth day, and where 80 gallons of water were boiled each day, took 955 units per week, costing 11d. per unit; this installation had done two years' work. In another case, a convalescent hospital, where all meals were supplied and 36 gallons of water boiled, 130 units were required per day; this installation had been in use three years.

Mr. P. FLETCHER said a great deal could be said on the technical side, but the chief thing was reliability. He saw no reason why elements should not be made of uniform dimensions, so that any dealer could stock replacements. Theoretically, the large installation was the more efficient, but its efficiency was affected by having to meet small demands as well as large. Looking ahead, it seemed that it would be impossible to continue low-pressure distribution, and they would have to adopt high pressures with transformers in order to save the cost of mains, if much cooking apparatus were connected. He asked what was the desirable point to depart from electric water heating. He also urged that it was up to our manufacturers to produce a satisfactory switch for this work.

Mr. W. R. COOPER would have liked to see the paper more critical; the character of the service required more minute description. There appeared to be a smaller diversity with the works kitchen than in domestic cooking. The oven and grill faults appeared to be excessive, and he thought that wiring faults could have been reduced in number. He asked what was the author's experience with radiant apparatus, and whether he had employed thermostatic control.

Mr. GODDARD (of Messrs. J. Lyons & Co.) expressed his

interest in the results shown in the paper. His firm were not using electricity for cooking, and had no figures as to the cost of gas, &c.

Mr. WILSON felt that the load curves shown were not such as to encourage the supply authority to give a low tariff. He thought possibly the "hay box" principle, recently described in the ELECTRICAL REVIEW, could be so adapted as to modify such a peaked load, and that probably a saving in food would result by slow cooking. Engineers and manufacturers must co-operate to push forward electric cooking, and great assistance would be obtained by the installation by the industry of electrical equipment in the numerous cooking schools throughout the country.

Mr. WALKER, speaking as a hotel manager, thought that the kitchen temperature in a dining-car must be raised by gas apparatus, and that electric cooking had a considerable future. The time taken to obtain cooking temperatures was very important, especially for grilling, in hotel and restaurant work. He discounted staff reduction with electrical methods, and asked whether records of kitchen temperature were available where electricity was used. Any chef would, he thought, favour a solid-top heating table, where the locally heated areas enabled the cook to select any degree of temperature for his pans, &c.; this gave much better heat control than by switches. A good cook would get good results whether using gas or electricity, but the gas did affect the utensils.

Mr. HOLMES said, as a considerable user of electric cooking, he found it very satisfactory, and had no wish to change to other methods.

Mr. C. W. CROSBIE drew attention to the practical importance of the similarity of load factors in the installations cited, viz., 13, 17.8, 13.4, and 13.1 respectively, or an average of 14 $\frac{1}{2}$ per cent. The figures for installation B, however, were worked out on 130 kw., whereas a total of 165 kw. was installed, and, taking the latter figure, the load factor came down from 17.8 to 13, or almost identical with the other installations. They might expect a maximum demand from such installations of 45 $\frac{1}{2}$ per cent. of the connected load, the actual figures being 35, 48, 44.5, and 55 per cent., and giving some indication of the probable cost of maintenance. Maintenance cost in terms of 1,000 units consumed had a tendency to mislead; expressed in per cent. of capital outlay, the figures became .75, 2.35, 3.65, and 4.17 per cent., and he did not regard them as satisfactory. Installation B in particular showed a bad record, especially as regarded ovens, hot cupboards, urns, and steamers; it would be interesting to know, if external wiring faults were referred to, if the same contractor was responsible for all the work. The relation of the meal hours to peaks was not shown. He agreed with the principle of pre-heating water, but not with the method of doing it. In the 350-kw. installation, the conditions were such that open lights and fires could not be permitted, and it was essentially a case for electric thermal storage, with a view to reducing the peak and filling up the load gap between 6 p.m. and 8 a.m. The water-heating load of the boilers and urns in this plant would, he thought, add 55 to 60 kw., which was a considerable proportion of the average 190-kw. peak which might be assumed from the average of "peak load/connected load" shown by the load curves. Much of this water-heating load could have been transferred to the slack time had a thermal storage system been installed in connection with the urns, which latter would then only be used when the load from other apparatus was considerably reduced. The exact effect on the load factor would depend on the amount and incidence of the load on the rest of the plant, but its importance in this case might be judged from the fact that for every 1 per cent. increase in load factor above 10 per cent., a reduction of 2 per cent. was made in the charge. As an instance of the improvement of load factor due to thermal storage, Mr. Crosbie mentioned the case of his domestic installation, where the load factor of the lighting was about 5 per cent., the cooking and heating load factor 6.8 per cent., and adding the 100 per cent. thermal storage load factor, gave a combined load factor of 11 or 12 per cent.

Mr. E. T. WILLIAMS asked why, when steam heating was used, the water was not brought to boiling temperature for direct use, instead of being pre-heated. The author did not state whether the meals were spread out or eaten at one time. He thought wiring faults were numerous, and asked what they included. The capital cost of installing the equipment was misleading, because it included connecting to the source of supply, and was not applicable in cases where a works generated its own supply. Future development depended on hiring facilities, which must be provided. Where the price of energy depended on load factor, the effect on this of the cooking load must be closely watched, as under certain conditions the price for the whole supply might be increased. He understood that in the North it had been found in some cases that the cooking demand was high on a Monday, and dwindled away to nothing on Friday.

The AUTHOR, in replying, said the consumer should not imagine that the cost of energy was a determining factor; there were so many other advantages. He considered that electricity at .75d. per unit would easily compete with gas at 2s. per 1,000 cu. ft. for cooking. The Ministry of Food was conducting tests in various localities on gas, coal, steam, and electric cooking, but he (the speaker) did not agree with

its methods of cooking. It was not possible to get munition workers to economise in food, and this affected the results shown. In installation "B" all the steaming was done by electrical steamers, but in "A" continental steamers were used. Electric cooking in a dining-car might entail the use of an independent generating set, or of a battery which could be boosted at stopping places; the ordinary belt-driven dynamo would not suffice for heavy discharge work. A short time previously he had investigated the question of electrifying a whole village, where the maximum demand would be 5,000 kW., and he found that L.T. supply would not meet the case; he thought it would be best to distribute 200-volt single-phase current, and so dispense with balancing difficulties.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AUSTRALIA.—A new and consolidated list has recently been issued by the Department of Trade and Customs specifying the articles for the exportation of which from the Commonwealth a Customs "Permit" must first be obtained. The list is a very comprehensive one, and includes the following:—Electric appliances adapted for use in war, and their component parts; metals, alloys, minerals and ores of all kinds; searchlights and parts; rubber of all kinds and in any form, including goods made wholly or partly of rubber; materials for telegraphs, telephones, and wireless; celluloid; copper, part wrought; cork, corkboard, and cork dust.

The Department of Trade and Customs has also issued the approved form of declaration which is required to be printed or stamped on invoices for goods exported to Australia, and duly signed and completed by a principal officer of the manufacturer or supplier. In view of its importance, the text of the form is given below:—

I,.....(manager, chief clerk, or as the case may be).....of.....(name of firm or company).....of.....(name of city and county).....the manufacturer or supplier of the goods enumerated on this invoice, amounting to....., have the means of knowing and do hereby declare—

1. That the said invoice is in all respects correct and true.
2. That the said invoice contains a true and full statement showing the price actually paid or to be paid for the said goods, the actual quantity thereof, and all charges thereon;
3. That the said invoice also exhibits in a separate column the actual price at the date of this declaration of equal quantities of identically similar goods to any purchaser for home consumption in this country;
4. That no different invoice of the goods mentioned in the said invoice has been or will be furnished to anyone; and
5. That no arrangement or understanding affecting the purchase price of the said goods has been or will be made or entered into between the said exporter and purchaser, or by anyone on behalf of either of them, either by way of discount, rebate, salary, compensation, or in any manner whatsoever other than as shown in the said invoice.

Signature.....

Witness.....
Dated at this day of 19.....

NOTE.—The witness need not necessarily be a magistrate, notary, or other public official, but may be any person competent to sign as a witness to signatures on ordinary business documents.

All declarations tendered to the Department must be made by the declarant in a personal capacity—that is, the declaration must run "I, John Jones," &c., &c., and be subscribed "John Jones" (or John Jones's ordinary signature), and not, e.g., "Brown & Thomas, per John Jones." The ordinary signatures of declarants are sufficient at the foot of declarations, the full name of the declarant being stated at the head of the form.

CHILE.—In virtue of a Decree issued subsequently, the provisions of the Decree of January 26th last, which instituted a new form of Consular invoice for goods shipped to Chile—see *ELECTRICAL REVIEW* of August 24th—are not to come into force until further notice, so that Article 283 of the Chilean Consular Regulations, specifying the particulars to be given in Consular invoices for goods shipped to the Republic, is to remain in force.

SOUTH AFRICA. By the provisions of Act No. 36 of 1917, the increases of Customs duties which were imposed in 1915, and resumed last year, are again re-imposed, with a few exceptions, and will continue in force until June 30th, 1918. Particulars were given in the *ELECTRICAL REVIEW* of September 15th, 1916, as to the electrical goods affected.]

SOUTHERN RHODESIA. A Customs decision has recently been issued which brings Southern Rhodesia into line with the Union of South Africa in regard to the duty on insulating tape (sheving) see the *ELECTRICAL REVIEW* of October 12th last. Under the General Tariff the duty is 3 per cent. ad val. British goods entering free.

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electric Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

- 17,841. "Electric accumulators of the alkaline type." W. N. STEWART. December 3rd.
17,849. "Dynamo-electric machines." BRUCE PERKES & Co. AND H. E. WARR. December 3rd.
17,872. "Telephonic apparatus." A. BERLINER, I. BERLINER & S. BERLINER. December 3rd.
17,874. "Connecting cables or wires." R. A. BOUSSON. December 3rd. (France, September 14th.)
17,876. "Spark plug." M. J. WILLCOCKS. December 3rd.
17,878. "Connecting cables or wires." R. A. BOUSSON. December 3rd. (France, September 14th.)
17,923. "Electrical instruments for transmission and reproduction of sound." D. F. McQUEEN & F. W. McQUEEN. December 4th.
17,939. "Electromagnetic clutches." W. LANGDON-DAVIES & A. SOAMES. December 4th.
17,941. "Leading-in wires or conductors of incandescent electric lamps, high-vacuum apparatus, &c." F. HOGG. December 4th.
17,942. "Secondary or storage batteries." F. E. WHITNEY. December 4th. (U.S.A., September 20th.)
17,947. "Distributors for high-tension magnets, &c." G. E. BARSTO & H. FOWLER. December 4th.
17,954. "Storage batteries." J. J. MAYROW. December 4th.
17,955. "Instruments for testing batteries, accumulators, motor dynamos, &c." A. A. PRICE. December 4th.
17,965. "Spark plug." L. BLAZOT & M. MONIN. December 4th.
17,977. "Electric signalling." B. H. THOMSON. December 4th.
17,986. "Electric insulators." BRITISH THOMSON-HOUSTON Co. (General Electric Co., U.S.A.) December 5th.
18,014. "Electrically-actuated control apparatus for hydraulically-operated cranes, &c." F. MUNK. December 5th.
18,022. "Ignition systems for explosion engines, &c." SOC. ANON. DES ETABLISSEMENTS L. BLEROT. December 5th. (France, February 2nd.)
18,032. "Controllers for electric motors." J. ANDERSON & G. ELLISON. December 5th.
18,040. "Machine switching telephone systems." L. POLINKOWSKY AND WESTERN ELECTRIC Co. December 5th.
18,042. "Electric interrupters." SOC. D'ELECTRICITE NIMMELOR. December 5th. (France, January 19th.)
18,043. "Ignition starting apparatus for internal-combustion engines." SOC. D'ELECTRICITE NIMMELOR. December 5th. (France, March 2nd.)
18,046 & 18,048. "Dynamo-electric machines." H. CHITTY. December 5th.
18,047. "Motors of the double rotation type." H. CHITTY. December 5th.
18,057. "Leading-in wires or conductors of incandescent lamps, high-vacuum apparatus, &c." B. LAWRENCE. December 4th.
18,069 & 18,070. "Electric signalling systems." F. G. BELL, W. C. DAVEY, AND STERLING TELEPHONE & ELECTRIC Co. December 6th.
18,080. "Electromedical apparatus." E. E. GREVILLE. December 6th.
18,102. "Wood separators for secondary electric batteries." CHLORIDE ELECTRICAL STORAGE Co. & B. HEAP. December 6th.
18,108. "Lubricating sponge for electric motors, trancars, &c." I. GREGORY. December 6th.
18,115. "Telegraphy." E. S. HEURTELEY. December 6th.
18,127. "Locking-out disengaged levels on electric signalling systems." M. O. MYERS & R. C. ROBSON. December 7th.
18,145. "Method of testing ohmic resistance of liquids." J. TOWNLEY AND S. R. WINDLE. December 7th.
18,153. "Electrode holders for arc welding." V. S. ROBINSON & P. F. SMITH. December 7th.
18,168. "Protective means for systems of distribution." BRITISH THOMSON-HOUSTON Co. (General Electric Co., U.S.A.) December 7th.
18,172. "Engine starters." V. BENDIX. December 7th.
18,201. "Telephone receivers." SOC. FRANCAISE RADIO-ELECTRIQUE. December 7th. (France, December 7th, 1916.)
18,216. "Alternating-current relays." OTIS ELEVATOR Co. & WAYGOOD OTIS, LTD. December 8th.
18,225. "Automatic electric switches." S. TURNER. December 8th.
18,226. "Electrically-operated indicators." S. TURNER. December 8th.
18,228. "Wireless signalling systems." BRITISH THOMSON-HOUSTON Co. (General Electric Co., U.S.A.) December 8th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

- 5,300. ELECTRIC ARC LAMPS. T. L. CARBONE. April 14th, 1916. (111,115.)
11,564. ELECTRIC METALLURGICAL FURNACES. A. TURNER. August 16th, 1916. (111,120.)
12,985. ART OF ELECTRICAL TUNING. M. I. PUPIN. September 17th, 1915. (101,540.)
14,325. PROTECTIVE DEVICES FOR MULTIPHASE ALTERNATING CURRENT APPARATUS. J. R. BOARD & Electrical Improvements, Ltd. October 9th, 1916. (111,125.)
14,509. ELECTRICAL CONNECTIONS. British Electric Transformer Co., A. F. BERRY & E. ELLWOOD. October 12th, 1916. (111,126.)
16,170. MANUFACTURE OF CAPS OR BASES FOR INCANDESCENT ELECTRIC LAMPS, AND APPARATUS THEREFOR. J. A. SCULLER. November 16th, 1916. (111,138.)
16,171. APPARATUS FOR THE MANUFACTURE OF CAPS OR BASES FOR INCANDESCENT ELECTRIC LAMPS. J. A. SCULLER. November 16th, 1916. (111,139.)
16,294. PACKING BOXES FOR ELECTRIC LAMP BURNS. A. ASTLEY. November 16th, 1916. (111,151.)
16,434. SIGNALING BY MEANS OF ELECTRIC LAMPS. W. S. G. BAKER AND McKENZIE, Holland & Westinghouse Power Signal Co. November 16th, 1916. (111,159.)
16,536. MINORS' ELECTRIC SAFETY LAMPS. D. Oldham. November 17th, 1916. (111,165.)
16,977. TELEPHONE SWITCHING APPARATUS. C. B. KERSTING & J. W. DUNGEY. November 27th, 1916. (111,174.)
17,393. ELECTRICALLY-OPERATED SIGNAL INDICATORS FOR USE IN MINE HAULAGE, WINDING, AND THE LIKE OPERATIONS. J. P. FORSTER. December 4th, 1916. (111,183.)

1917.

699. IGNITION PLUGS. H. G. LONGFORD, W. W. LONGFORD & W. A. CLARK. January 12th, 1917. (111,198.)
1,491. TOY FUSIBLE MOTOR INSULATION. A. C. GILBERT Co. April 16th, 1916. (105,744.)
1,661. ELECTRIC FURNACES. C. E. HEARSON. February 1st, 1917. (111,207.)
3,268. FUEL-STARTING MECHANISM FOR THE IGNITION MAGNETS OF INTERNAL-COMBUSTION ENGINES. K. W. Ignition Co. March 15th, 1916. (105,328.)

THE ELECTRICAL REVIEW.

Vol. LXXXI.

DECEMBER 28, 1917.

No. 2,092.

ELECTRICAL REVIEW.

THE HACKNEY CASE.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE 1-4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: "AGREKAY, LONDON," Code, A B C.

Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 8d.; Canada, £1 8s. 10d. (\$5.60). To all other countries, £1 10s.

FOREIGN AGENTS:

AGS LAIDE: Messrs. Atkinson & Co., Gresham Street.

AUCKLAND, N.Z.: Gordon & Gotch, Albert Street; The Mining and Engineering Review, 31A, Strand Arcade, Queen Street.

BRISBANE: Gordon & Gotch, Queen St.

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LANCASTER: Gordon & Gotch, Cimitiera Street.

MELBOURNE: The Mining & Engineering Review, 90, William Street; Gordon & Gotch, Queen Street.

MILAN: Fratelli Treves.

NEW YORK: D. Van Nostrand, 25, Park Place.

PARIS: Boyvean & Chevillet, 22, Rue de la Banque.

PERTH, W.A.: Gordon & Gotch, William Street.

ROME: Loescher & Co., Corso Umberto 1° 307.

SYDNEY: The Mining & Engineering Review, 273, George Street; Gordon and Gotch, Pitt Street.

TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.

WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

THE "ELECTRICAL REVIEW'S"
ELECTRICAL & ALLIED TRADES DIRECTORY
(THE RED BOOK),

1917 EDITION.

H. ALABASTER, GATEHOUSE & KEMPE,
4, Ludgate Hill, London, E.C. 4.

With the decision of the Court of Appeal, on Tuesday last week, dismissing the appeal of the Attorney-General "at the relation of the Gas Light and Coke Company," against the judgment of Mr. Justice Astbury, a further stage has been reached in the controversy between the gas interests and the electricity supply industry. Whether the dispute will be carried to the final Court does not appear; as notice of appeal was not given, however, we feel at liberty to comment on the case. To our mind, from the very first the result was a foregone conclusion, and, while we were debarred from expressing our views upon the merits of the case, in our issue of April 20th last we urged the municipal electricity supply authorities to rally to the support of the Hackney Borough Council, which was singled out for attack by the Gas Co., and whose success was of vital importance to all of them that had a power load, believing, as we indicated, that there could be little doubt as to the outcome.

As in previous cases, the matter turned upon the question of preferential treatment of a certain class of consumers by the supply authority. To us, who are not lawyers, it is difficult to understand how any such action could be expected to succeed, seeing that the Act distinctly states that undue preference must not be shown to any consumer in comparison with any other consumer under similar circumstances. Now, consumers of electrical energy for lighting are not consumers "under similar circumstances" to those who take energy for power only; the gas companies admit that this is true, and in some cases they themselves make different rates for lighting and for power. Again, consumers of energy both for lighting and for power form a third class, and each of these classes is capable of indefinite sub-division, from the point of view of their effect upon the working and finances of the supply undertaking. So long as the same terms are offered to every consumer in a given class, we fail to see how the terms of the Act are infringed, and there never has been any suggestion that such was not the case at Hackney or elsewhere under the type of tariff in question.

What the Gas Co. really claimed was that one class of consumers was preferred over another—that the user of light only was charged at a higher rate than the user of both power and light, so far as the lighting portion of his consumption was concerned; but the Act says nothing about preferential treatment of a whole class of consumers, and a class may comprise any number of consumers from one upwards without undue preference, if the same tariff is offered to all who choose to place themselves in

that class. Thus, a special rate might be offered to all electrochemical works which came on the mains; there might be only one such works in the district—but at any time others might be established, and would be entitled to the same terms, under similar circumstances.

The law, however, appears to require that preference shall not be shown to a class of consumers, but that where more favourable terms are granted to one class than another, it must be capable of demonstration that the former are the more advantageous consumers to the supply undertaking. The Gas Co. contended that an intermediate scale should be provided for customers who used both light and power, higher than that offered to power users only, but lower than that offered to users of light only, thus recognising the division into classes, but alleging undue preference as between class and class. But the weakness of their case was effectively demonstrated by Lord Justice Swinfen Eady in his admirably lucid judgment, of which we give a summary elsewhere in this issue. He pointed out that by the working of the maximum-demand system upon which the tariff was based, precisely that result was attained which the Gas Co. desired—namely, that the user of energy for both purposes was charged at a higher rate than he would have had to pay for power only, because the lighting load necessarily worsened his load factor. "The effect," he said, "of the sliding scale is that it does in fact introduce and adjust a third scale for power and light combined, the charge being higher than would have been the charge for power only, and lower than would have been the charge for light only." Hence there was no breach of the Act. Lords Justices Warrington and Scrutton held the same views, and the appeal was dismissed with costs.

Incidentally, we may point out that, following the line of argument of the appellants, a flat rate is one of the worst offenders from the point of view of equity. A one-hour lighting consumer under this tariff is charged at the same rate per unit as a three-hour lighting consumer; but the latter is by far the more profitable to the electricity undertaking. Hence the former, who may even be supplied at a loss, receives undue preference over the latter!

National Works in Germany.

THE threat of nationalising the supply branch of the electrical industry in Germany has been hanging over the undertakings now for some years past, and is gradually assuming a material form in directions which were scarcely expected. In the first place, an act which may be regarded as a war measure is the recent acquisition by the Imperial Government of the undertaking of the Electro-Works Co., which furnishes energy to Government works for the fixation of nitrogen, from a lignite fuel generating station in the district of Bitterfeld, the cost of acquisition being put at approximately £2,500,000, as mentioned a short time ago. Secondly, a big scheme is under way in Bavaria for the further utilisation of water powers in connection with the establishment of local industries, and the conversion of Bavarian railways to electric traction. In the third place, the Prussian Government has laid before the Diet an estimate for £650,000 for the erection of a steam-power station near Hanover. This scheme lies in connection with the power station built on the Weser near Bevergen in 1906, and the project settled in 1916 for the utilisation of the upper reaches of the Weser and of the water power of the Main. The object of the Hanover station is to connect these two power stations, and thus form a large and self-contained State area of supply from Bremen to the Main, but

the new station is only to be brought into service two years and a half after the conclusion of peace. In Saxony, too, where the Government already owns certain electricity supply works, estimates have just been placed before the Diet for an expenditure of £2,000,000 on extensions and the acquisition of further shares in two companies. It would thus appear that the developments being undertaken by Federal States independently will render it exceedingly difficult for the control of the supply business to be proceeded with, as was originally suggested, on an Imperial basis. At the same time, no one can foresee what results may possibly ensue from the Imperial absorption of the large works in the district of Bitterfeld, and the long-distance line which is now being carried thence to Berlin to assist in coping with the effects of the coal scarcity in the capital.

Electric Cooking.

ELSEWHERE in this issue we conclude our abstract of the interesting paper on electric cooking read by Mr. W. A. Gillott before the Institution of Electric Engineers. The subject is of particular interest at the moment, as, though domestic electric cooking has necessarily been somewhat in the shade during the war, the latter has apparently brought into greater prominence than might otherwise have been the case the advantages of large-scale or collective electric cooking. One of the features of Mr. Gillott's paper which will interest central-station men is the almost monotonous similarity of the load curves, although both restaurant and staff kitchens are included; the curves, in fact, coincide too well, and this presumably will be a feature of the works cooking load in most industrial centres. The London discussion disclosed the similarity of the load factors of the installations described, which for this class of cooking can apparently be taken at 13 per cent. with a maximum demand of 35 to 55 per cent. of the connected load; attention was also drawn to the obvious necessity, where the charge for energy is based on load factor conditions, of adopting those types of apparatus which favour an off-peak load—this, of course, being possible where electric water heating is employed.

It was noteworthy that the sense of the meeting was almost wholly in favour of placing reliability before heat efficiency; this is a point we have often emphasised, for it is obvious that the consumer must be able to depend on his apparatus, and that, even were the latter highly efficient in the hands of an expert, the average user could not hope to reproduce his results day in and day out. What we may call the "cooking efficiency" of the apparatus must exercise an important influence on its design; a few units more or less are of little consequence, in comparison with ease and certainty of obtaining the desired cooking result. In this connection, the heated surface hob, by reason of the great range of heat intensities which it allows to the cook, would appear to offer considerable advantages over any form of switch-controlled hot-plate, though, of course, this is a matter which practice only can settle.

As there is no question that electrical cooking on a large scale is a desirable enterprise, both to the user and to the central station, it is probable that not so much interest attaches to Mr. Gillott's paper itself as to his concluding remarks on the necessity of forming an energetic and unbiased advisory committee representative of both central-station authorities and manufacturers, in order to promote the business end of what is already a good proposition.

This proposal is, of course, not a new one, and if carried out it would greatly speed-up the commercial development of electric cooking.

COAL STACK FIRE RISKS.

By E. B. PAUSEY.

DURING the present difficult times, and doubtless for a considerable period after the fighting has ceased, there can be no question but that fuel will occasionally, like many other necessary commodities, be abnormally scarce. On the one hand, shortage of skilled efficient labour, and, on the other, heavy and sudden demands, are conditions that are certain to persist at least during the period of reconstruction, and, in spite of increased economies which may be brought about by the general adoption of scientific systems of boiler-house control in place of the more or less crude methods in operation at the present time, the possibility of shortage due to these conditions will compel those in charge of important power stations to safeguard themselves by providing sufficiently large stocks of fuel to tide over any such temporary periods of scarcity as may be reasonably expected. In this country coal is at present practically the universal fuel, and the provision of a coal stack is the most obvious and most popular means of keeping reserve supplies at hand.

Now, easy though it may be to dump down coal on a stack, bitter experience tells us that care and thought must be used, otherwise serious loss may take place owing to the overheating or, maybe, ignition of the stored fuel. This is a risk which cannot be completely covered by insurance; if the reserve fuel is lost and the regular supplies fail, no amount of money payment will avail to prevent stoppage of the plant, an occurrence whose cost to the community cannot be estimated. Therefore, in asserting, as I do, that the matter is of national importance, I believe that I am not exaggerating its claims, and I hope that a little discussion of the possible causes of the spontaneous ignition of coal and the means whereby the risk thereof can be minimised may not be without interest. I am, of course, quite aware that the subject is not entirely new; there has, indeed, been a large amount of theorising upon it; but I certainly think that a majority of the theories propounded have been built up on hasty generalisations from insufficient evidence.

For instance, there is the question whether sulphur is responsible for the spontaneous ignition of coal. Many people whose opinions are well worthy of consideration will answer this question decidedly in the affirmative, while others, equally worthy of consideration, will give just as emphatic a negative. Both parties claim to speak in the light of experience, yet, so far as I am aware, not one has given us any definite reason, or anything but bare assertion or denial, for his belief or unbelief. Now, on the one hand, the oxidation of sulphur is not, at ordinary temperatures, such a very vigorous action, nor does it evolve nearly so much heat as that of carbon or hydrogen, and at the same time sulphur only forms a small proportion—say about 1 per cent.—of coal, so that apparently it can have but little heating effect in any case. On the other hand, an efflorescence of what appears to be sulphur is a frequent sign of fire in a coal stack or large ash heap; at the same time, this is not evidence that the sulphur is responsible for the outbreak. It is quite possibly due to the dissociation by heat of sulphur compounds, with the result that on arrival at the cool exterior of the stack the sulphur vapour becomes condensed and appears as flowers of sulphur, being thus not a cause but an effect of the internal heat of the stack.

It is, however, quite possible that sulphur, either in the free state or in combination with other elements, may so enormously accelerate the oxidation of the carbon or hydrogen in the coal by catalytic action as to be an indirect cause of the overheating. In any case, I think there can be little doubt that the overheating is at least started by catalytic action of some kind.

While catalysis is a well-known and familiar phenomenon, it may be as well, in order to emphasise its importance and the great probability that it is largely responsible for coal stack fires, to illustrate it by a description of the catalytic effect of platinum on a mixture of hydrogen and oxygen. It is a matter of common knowledge that if a mixture of

these two gases be kept at an ordinary temperature no apparent combination will take place between them, no matter how long they are kept; but that if a lighted taper be introduced the two gases immediately combine explosively, forming water and liberating considerable heat. Why, it may be asked, should the introduction of the light have such an effect? The unthinking "man-who-knows-it-all" will say: "Why, because you have set light to it, of course!" and put you down as a fool for asking such a question. But it pays sometimes to ask obvious questions, and to give consideration to what are generally accepted unquestioningly as every-day facts.

In the present instance, what happens is that the portion of gaseous mixture immediately adjacent to the flame becomes heated so much that combination takes place, developing so much heat that the next portion of gas is sufficiently heated to combine, the effect being that a flame suddenly flashes through the mixture, and the combination of the whole is completed almost instantaneously. If the experiment be repeated with finely divided platinum in place of the lighted taper, practically the same result occurs, the cold platinum having the same effect as the hot flame of the taper. Moreover, if the mixture of gases be pure the platinum can be used over and over again indefinitely, showing that it does not enter into combination itself, but that its presence is sufficient to accelerate enormously the chemical action. This is the phenomenon known as catalysis.

To get an idea of what this catalytic action means, it should be borne in mind that the chemical combination of hydrogen and oxygen although it does take place at ordinary temperatures, is then vanishingly slow, the relation between the time taken for the action to proceed to completion, and the temperature of the mixed gases being such that for every 18° F. increase of temperature the speed of the action is approximately doubled. If, therefore, a mixture of the two gases in a certain vessel would completely combine in the thousandth part of a second when at a temperature of $2,000^{\circ}$ F., a fairly simple calculation will soon show that a period of many millions of billions of years would have to elapse before the action could proceed to completion if the temperature were maintained constant at 60° . Yet this awful abyss of time, long enough, conceivably, to cover the whole life of the Solar system from the almost infinitely distant period when the primordial nebula began to condense right along to that other far-off time when the sun, its last spark of fire vanished, shall be no more than a huge mass of clinker, may be shortened to a fraction of a second merely by the application of a little platinum, which need not even be hot!

Catalysis may be, therefore, a prodigiously powerful factor in increasing the speed of an action. When we consider that though a piece of coal may be kept indefinitely at ordinary temperatures without any apparent change taking place, yet when stored in a stack of large size heating occurs, we are almost forced to believe that the first heating must be due to catalytic action by some substances present in the coal upon the hydrogen or volatile hydrocarbons given off by it—in extremely small proportions at first, but more and more rapidly as the stack heats up.

Another property of catalysts may be noted; it was remarked in connection with the combination of hydrogen and oxygen that if the gases were pure the platinum could be used over and over again indefinitely. If there are certain impurities present, the catalyst will gradually lose its power, becoming, in fact, "poisoned." This is the reason why automatic gas-lighters on the catalytic principle are not a success—they are too short-lived.

A fine field for investigation is thus opened; let some chemist ascertain what are the catalysts which cause spontaneous ignition of coal, and also their appropriate "poisons," then all we shall have to do will be to spray our coal with the latter, and we shall be able to stack it to any depth we please without any fear of danger!

Such an achievement is, however, decidedly a thing of the future, and, in any case, its accomplishment is very problematical; so that at present, when stacking any coal containing more than a small proportion of inflammable volatile matter—a bituminous coal, such as is often used—

all that we can do is to assume that it is dangerous, and act accordingly.

Probably the chief factors regulating the liability of a given coal to fire when stacked are: the amount of free hydrogen, or methane, or other hydrocarbons given off by it at ordinary temperatures; smallness of size and consequent increased surface from which such volatile bodies may be disengaged; the possibility of a sufficient supply—and no more than a sufficient supply—of oxygen to its interior; and insufficient means of dissipating any heat generated. A bituminous slack, especially a “nutty” slack made up of particles of all sizes up to, say, $1\frac{1}{2}$ in. or 2 in. cube—such a coal as is commonly used for burning on mechanical stokers and, consequently, for storage in stacks—fulfils the first three of these conditions to a greater degree than any other class of coal, and a fuel of this kind is, therefore, badly adapted for stacking. While, as already pointed out, the small coal offers a large surface on which chemical action and liberation of inflammable gas may take place, the larger pieces tend to run together and form pockets and channels whereby air can slowly percolate through the stack in quantities sufficient to keep the temperature low, but quite enough to ensure a constant supply of oxygen and maintain the chemical action. The fourth condition will be fulfilled if a coal of this description be stored in a large, deep stack, especially if very much fine coal be placed on the top so as to blanket it and keep the heat in: a good rule to follow is to limit the stack to such a size that no part of its interior is more than 10 ft., or preferably 8 ft., distant from its free surface. If the coal can be deposited in small heaps of from 30 to 60 tons, and so kept for a few weeks before its final removal to the stack, its safety will be much enhanced, since much of the more volatile and dangerous constituents will then be got rid of. While it may be objected that this means a loss of heating value, it must be remembered that this loss is bound to be incurred in any event, and that if it take place in the stack it involves the risk of the much greater loss of the whole, or a large part of the fuel. Stacks should be of a moderate size, and means should be provided for accurately taking their temperature in one or more places; not only should such means be provided, but they should be used regularly, and records should be kept.

Various methods have been suggested for taking the temperature of a coal stack: most of them are incorrect and misleading, the error always being the dangerous one of making the temperature appear lower than it actually is. One proposal is to drive a pipe down into the coal where the temperature is required to be taken, and lower a thermometer down it by means of a string; the method of taking the reading is to haul the thermometer madly up the pipe, and, if one has the luck to bring it up unbroken, to snatch a reading of the rapidly falling mercury, add as much as you think proper to allow for the drop in the reading which occurs when hauling the instrument up, and then pretend that a satisfactory reading has been taken. Another method is to fill the tube with water or other liquid: this is certainly an improvement, inasmuch as the reading of the thermometer does represent the correct temperature of something—although the something is not the coal in the interior of the stack but the water in the pipe; and what use that is, I am unable to see. A much more accurate, but needlessly expensive, system is to use some form of electrical thermometer, placing its resistance or thermocouple element in that part of the stack the temperature of which it is required to ascertain. To overcome the disadvantages of these methods I have proposed the system illustrated in the accompanying sketches, this system being at once cheap, simple, and accurate. Fig. 1 shows an ordinary stem thermometer, graduated to, say, 220° F., enclosed in a glass tube such as a boiler gauge glass; both ends of the tube are fitted with corks, the bottom one being stuck in with varnish to prevent any risk of its dropping out and losing the thermometer. The glass tube is nearly filled with water, and a string attached to the upper end serves to lower it into the thermometer pocket. It is evident that, as the glass tube, water, and thermometer together have a much greater capacity for heat than the thermometer alone, no appreciable drop in the level of

mercury will occur as the instrument is drawn up the pocket, and no doubt need be entertained that the reading taken is a correct one, provided that the instrument is subjected to the correct temperature when in position at the bottom of the pocket. By proper arrangement of the pocket this can be ensured; the pocket, which, as shown in fig. 2 consists of a piece of 2-in. iron pipe of a convenient length fitted with a pointed plug at the bottom and a loosely fitting lid at the top, should contain just sufficient oil to immerse the thermometer tube completely. A very accurate indication of the temperature of the coal adjacent to the bottom of the pocket may then be obtained, from which the condition of the interior of the stack may be deduced.

No more liquid than a sufficient amount to submerge the thermometer tube completely should be placed in the pocket; if an excess be used, convection currents in the liquid may cause a low reading, and, if an insufficient quantity of liquid be used, a similar result may be due to convection currents in the air. The lid has the effect, not only of keeping the pocket free from small coal or other foreign matter and forming an attachment for the thermometer string, but also of preventing any possibility of errors due to the cold outer air obtaining ingress to the pocket.

It cannot be definitely laid down that there is a distinct temperature limit below which a coal stack is safe and



FIG. 1.



FIG. 2.

above which it is in danger, though, of course, if the temperature is approaching 200° F. the stack is undoubtedly in a dangerous condition. The rate of increase of temperature is a much more important factor, and from this, together with any tendency the increase may show to proceed either faster or slower, a sound conclusion regarding the safety of the stack may be drawn. For instance, a stack whose temperature has reached, say, 140° F. but shows little or no tendency to rise further, is in a much safer condition than one whose temperature is at the time of observation low—say 110° F.—but is showing a tendency to rise more and more rapidly. It is, therefore, useful to plot a graph of the temperature on a time base, and to give special attention to any stack which may show a steep temperature graph, particularly if its slope be an increasing one. From this, the necessity for taking temperatures accurately will at once be evident, and the value of such a simple and efficient means of doing this, as has been detailed above, will need no further demonstration.

There seems to be little room for doubt that a wet coal, much as a washed slack, has a distinctly greater tendency to

overheat than a dry one. The lower portion of a wagon of washed slack is often uncomfortably hot to the touch, even though the wagon may not have stood very long. This is probably due to the greater blanketing action of the fine, wet coal, which retards the escape of the heat. For this reason it is a bad policy to put a rough dry slack at the bottom of a stack and cover any considerable portion of it with wet slack. No doubt much less risk would be run if the arrangement were reversed. A rough analogy, which will appeal to those readers, of whom there are, no doubt, many at the present time, who have had gardening experience, is that of a "smother" fire for burning garden rubbish; here slow, but steady, combustion is required, and to secure this, one puts the larger, more combustible matter at the bottom, and covers it progressively with smaller and smaller, less and less inflammable stuff, carefully providing just sufficient means for air to reach the interior. Exactly the opposite principle is the one to follow in laying down a coal stack.

On the question of ventilation very conflicting opinions exist, but most people seem to hold the belief that ventilation is an advantage. For my own part, while I am quite prepared to agree with that belief, provided that the stack is thoroughly and completely ventilated, I contend that this is a very difficult problem, and that inefficient ventilation is much worse than no ventilation at all. For example, if a stack could be sealed up completely air-tight, a little heating might occur at first until the small quantity of oxygen present in the air filling the interstices between the particles of coal had been consumed, but, after that, no further action could take place, and the stack would cool down again. But if an inefficient ventilating system were in use, the air which had been robbed of its oxygen would be replaced by fresh air, and, at the same time, the inflammable gases given off by the coal would, in a large proportion, remain in the stack, so that further heating would be the result. Further, should a fire actually break out, any ventilating system of pipes would act as flues, making it burn more fiercely by creating a draught of air, and spreading it by carrying the heated products of combustion to other parts of the stack. An efficient ventilating system would have to carry away all inflammable and hot gases from every part of the stack, thus ensuring that no dangerous accumulations whatever should take place. This is neither an easy nor a cheap matter, and a better policy is to make the stack as air-tight as possible, and to keep its depth within such reasonable limits as I have already suggested.

It is no easy matter to extinguish a stack which has already fired. Playing water upon it with a hose-pipe is not very satisfactory in its results; it even seems to have the very unwelcome one, of spreading the area of the fire. Excepting as a temporary expedient to enable men to handle the coal, it should not be resorted to. If the hose pipe be used from the top of the stack there is considerable risk of a quite dangerous explosion taking place when the water reaches the fire; considerable quantities of steam, hot water, foul gas, and cinders may be shot up, with possibly serious results. The best policy is, if the stack is a small one, as it ought to be, to remove the whole of it, and, if possible, use it on the boiler fires at once. Parts of it which have not suffered much damage may be used to form the beginning of a new stack; as they will have lost much of their volatile constituents they should, after cooling, be perfectly safe. If the stack is, unfortunately, a large one, the area of the fire should be located and isolated from the remainder by digging a division through the stack as quickly as possible.

The process of removing coal from a burning stack is an unpleasant and dangerous one, and the necessity for it should be avoided as far as possible. I will, therefore, conclude by summarising the means by which coal may be stored in stacks with a minimum of danger. The coal should not be stored in one large stack, but in several stacks each of a moderate size; the depth of each stack should be such that no part of the coal is more than 10 ft. at the most distant from the surface; accurate temperature readings should be taken regularly and recorded. If possible, the coal should be graded; the fine at the bottom, the coarser at the top. Ventilation should not be used; the coal may with advantage be dumped in small heaps to season prior to

stacking. I have little doubt that the more closely these rules are adhered to the less will be risk of loss due to spontaneous ignition.

THE INSURANCE OF ELECTRICAL MACHINERY.

By C. STUART BUYERS, A.M.I.E.E.

(Concluded from page 581.)

Colliery companies are possibly the class of electric power users who favour insurance most. This is only natural, as the conditions of working in coal mines are hard, and breakdowns are frequent, especially in wet mines, where the air is laden with moisture.

The average colliery manager or owner places great value on the insurance company's quarterly reports. Although not an expert in electrical matters, he has sufficient technical knowledge to understand thoroughly the defects reported, and he will usually feel impelled to aid his electrician by giving facilities to have a faulty motor or armature brought to the surface for overhaul.

When a breakdown occurs and the defective part is sent away for repair, he receives one or more reports stating what repairs are being executed, and when the part is likely to be ready for dispatch.

At certain collieries possessing a number of electric coal-cutters, together with a considerable amount of other underground electric plant, it is not unusual to have an armature burnt out, on an average, once a week. Although in these cases the premium charged is high, the fact that the repairs are carried out under supervision, relieves the colliery officials from a considerable amount of correspondence, and any doubts whether they are being overcharged for repairs, do not arise, as the accounts are rendered direct to the insurance company.

The majority of collieries are entirely dependent on electrical machinery to maintain their output, and owners realise that efficient inspection is a valuable feature to ensure continuity of output. It is for this reason that the percentage of colliery companies who have tried insurance and given it up is extremely small.

The adoption of turbo-alternators by many of the smaller municipalities and electric supply companies has caused these concerns to consider the question of insurance.

Turbine plant is by no means beyond the possibility of breakdown, as anyone with experience of this type knows to his cost, and it is the "glorious uncertainty" and the extensive amount of damage which may occur in a few seconds of time which dictate insurance to all users except, perhaps, a few large undertakings having a special reserve fund to meet contingencies.

A fairly large turbine set will cost some £20,000 complete, and it may be insured for the full amount if desired, or against damage amounting to, say, £10,000 or £7,500.

The question of damage to surrounding property should be carefully considered when insuring turbo-alternators, as the ordinary policy only covers damage to the machine itself by breakdown. It is, therefore, in many cases, advisable to have the policy endorsed so as to include damage to surrounding property. The risk of external damage is not great, and consequently the additional premium is small percentage.

A case occurred a short time ago illustrating the uncertainty of turbo-alternator risks. An H.T. machine, about 1,000 kw. capacity was insured when it was installed and it worked in an exemplary manner for several years. So satisfactory was its behaviour, that the firm who owned it decided to give up insuring it; but only a few months after cancelling their policy a serious breakdown took place, necessitating considerable expenditure for repairs. Needless to add, the machine was insured again when it was repaired and resumed work once more.

As the use of electric power is growing rapidly among small power consumers, for whose requirements one or two motors are sufficient, and who thus do not require to employ an engineer or electrician, electrical insurance and inspection

appears to have a considerable future before it, and additional electrical surveyors will be required each succeeding year.

The qualifications required of a surveyor are twofold, and, to use an American mode of expression, they may be stated as follows:—

Tact and common sense ...	...	50 per cent.
Engineering knowledge ...	...	50 per cent.

It goes without saying, that an electrical surveyor must have a good theoretical training, so that he can diagnose irregularities in the working of the machinery he inspects, and thus indicate the remedy. A good practical knowledge of armature winding is very useful when dealing with repairs, but is not essential.

Some insurance companies require candidates to sit for a written examination of an elementary description, but, usually, an applicant's theoretical qualifications can be suitably judged by the certificates he holds from technical colleges. A tactful manner in dealing with clients when breakdowns occur is a *sine qua non* to the inspector who means to be successful.

Occasionally a breakdown arises which requires delicate handling by the inspector, such as, for example, the case of an attendant examining a motor with a lighted taper, and thereby setting it on fire owing to accumulated wool fluff and oil about the brushgear.

A breakdown policy would not cover damage to windings from such a cause, and unless the owner was insured against fire, he would require to make good the damage, caused by his employee's carelessness, at his own cost.

Such incidents, fortunately, are infrequent, and if the matter is explained in a judicious manner, no feeling of injustice will be left in the mind of the owner.

Many persons, on receiving a policy of insurance, lock it in a safe without reading the printed "Conditions" and "Definitions." These "Conditions" state in legal phraseology that while the insurance company is liable for all breakdowns happening to the machine itself whilst at work, unless caused by habitual overloading, the owner may require to renew, at his own expense, certain parts, such as carbon brushes, commutator, or bearing bushes, which are liable to wear out from time to time.

In conclusion, it may be stated that policies are issued for a year at a time, and it is open to either the insured or the insurer to cancel the policy at the annual date when it falls due for renewal.

This is a valuable safeguard to both parties to the contract, and it tends to ensure smooth working and prevents any high-handed action.

THE GOVERNMENT AND FOREIGN TRADE.

(Continued from page 582.)

We are glad to learn that it is proposed to bring about measures of reform in connection with the *Board of Trade Journal*. We do not wish to underrate its past usefulness, but we shall certainly welcome it in its revised form if it is going to be of real value in circulating articles founded on official information which will help the traders of the country promptly, and if it is going to co-operate with the trade journals—an office which it has filled in an acceptable but limited way in the past.

We presume it will not be long now before the Government is able to announce the names of the twelve new Trade Commissioners from whom we expect so much. We believe that practically all of them will be found to be men of business experience; but until the names are known we shall be unable to estimate how far their qualifications promise well in respect to the great engineering and electrical industries, in the future of which we are naturally more directly interested. We have long observed how valuable have been the services rendered by the four Trade Commissioners acting for us in Canada, Australia, South Africa, and New Zealand, and we trust that now that the number is increased to sixteen, spreading their efforts over wider fields, British industry will be materially advantaged, but our manufacturers and traders will require to show a

full measure of confidence in their ability by availing themselves of the valuable co-operation in information and action which these Commissioners are able to afford them. This remark applies to the period of activity of these officials while in the markets to which they will devote their energies, and also to their visits Home when our firms are able to interview them. Of course, at this date it goes without saying that the Commissioners will require to be most fully informed regarding our industrial manufacturing ability and capacity before starting to take up their posts abroad. It is reasonable to suppose that, however extensive their general knowledge of certain trades may be now, they will have other things to learn before they proceed to the scene of action abroad. It has been obvious in the past that only first-class men will be possessed of the training and experience that will fit them for this very important duty to the State and to industry, and we are glad to know that it is intended that the remuneration and allowances are to be such as to make the posts attractive to men of the required type. As we had occasion several years ago to urge an improvement in the remuneration of our Commissioners, we welcome the more reasonable treatment that is to be meted out to this branch of the Overseas Intelligence Services. It is intended that the Commissioners' extended activities will affect India and some of the Crown Colonies and Protectorates, as well as the self-governing Dominions. The Commercial Attaché Service is also being reorganised and greatly increased in numbers. The control of both these Services has been handed over to the new Department. The improvement of the Consular Service, the need for which everybody recognises, is also being dealt with, but very many matters in this connection require adjustment, and when so many excellent men who could fill such posts with distinction and success are engaged with the Forces, it is not possible to proceed so expeditiously as might have been done were they available now. The Consular Service is not as yet under the control of the new Department, but for the present it has been placed under Sir A. Steel-Maitland's personal charge as Parliamentary Under-Secretary in the Foreign Office. It is proposed that the Commercial and Consular Departments of the Foreign Office shall be definitely assimilated by the new Department when adequate accommodation for the entire new Department has been obtained near the Foreign Office.

There can be no question that Sir A. Steel-Maitland has personally a correct appreciation of what German commercial strategy has been in the past. It is almost impossible to doubt that those who are working under, or in co-operation with, him will have that same understanding of the situation and of the responsibility resting upon us as a nation to be equal to whatever the future may bring forth. This new organisation, given, as we say, goodwill on the part of its different sections, also confidence in its intentions and abilities on the part of traders, should go far to give us the needed measure of Governmental assistance, as regards intelligence service, that is required.

Since the foregoing was written the following official announcement has appeared in the *Board of Trade Journal*:—

The new Joint Department of the Board of Trade and the Foreign Office has now been constituted.

The new Department will be known as the Department of Overseas Trade (Development and Intelligence). It will be represented in Parliament by Sir Arthur Steel-Maitland, M.P., who will occupy the position both of Additional Under-Secretary of State for Foreign Affairs and also of Additional Parliamentary Secretary at the Board of Trade. The Department will comprise the existing Department of Commercial Intelligence of the Board of Trade, including the management of the British Industries Fairs, the War Trade Intelligence Department, the section of the Foreign Trade Department of the Foreign Office dealing with Form K and with other matters relating to the promotion of trade abroad; and certain functions now performed at the Foreign Office in connection with commercial intelligence and with the Commercial Attaché and Consular Services. Sir William Clark, K.C.S.I., C.M.G., has been appointed Comptroller-General of the new Department, and Mr. F. G. A. Butler, C.B., C.M.G., formerly of the Colonial Office, has been appointed Director of the Overseas Division.

The temporary headquarters of the Department will be at 73, Basinghall Street, London, E.C. 2, to which personal letters for Sir Arthur Steel-Maitland should be addressed. The Commercial

Attention is called to the fact (as regards which some misconception has prevailed) that the whole of the rest of the Foreign Trade Department will remain as heretofore under the Controldership of Sir Ernest Pollock, K.B.E., K.C., M.P., at Lancaster House.

Intelligence staff will for the present continue to be housed at the same address. The office at Basinghall Street contains an Inquiry Bureau where information on all matters affecting trade can be obtained on personal application; or inquiries can be addressed there either by post or telephone (telephone numbers, London Wall, 4713 to 4717).

The War Trade Intelligence staff will remain at their existing offices in Lake Buildings, London, S.W. 1.

WIRELESS TRANSMITTING STATIONS ON GERMAN AEROPLANES.

SOME highly important and interesting information on the means adopted by the Germans for signalling between aeroplanes and land batteries, infantry, &c., is given in *La Nature* for December 8th. It is realised, of course, that owing to engine noise, &c., aeroplanes can only transmit, and not receive wireless messages.

The receiving station on the latest type of German aeroplane consists of:—

1. A generator of D.C. and A.C.
2. The oscillating circuit.
3. The antenna.

1. At first the necessary current was provided by a storage battery. Difficulties arose, however; the batteries were very heavy, very fragile, and liable to be discharged rapidly. Small A.C. and D.C. generators were then fitted. These generators are driven by an air screw, or are coupled to the aero motor by a coupling (clutch) operated by the pilot. The generating plant, styled "J. A. Flieg, 1917," by the Germans, comprises two generators mounted on the same shaft. One of these, forming a simple dynamo, supplies the D.C., and is used for exciting the alternator, for the oscillator circuit, and probably also for lighting the lamps and projectors on the aeroplane.

The other generator supplies the A.C. for the oscillating circuit.

The three types of transmitter actually employed are the "Sender" type C, 1916, the "Hüth transmitter," and the "Telefunken transmitter."

Underneath the alternator is a sort of case, into which 12 terminals lead. These terminals permit of inserting in the exciting circuit different values of a resistance placed in series, and housed under the generator.

According to the type of transmitter fitted on the aeroplane, these terminals are used with the corresponding types of current. For check purposes they are connected up by connecting plates corresponding to the transmitter employed, the connectors being small plates of insulating material.

In the cover of the case mentioned above is a small transparent window for observing whether the generator is properly regulated in respect of its oscillating circuit. The generators are constructed so as to work rotating either right or left, according as they are driven by air screws or by the aero engine. The type of generating set just described weighs, with its air screw, cables, &c., 10.3 kilograms (about 23 lb.). The driving screw is designed to give a speed of 4,500 R.P.M. with a wind speed of 150 km. (say 90 miles per hour). Variations of aeroplane speed do not appreciably affect the output of the generating set. The set is air-cooled.

2. *Transmitting Apparatus.*—The "Telefunken" apparatus comprises the usual parts, the whole being contained in a case measuring about 14 in. × 10 in. × 6 in., and weighing some 19 lb. These parts are: a transformer, a condenser, a plate-type spark gap, and a variometer. There is a three-stud contact device for varying the intensity of emission by a rheostat in the excitation circuit, and at the same time decreasing the resistance of the spark-gap by short-circuiting part of the plates.

Another three-stud contact permits of employing three different wave lengths, viz., 150, 200 and 250 metres, by using one or more turns of an Oudin coil. The variometer (variable self-inductance) permits of tuning the aerial with the primary circuit. The observer knows that his circuit is properly regulated when the ammeter pointer attains a maximum.

3. The transmitting aerial is formed by a 1-mm. diameter copper cable about 40 metres long. This wire, which hangs below the aeroplane, tends to assume a nearly horizontal position by reason of its inertia and the wind resistance.

A special arrangement is provided for preventing the antenna swaying, and for ensuring that the correct length is unwound. The manipulator and ammeter are of the usual type. The conductors of this system are insulated and mounted in special flexible aluminium tubes.

The total weight of the complete set is as follows—

Oscillatory circuit	...	...	8.7 kg.
Generator system	...	...	10.3 "
Aerial, &c.	...	...	3.7 "
Manipulator, wiring, and ammeter	...	...	3.0 "
			25.7 kg.

or, say, $\frac{1}{2}$ cwt.

The mean range of the set seems to be about 3.5 kilometres, or something over 20 miles.

Every squadron of the German Army Service Corps attached to the air service includes a tractor wagon specially fitted up for dealing with repairs to, and tests on, wireless sets.

The article from which this information is derived is fully illustrated by photographs and diagrams.—E. S. H.

JUSTIFIABLE INDUSTRIAL UNREST.

By G. BASIL BARHAM.

EVERYONE who is in close touch with the engineering trades is aware that a good deal of unrest exists, and that this is due principally to the inequality between the wages paid to those who have been in the shops since boyhood, and who have attained a high degree of skill, and those who have drifted into the fitting and machine tool shops since the war, and who possess neither experience nor special skill. These men are engaged principally on repetition work, and in many instances can earn, with comparatively little effort, more money than those who have been in the trade for years. No one with a sense of equity can endorse a system of payment under which a labourer who merely feeds metal bars into an automatic machine receives more than the skilled supervisor, tool maker, or tool setter, on whose accurate work the correct running of his machine depends. Yet this is the system which obtains in a great number of shops, and countless instances could be given where the difference in wages runs into pounds per week rather than shillings.

Since this inequality was first recognised, a number of movements have aimed at rectifying the anomaly, but neither individually nor collectively have they achieved their object; and it is hardly to be wondered at that the skilled workman, irritated at their failure, has been tempted, in some instances, to take matters into his own hands, and see whether by *force majeure* he cannot bring about a better state of things.

The weapons he has employed have been threats to stop work, threats to stop all overtime, threats to stop dilution, and even to restrict production by less creditable and legitimate means. No talk of payment by results will meet his approval, as he knows that amongst many grades of engineers—especially those possessing considerable skill—piece-work rates or premium bonuses could not be introduced. General fitters and turners, the more skilled amongst the pattern makers, and tool setters are men who could not be paid at piece-work rates, at least for the greater part of their work, although it is true that many of the setters-up and some of the tool-room hands share in the bonus earned by the men in charge of the machines for which they look after the work-setting and the tool-making and setting respectively.

It is time that the employers generally recognised the fact that the skilled workmen are strongly opposed to the establishment of any system of "premium bonus." The Employers' Federation would be well advised to give way

on this point; as a matter of fact, it has little to commend it, and it is generally admitted to be unfair, as under it men only receive a portion, and not the whole, of the value of the time they save for their employers. A man rightly argues that if he, by special effort, succeeds in doing 60 minutes' work in 15 minutes, the value of the saved 15 minutes should belong to him, more particularly as he feels that the employer receives his share of the benefit in the extra amount of work done.

In some parts of the country a scheme of collective piece-work payment has been adopted, and it has met with a certain amount of success in United States shops. It is admitted that American "scientific management" has failed up to now to serve as a medium for reconciling deep-rooted differences between employer and employed; but the system of payment mentioned has many good points. Where adopted, it is arranged that piece prices shall be fixed at such a rate that an ordinary workman can make time-rates plus 50 per cent., these prices being fixed by mutual agreement. A day worker who cannot be placed on piece-rates shall be paid a bonus which shall bring his wages up to the average amount earned by the piece-workers; and although this is merely a bald statement of the scheme, and although it is admittedly imperfect in some respects, it is a scheme which at the present juncture might be introduced with advantage, as it would do away with the majority of labour troubles.

From the employers' side it might be urged that under such a scheme the energy of the piece-workers might result in a higher addition to the wages of the day workers than they expected or demanded, and that, consequently, they would be satisfied with less. To those who argue in that way it is sufficient to say that the war has revolutionised the old ideas as to the relations between Capital and Labour; it will do away with the "Ca'-canny" master as well as the "Ca'-canny" workman, and it is gradually becoming recognised that the labour of the man who works with his brains and the labour of him who works with his hands are both worth exactly what they can obtain. In both cases the only test of reasonableness is the price that can be commanded. Masters must put aside the old idea that the amount of wages paid per week is of any importance, and realise that the only thing that matters is the cost per unit of their production.

REINFORCED CONCRETE POLES FOR TRANSMISSION CABLES.

By A. V. CHITTY.

(Paper read before the ASSOCIATION OF MINING ELECTRICAL ENGINEERS, NORTH OF ENGLAND BRANCH.)

THE colliery where these poles, to be described, have been made and erected has undergone a complete change; for no electricity of any kind had been in use before. The new houses for engines, pumps, boilers, &c., have all been built with reinforced concrete, so that when the poles came to be made everything was ready for the purpose.

As the poles were not required for a few months, one mould served to make them all. The mould was made ready; then as opportunity occurred the concrete was put in, and when finished left to set for about 11 days, according to the weather. A little water was thrown over the concrete occasionally to assist the hardening, and when set sufficiently the box was taken off and made ready for another mould. At this stage the poles were quite "green," and not safe for handling.

The concrete mixer was kept going principally to make concrete for the buildings, &c., but there are periods during work of this description when delays occur, especially at the present time. When the mixer was not supplying concrete to buildings, the concrete was used for moulding a pole.

The illustration gives the dimensions of the pole. Reinforcing rods run the full length, and iron wire was fastened in between the rods to give a better binding. One rod was bent about 1 ft. from the bottom of the base, and brought out at the side. An earth plate was attached to this rod after the pole was erected. At the top the rods project for a short distance to take an iron plate about 3/16 in. thick and 4 in. square. A hole is left in the top to take the top insulator spindle, and a slot in one side to enable the nut

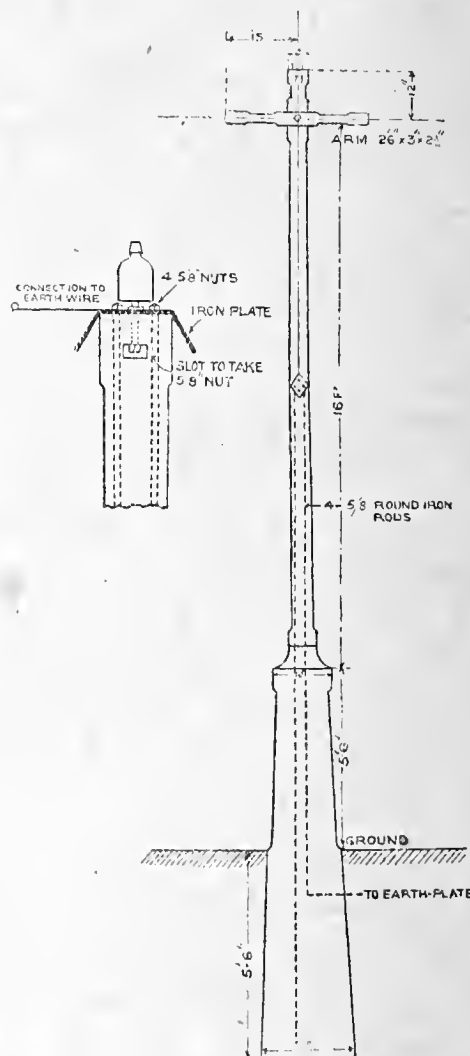
to be secured. A rod was fastened to one of the nuts to carry an overhead earth-wire. About a foot from the top a slot was left to take the cross-arm and a bolt-hole for securing it.

The arms were 2 ft. 6 in. long by 3 in. square, chamfered at the edges, and secured to the pole by a 5/8-in. bolt. Three inches from each end of the cross-arms are the insulators. The shortest distance between the wires, provided they are all at an equal tension, is about 15 in., which for a 440-volt, 3-phase transmission is ample.

The weight of a 28-ft. pole is about 2 tons 7 cwt. Each pole was placed on rollers and moved to its place of erection, care being taken to see that the rollers were fairly equidistant to obviate risk of cracking the concrete, which did happen in one case. The best method is to move the pole on planks strapped to it.

The ground where these poles were set was good solid clay with about 8 in. of soil at the top. The hole was stepped down to about 5 ft., so as to leave a solid wall at the back. The pole was then placed over the stepped side of the hole and set into position by means of a derrick.

A board was placed against the back wall to prevent it burying itself in the ground and breaking the earth away



REINFORCED CONCRETE POLE FOR TRANSMISSION CABLES.

while being lifted. No stay wires were used, as they were not considered necessary in a sheltered colliery yard; also the length of span is only about 40 yds. For a transmission line, say from one colliery to another, through open country, wind stays might be necessary.

One of the reinforcing rods of each pole has an earth-plate attached at the base, and the poles are connected together by an overhead earth-wire which terminates at a steel tower. The wire is taken down the tower and connected to two earth-plates about 20 ft. apart. These plates serve as a central earth for all the surface motors and the underground circuits. It is not necessary for each pole to have an earth-plate, but they were convenient for connecting the motors to. In the case of a long line with a number of poles, an earth-plate at every fifth pole would suffice.

The approximate cost of the pole is about £3 10s., including reinforcement and the mould. A wooden creosoted pole would cost at the present time about 2s. a foot. The life of a wooden pole would be, say, 15 to 20 years, whereas a reinforced concrete pole should last as long as the colliery. For general appearance and strength, concrete is best.—*Iron and Coal Trades Review.*

GAS-FIRING BOILERS.

Mr. T. M. Hunter's paper was read before the members of the BIRMINGHAM LOCAL SECTION OF THE INSTITUTION OF ELECTRICAL ENGINEERS on December 5th. An abstract of the paper appeared in the ELECTRICAL REVIEW for December 7th and 14th.

In the discussion, Mr. W. N. Y. KING said that an important factor was the question of dust in the flues. In a paper on "Waste-Heat Boilers in Steam Plants," read by Mr. C. J. Bacon before the American Iron and Steel Institute, open-hearth practice was referred to, and it was stated that dust was blown off the tubes every six hours. This was a serious item, as in the case of coal-fired boilers two or three times a week was considered quite frequent for this operation. The result of leaving the dust on the tubes was a great loss of efficiency, on account of reduction of heat transmission; the amount of this was shown in some figures published in the *Electrical Review* and *Western Electrician*, September, 1917, as follows:—

Thickness of soot on tube ...	1/32	1/16	1/8	3/16 in.
Loss of conductivity per cent. ...	9.5	26.2	45.3	69.0

The use of waste products as mentioned had been tried at various times, and the main obstacles to successful working had been reduction of output from the plant due to the large amount of refuse, and the increase in labour costs and difficulty of disposing of the refuse. Even with coal of the quality obtainable at the present day, the handling and disposal of ash and clinker was a serious item of expenditure. The infiltration of air had an appreciable effect on the efficiency; boilers should be fitted with tight casings, and these maintained in good order to reduce losses to a minimum. Explosions, which occurred at times due to unburned gas accumulating in the flues, were not often so violent as to disturb the stability of the boiler, but did affect the walls, loosening the joints, which had to be made good again if heavy losses due to air infiltration were to be avoided.

Mr. A. GOLDIE ENGHOLM said Mr. Hunter had not given any definite information concerning the costs of gas-firing boilers. So far as he was aware, it did not pay to put down gas plant to recover the various by-products unless the plant could deal with, say, two to three hundred tons of coal per day. Mr. Hunter stated that a 30 ft. by 8 ft. Lancashire boiler to evaporate 6,000 lb. of water would require 71,000 cu. ft. of gas per hour at 107 therms per cu. ft. If the gas could be supplied at 1½d. per 1,000 cu. ft., this would work out at about 9s. per hour for the gas alone. He did not think that at present gas at 107 therms could be supplied at 1½d. per 1,000 cu. ft.

Mr. R. L. GOULD said the author emphasised the importance of minimising the excess of air. The admitted air, even when pre-heated, was, he presumed, at a temperature of 100 or 200 deg. C. The excess air had to be raised to a temperature of 1,200 or 1,500 deg. C. The consequent reduction of calorific intensity was obvious. They had to operate between this evil and the evil of unburnt gases in the stack. These unburnt gases probably consisted largely of combustible gases which had been manufactured in the flame, as distinguished from gases which had escaped from the burner. It was conceivable that the wetted surface of the boiler might be the means of so reducing the temperature in a region in which the regenerated gases were liberated that they escaped combustion. The importance of thoroughly mixing the air was emphasised in the paper; this mixing of the air with the gas was, however, a matter of the greatest difficulty, and the regenerated gases escaped combustion on this account also. He suggested an inquiry as to whether the desideratum of substantially complete combustion with a minimum of excess air could be more nearly attained by a gas-fired boiler, the design of which was founded, *inter alia*, upon a recognition of the existence of combustible gases generated in the flame.

LEGAL.

GAS LIGHT & COKE CO. v. THE METROPOLITAN BOROUGH OF HACKNEY.

THE Court of Appeal on Tuesday, December 18th, delivered judgment in this case.

LORD JUSTICE SWINFEN EADY's judgment is abstracted below:—The relators complain that the defendants, who are empowered to supply electrical energy within their districts, are committing breaches of Sections 19 and 20 of the Electric Lighting Act, 1882. They complain that the defendants are supplying electrical energy for lighting on different terms instead of the same terms to persons taking under similar circumstances a corresponding supply contrary to Section 19. They also complain that the defendants are showing undue preference to persons taking current for lighting who also take it for power, contrary to Section 20. Mr. Justice Astbury decided that the relators had failed to give any breach by the defendants of the statutory provisions, and dismissed the action and the relators' appeal.

The scale of charges of which they complain is set out in paragraph 5 of the Statement of Claim, and was contained in

a circular issued by the defendants in July, 1914. The plaintiffs do not make any complaint as to defendants' charges for energy for lighting, or for power alone; their complaint is limited to the provision enabling power users taking current under the B.1 scale to consume up to 20 per cent. of the energy so taken in lighting their factories. The substance of the plaintiffs' complaint can be put in a very few words. They say that if two customers take from the defendants energy for lighting under what they allege to be similar circumstances, as, for instance, if two customers take current for lighting their factories, and one has steam or gas-engine motive power, and the other takes from the defendants electric current for his motive power, the latter is able to obtain his lighting at a cheaper rate than the former. The plaintiffs contend that in such case both customers take energy for lighting under similar circumstances, and ought to be charged at the same rate for such energy. The defendants dispute that both customers take current under similar circumstances, and contend that the customer who takes one combined supply for lighting and power—who takes at least four units for power for each unit for light—is a better customer for the electric station, and takes energy under different circumstances from one who takes it for lighting only.

The plaintiffs' contention is that the defendants ought to have a third scale—namely, an intermediate scale for customers who use current for light and power, higher than the scale charged to power users only, and lower than the scale charged to light users only.

In approaching the consideration of the matter in dispute, it must be borne in mind that customers affect the central supply station differently according to the different circumstances under which they take current. The purpose for which current is taken is immaterial, except so far as the station is affected by the amount taken and the circumstances under which it is taken. An ideally perfect customer would be one whose maximum demand on the station was also his minimum, and whose load remained constant throughout the whole year. Speaking generally, it is agreed that customers for power have a better load factor and more favourably affect the diversity factor of the station than customers for light. A figure of 25 per cent. was accepted as a general figure of load factor for power users. The general figure given as the load factor of light users was 12.5. The diversity factor of the station is, speaking generally, more favourably affected by power users than by light users. It is essential to bear in mind the effect of load factor and diversity factor on the working of an electrical undertaking when considering the scale of charges. It appears that defendants' charge under scale A.1 for lighting is nearly double the charge under B.1 for power. Under A.1, if the unit be taken at 5d. for the purpose of calculating the cost of one hour's supply at maximum demand, and then all current consumed be charged at 1d. per unit, the annual charge per kW. of maximum demand will be £7 11s. 8d., as against the fixed charge of £4 per year per kW. for power, and the charges for current will be 1d. per unit for lighting and ½d. per unit for power. No complaint is made of these charges if enforced for light only or power only, as the case may be. It is now necessary to consider the position of a power consumer who is allowed to use for lighting 20 per cent. of the energy he takes. Sir John Snell, the electrical engineer called by the plaintiffs, agreed that in so far as a power user consumed for lighting 20 per cent. of the current taken, his load was rendered worse than if he used all current taken for power alone, and that, as a class, a power user although consuming 20 per cent. of current for light had a better load factor, a better diversity factor, and was a better customer than one taking only current for light, and he concurred in the view that the average price which should be paid by a consumer taking current for power, and using part of it for light, should be higher than was paid by a customer taking current for power only, and lower than was paid by a customer taking current for light only. The defendants point out that this is the effect of their automatic scale, and that in proportion as the load factor of a power user is rendered worse by his taking current for light, to that extent will he pay at a higher rate for all energy consumed, as the worse his load factor the higher the rate at which he pays for current taken. The table put in by Mr. Merz shows how this works out in the hypothetical instance taken; exactly in the proportion in which the load factor becomes worse, the smaller is the relative quantity of current over which the fixed charge has to be spread, and accordingly the cost per unit of current consumed rises in proportion. Down to this point, I do not understand that the plaintiffs dispute the position. But they contend that this result is arrived at without considering another element, namely, the diversity factor; and they urge that if a customer takes power only at a similar load factor to one who uses current for both purposes, they will both be charged at the same rate for all current taken, although, by reason of the latter customer adversely affecting the diversity factor of the station, he will be a worse customer than the one with the same load factor taking for power only. At most, it comes to this, that given two power users with the same load factor, one only using current for lighting, they pay at the same rate, and thus, it is said, lighting is given at a cheaper rate than it is supplied at to a customer taking current for lighting only. No doubt it is. In my opinion, how-

over, a customer who takes current for power as well as lighting, being a more beneficial customer to the undertaking, and taking at least four units for power for every unit for lighting, cannot be said to be taking a supply under similar circumstances to one who takes for lighting only. Indeed, the appellants conceded in argument that such two customers might be charged a different rate. What seems to be the plaintiffs' real grievance is, not that two light users are charged a different rate, but that two power users are charged at the same rate through each having the same load factor, although one uses part of his current for lighting. Mr. Colefax criticised the use which the defendants' counsel made of the table, and the way they dealt with it in argument. He contended that the table takes no account of the diversity factor, but merely shows that every power user pays according to his load factor, neither more nor less, because the difference of load factor is taken into account in the method of charging. It must be remembered, however, that we start with this—that using current for light as well as power renders worse the load factor. If, therefore, two power users have the same load factor, although one uses current for light, it follows that without using current for light they would have had different load factors, and, as such, would have been charged at different rates if worked out per unit per consumer; it is only by reason of one of these customers also taking current for light, and so adversely affecting the load factor, that he is reduced to the same level or charge as the other customer, who has a worse load factor than his own for power only. The effect of the sliding scale is that it does in fact introduce and adjust a third scale for power and light combined, the charge being higher than would have been the charge for power only, and lower than would have been the charge for light only. The appellants have, in my opinion, failed to show any breach by the defendants of either Section 19 or 20 of the Act of 1882. The case of the Attorney-General *v.* the Long Eaton Urban District Council is clearly distinguishable from the present. In that case, where power and light were both taken, the charge was at a lower rate than when power only was taken, although the consumer was not so good a customer to the station. Again, a difference was made when partial lighting only was taken, so that if any lighting was obtained from any other source the higher rate was charged. The Long Eaton case cannot govern the present one. In my opinion the appeal fails, and should be dismissed.

Lords Justices Warrington and Scrutton also delivered judgments dismissing the appeal, which was accordingly dismissed with costs.

KENSINGTON & KNIGHTSBRIDGE ELECTRIC LIGHTING CO., LTD., v. THE NOTTING HILL ELECTRIC CO., LTD.

In the King's Bench Division, on Wednesday, December 19th, Mr. JUSTICE MCCARDIE had before him this special paper case, which came up upon the consideration of an arbitrator's award adverse to the Notting Hill Co. upon a dispute between the two companies with reference to the use of electrical power from a joint station. The case was reported in the *ELECTRICAL REVIEW* of July 20th, 1917, and the arbitrator's award in that of October 12th, 1917.

Mr. Tomlin, K.C., and Mr. Bruce Thomas were counsel for the Notting Hill Electric Lighting Co., and Mr. Vesey Knox, K.C., and Mr. Marriott represented the Kensington and Knightsbridge Electric Lighting Co., Ltd.

Mr. TOMLIN, K.C., in opening the case, said that he represented the Notting Hill Co. on a special case where an award had been made by Mr. Swinburne. The case arose out of a difference that had resulted between the two companies in reference to their obligations under certain agreements which they had entered into, and under a special Act of Parliament in regard to the same matter. These agreements related to the erection and maintenance of a joint generating station, and the nature of the question in dispute between them was substantially as to whether or not the Notting Hill Co. in certain circumstances had failed to take from the joint generating station the amount of electrical energy which, by reason of their obligations under the agreement and the Act, they were bound to take. It was alleged against the Notting Hill Co. that they ought to have taken more current than they had taken from the joint station, but his case was that one of the purposes for which it was alleged they ought to have taken current, and for which they had not taken current, was a purpose that was outside of the Act altogether, and for which it would never have been possible for the generating station to have supplied current consistent with the provisions of the Act. Under the agreement it was provided that the output of 1,500,000 watts might be used by the companies as they should require, but it was afterwards agreed between the two companies that the Kensington Co. should not be entitled to use more than 1,200,000 watts without the consent in writing of the Notting Hill Co., and the Notting Hill Co. should not be entitled to use more than 100,000 watts without the consent in writing of the Kensington Co. If the joint station was unable to supply the total output required, the companies could take the available output in accordance with the proportions indicated, or in such proportions as might be agreed upon from time to time. Under this agreement, the Notting Hill Co. had taken their maximum, and yet they had been fixed with damages in the

arbitrator's award for not having taken more. After dealing in detail with the various agreements and the provisions of the Acts conferring the powers on the companies incidental to the erection of the joint power station at Hammersmith, Mr. Tomlin said his case was that the Act authorised the acquisition of land and the construction of the joint station for one purpose only—for supplying energy within the areas of supply for the time being authorised, and nothing outside of those areas fell within the scope of the agreements, and any agreement, therefore, for the use of electrical energy supplied by the joint station for some purposes outside of that would have been *ultra vires*. Here the Notting Hill Co. had had damages awarded against them for not taking from the joint station energy for a district that was outside of the statutory area. The fact was, they could not have supplied that district from the joint power station except at enormous commercial loss, as it involved a low-tension continuous supply, and they could not, and would not, have done it.

Mr. VESSEY KNOX, K.C., interfering, said that the arbitrator who had made the award was an experienced electrical engineer; the Notting Hill Co. set up before him the case that they could not possibly have taken this supply from the joint power station, and the arbitrator found against the Notting Hill Co. on that contention. The case for the Kensington & Knightsbridge Co. was that the supply could have been, and should have been, given from the joint station.

Mr. TOMLIN said that their case on this was that the supply could only have been taken from the joint power station at great commercial loss, and the evidence on the other side was also to the same effect. They would not have been able to supply this district at all except for the fact that they were able to make arrangements for the supply from another source. An arrangement was made with the Metropolitan Co. The district in question was the Kensal New Town locality, and the arrangement began about the year 1909. He asked the Court to declare that the arbitrator's decision was incorrect, because energy could not be taken from the joint station for any purpose outside of the area. Counsel proceeded to deal with the effect of the Electric Lighting Act of 1909, which, he suggested, gave a licence to use outside of their area some energy for particular purposes. This licence was to supply at their will and pleasure to particular places. The Kensal New Town district had no characteristics of the statutory area.

Mr. JUSTICE MCCARDIE: So that one of the chief questions in the dispute is whether premises covered by this licence under the Act of 1909 constitute an extension of the original statutory area?

Mr. TOMLIN: Yes—whether those districts come within the area of supply authorised by the agreements and the Acts.

The case was adjourned till Thursday, December 20th.

At the close of the arguments his Lordship reserved his judgment until the 1918 sittings.

THE OSRAM-ROBERTSON LAMP LITIGATION.

Mr. HUNTER-GRAY on December 20th, in the Chancery Division, before Mr. Justice Eve, moved for judgment in two cases in which the Osram-Robertson Lamp Works, Ltd., were the plaintiffs, the first being against the Serena Supply Co., and the second against the Electric Lamp Supply Co. Mr. Hunter-Gray, in reply to the Judge, said that the circumstances were exactly the same as in a case in which his Lordship had previously given judgment. The papers were all in order, and it was a consent order for which he was asking.

His LORDSHIP: Then take your orders.

WAR ITEMS.

Export Prohibitions.—A notice of various additions to and alterations in the list of exports prohibited appears in the *London Gazette* for December 18th.

Experts to China.—Additions to the names of persons and bodies in China and Siam to whom exports may be consigned are published in the *London Gazette* for December 18th.

War Loan.—Big subscriptions to the War Loan during Manchester's great "Tank Week" included £25,000 from the British Westinghouse Manufacturing Co., Ltd., £5,000 from the General Electric Co., Ltd., £25,000 from Messrs. Charles Macintosh & Co., Ltd., and £10,000 from the Chloride Electrical Storage Co., Ltd.

Sale of Electric Heating Apparatus Forbidden in Rome.—The *Times* correspondent at Rome states that a new decree limits the use of electric light, prohibits the use of electricity for heating between 1 and 10 p.m., and forbids the further sale of electric heating apparatus. Gas is already shut off the greater part of the day, and will shortly be cut off altogether for heating purposes. Wood and charcoal are very scarce.

Trading with the Enemy.—In the "London Gazette" for December 21st there appear further lists of persons and bodies with whom trading is prohibited in the following countries:—Argentina, Paraguay and Uruguay, Bolivia, Brazil, Central America, Chile, Colombia, Cuba, Ecuador, Greece, Netherlands, Netherlands East Indies, Norway, Peru, Spain, Sweden, and Venezuela.

Coal Shortage in Germany.—The "Daily Chronicle" special correspondent at Amsterdam says that the gas question is becoming serious all over the Central Empires. Vienna has introduced a gasless 24 hours weekly. Berlin's population has been warned to exercise the utmost economy, as only very small supplies of coal are being obtained. In Stettin gas may only be used for 12 hours roughly out of 24, from 4.30 till 8 in the morning, from 11 to 1, and 4 to 11. Leipzig fares slightly worse, and prospects everywhere are dismal. The reduced amount of gas interferes seriously with various industries, and the situation will become worse shortly, when a reduction in the amount of electricity used is introduced, as is reported will be the case.

Economic War.—In the course of a discussion on war aims in the House of Commons last week, Lord Robert Cecil said (see *Times* Parliamentary reports, December 26th, 1917):—"An economic offensive was quite as important as, if not more important than, any other aim that we had. It was perfectly right to 'bomb' German businesses. The policy of the 'statutory list,' which enabled them to do their best to put out of business German firms in neutral countries, had been one of the main instruments in weakening the economic power of Germany, and in making her look anxiously to the restoration of peace. Neither he nor any other member of the Government advocated an economic war after the war. There was in many respects a world shortage of raw material, and the longer the war lasted the greater would be the shortage. The country would have a right to impeach any Ministry which allowed this country to be in want of essential raw materials because they were being sent to those who had been our enemies in this war. There was nothing vindictive about that. It was a statement of economic fact which it was right to present to the world."

Germany's After-war Trade.—The Central Union of the German Wholesale Trade has issued a series of 20 essays, urging the importance of preparation for the transition period following the conclusion of peace. Imports, it is pointed out in one of these, will involve the payment of large sums to foreign countries. The wholesale trade, however, can make use of its own connections to obtain credit so that payments will be better regulated and more widely distributed. At the same time an effort should be made to export, as far as possible, goods of a high value, such as potash and dyes, whereby credits may be obtained abroad. The problem would be greatly simplified by setting aside a large amount of gold for the use of the importers, if that can be done without injury to the German economic system. Purchases abroad should be made through syndicates, consisting of representatives of both industry and the wholesale trade, and the Government should exercise a certain control over prices. So the Germans propose—but the Allies may dispose otherwise.—*Financier*.

Exemption Applications.—At the Lanarkshire Military Appeal Tribunal, the head electrician at the Royal Princess Theatre, Glasgow, B2, was granted exemption until the end of the pantomime season. He was stated to be the only practical electrician on the staff. He had charge of the network of electrical appliances on the stage, and he had eight unskilled workers under him. It was stated that it would be a source of danger to the public if he were taken. He is not to be called up until March 1st.

The Bispham-with-Norbreck Urban District Council appealed to the County Appeals Tribunal, at Preston, against the decision of the local Tribunal, which refused more than two months' exemption to their electrical engineer, on the ground that it was unreasonable to expect to retain two Class A men for the work. The Chairman asked if it was not possible for the Blackpool Corporation to take over the electrical supply of Bispham in advance of the date agreed upon for the amalgamation of the two areas. The reply was in the negative. The County Tribunal therefore granted temporary conditional exemption to March 31st, by which time winter lighting would be over, and amalgamation would have taken place. It was intimated that the Council would then want a much stronger case to gain any further consideration.

At Skipton, an Addingham electrician and engineer had his appeal refused, and was ordered to report for service on January 1st, with a strong recommendation that he be allocated to the Air Service, which was badly in need of such men.

Before the Essex Appeal Court, the Union Cable Co., Ltd., of Dagenham, appealed for H. Comley (20, Class A), cable machine help; W. H. Rowe (23, Class A), cable armoring machine help; C. W. Dean (24, Class A), lead-press help; G. E. Wheeler (20, Class A), cable armoring machine help; A. W. Taylor (24, Class A), help to cable vulcaniser; W. Matson (24, Class A), lead-press hand; and R. Thorpe (19, Class A), cable machine hand. Mr. Blackwood, the firm's representative, said that it had been found impossible to obtain substitutes. If the men had to go, the work would have to stop. The Military Representative pressed for Comley, Matson, Thorpe, and Taylor, as the Dilution Officer was of opinion that they could be spared. Substitutes had been offered, but had not been accepted. Rowe, Dean, and Wheeler were not pressed for, their claims having been accepted by the Dilution Officer. Mr. Blackwood said that he could not accept the substitutes on the terms under which they were offered. He could not spare any of the men. Mr. Hollick thought that someone who understood the work ought to decide whether or not it was necessary. If it was not necessary, all

the men ought to be in the Army, and if it was necessary older men who were accustomed to the work might be brought out of the Army as substitutes. Conditional exemption was granted in each case until efficient substitutes were found, when the cases could be reviewed.

Before the South Yorkshire Appeal Court, the Military Representative appealed against exemption held by Mr. A. B. Gott (35, B.D.), electrical engineer, and the exemption was cancelled.

At the Shoreditch Tribunal, S. J. Minter (26, single, C.U.), managing director of Stuart (Woodworkers), Ltd., made a third application on business grounds. It was stated that they were now doing a large business in electrical goods, with an ever-increasing trade. At one time the business was run by a man named Baber, and some time back the Tribunal agreed that as he was an A man he could join up, and this man Minter could carry on. This he had done very successfully, the business at the present time being a great success. Captain Weber said the arrangement that this man should stay and carry on was a legacy from a very reprehensible practice of theirs of some time back. Nobody dreamed the war was going to last so long, and they allowed these things. The Chairman said they had been ordered to take all fresh conditions into consideration, and there were clearly fresh circumstances here. The Tribunal decided to grant one month only, final.

At the Shoreditch Tribunal, on Friday, Messrs. W. A. and R. J. Jacobs, Ltd., electricians and electric torch manufacturers, applied that the condition of exemption as to his doing V.T.C. drill should be waived in the case of W. J. Bristow, the manager. He was classed C3. Owing to the heavy pressure of important work, he was unable to do any drilling. They were under the impression that he was not liable in view of the low medical category. The Tribunal declined to take any action in the matter.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Production of Ductile Tungsten.

In the lecture given by Mr. Sydney Johnstone at the London School of Economics on the subject of the Rarer Key Metals, as published in the December 2nd issue of the *Daily Telegraph*, the following statement is made with reference to tungsten:—

"A small quantity is employed for the production of filaments for incandescent electric lamps. The manufacture of ductile tungsten for this latter purpose was not carried on in this country before the war."

Mr. Johnstone has evidently been misinformed on this point, because the British Thomson-Houston Co. were supplying their whole requirements of ductile tungsten for Mazda lamp filaments in 1912 by manufacture at their Rugby works. At that time, and until within a month or two from the date of the outbreak of war, the raw material used was tungsten oxide; but the company, foreseeing a possible shortage of that material at the outbreak of the war, immediately started the manufacture of the metal from the raw ore.

This ore, which is of British origin, has always been available in sufficient quantities to supply the needs of the lamp industry. The metal required for tungsten lamp filaments must be of an exceptional purity—far higher than that required for steel alloys—so that the method of refining involved a considerable amount of research and development work before it could be put into regular operation on a commercial scale. This was successfully accomplished, and the whole process of refining the ore and producing ductile tungsten filaments from the metal obtained has now been continuously in operation since the middle of 1915, and many millions of feet of wire have been made.

The British Thomson-Houston Co. not only takes care of its own requirements, but supplies filament for lamps made by a number of its licensees. It has sufficient capacity for supplying far more than the requirements of the lamp industry of Great Britain, if needs be.

Trusting that you may be able to find space for this letter in an early issue,

The British Thomson-Houston Co., Ltd.
Patent Department.

JOHN GRAY,

London, E.C., December 19th, 1917.

Distinctive Colours for Braided Cables.

I have often wondered why the colour of the braiding of electric cable is either red or black. After years of experience, I think that if there were three colours of braiding, it would be of great service to "three-phase merchants."

As the electrical industry moves forward, three-phase plants and installations hold premier place. If a system of using, say, red, black, and yellow wire was followed, it would be an advantage in many ways. All wiring of machines, switchboards, and motor

circuits would be easily followed out, and wiring faults would be nearly eliminated.

In the case of star-delta connected machines and switchgear, three colours of wire would indeed prove beneficial. The leads from the machine would consist of two reds, two blacks, and two yellows. The mains into the switchgear would be one of each colour. In the connecting up of meters on three-phase work, three colours would be of great service. In house-wiring, &c., where the loop-in system is universal, the three colours would be greatly approved of. All feeds could be wired with red, returns with blacks, and switch wires yellow. In the wiring of three-phase automatic controllers, each phase would have its own colour throughout, and this would facilitate the tracing out of what is usually a maze of wiring. We all know the benefit of the various colourings of multicore telephone cable as used for, say, intercommunication systems. Without wishing to have a multitude of colours, I do think that if another colour were added to the V.I.R. cables it would indeed be useful. The colour I suggest is yellow.

I trust that some of your readers will state their valued opinions on this matter.

T. D. Spark.

Newcastle, December 4th, 1917.

BUSINESS NOTES.

Book Notices.—*Manual of Electrical Undertakings*, 1917-1918. By E. Gareke. Vol. XXI. London: Electrical Press, Ltd. Price 21s. net.—The Manual shows no disposition to shrink in proportions. It has arrived at its twenty-first birthday, and is putting on flesh still, judging from its bulkiness. The only change that war and rationing appear to have produced in regard to its general appearance is that its white paper has become grey, but this is not at all a drawback. It contains statistical and general information respecting 2,500 electrical undertakings. The aggregate capital issued by the electrical companies registered in Great Britain is stated at £475,400,320, which is about £5,000,000 less than for the year 1916-17, the reduction being due mainly to the exclusion of companies which are not entirely electrical or British, and to the redemption of debenture capital. There is a section dealing with electrical undertakings in the Colonies. The events of the year are reviewed, financial results of electric light and traction undertakings are summarised comparatively, there are 50 maps, a directory of officials containing about 20,000 addresses, and all the usual interesting features. The work has made its appearance later than usual, but it is stated that advantage has been taken of the additional period to insert various accounts and particulars of a later date than in previous years.

The International Mercantile Directory and Year Book, 1918. Edited by A. M. Pooley, B.A. London: Syren and Shipping, Ltd. Price 5s. net.—This interesting and useful annual, with the sub-title: "The Decimal Book," first issued last year, has been improved in many respects; the commercial information has been widely extended, and the convenient conversion and exchange tables have been expanded. Additions have been made to the tables for converting metric and British measures to other systems, and an explanatory article on the decimal system, by Mr. Harry Allcock, has been inserted. The ground covered by the contents is extremely wide and varied, and the arrangement is very convenient for reference. Anyone engaged in international trade should find the book invaluable.

We have received from the National Electric Light Association, U.S.A., bound copies of the Papers and Reports of the Fortieth Convention, held in New York City, May 9th-10th, 1917, including the following sections:—Technical and Hydro-Electric Section, Commercial Section, Electric Vehicle Section, General and Executive Accounting Section.

"Notes on Screw Gauges." By the Staff of the Gauge Testing Department of the National Physical Laboratory. Teddington: W. F. Parrott. Price 2s. 6d.

"Technologic Paper of the Bureau of Standards." No. 98. Effects of Heat on Celluloid and Similar Materials. Washington: Government Printing Office. Price 5 cents.

"Science Abstracts, A and B." Vol. XX. Part 11. November 30th, 1917. London: E. & F. N. Spon. Price 1s. 6d. each net.

"First Report to the Council of the North-East Coast Institution of Engineers and Shipbuilders on Certain Methods of Producing Vacuum." Newcastle-on-Tyne: The Institution. Price 1s. 6d.

"Tramways and Light Railways Association Journal." The December number contains a list of members and their addresses.

Trade Announcement.—With a view to centralising their business in London the Stanton Ironworks Co., Ltd., have opened an office at Maxwell House, Arundel Street, Strand, W.C. 2, and matters relating to their coal and cast iron foundry business will be dealt with there. Telegraphic address: "Cobbles Eastland London." Telephone number: "Central 6808." Mr. Arnold Longden, who has represented the company for some years on the London Coal Exchange, will, during the period of the war, supervise the foundry section of the business in addition to the coal business. The Foundry Agency arrangement between the company and Messrs. Beck & Co., Ltd., has been terminated.

Tramcar Tires.—According to the *Journal* of the Tramways and Light Railways Association, the makers of tires for tramcars have announced that, in consequence of increases in the cost of labour, fuel, &c., the price of steel tires for tramcars for the first quarter of 1918 will be advanced 50s. per ton.

Lists.—**WESTERN ELECTRIC CO., LTD.**, North Woolwich, London, E. 16.—Postcard executed in colour, showing the Western Electric "Quead" electric fires as cosy comforts for the children. Packets of the cards for correspondence purposes will be furnished to the trade on application.

Liquidation.—**W. C. TACKLEY & CO., LTD.**—This company is winding up voluntarily. Liquidator, Mr. W. Peet, 1, High Street, Croydon. Meeting of creditors January 2nd, at 27, Queen Victoria Street, E.C. 4. Particulars to be sent to Mr. Peet by December 31st.

NATIONAL PROVINCIAL ELECTRICITY CORPORATION, LTD.—Winding up voluntarily. Mr. S. Gillatt, Balfour House, Finsbury Pavement, E.C., Liquidator.

Proposed Industrial Bank.—A report has been issued by the Committee on Banking of the British Empire Producers' Organisation recommending a scheme for a proposed Imperial Bank of Industry.

The general motive of the scheme is to afford readier financial support on sound principles throughout the United Kingdom and the Overseas Dominions and Colonies for producers and manufacturers, and, amongst other results, it is intended that there shall thus be, in any event, no opening for German financial intrigue in obtaining control of any group of industry.

The available capital is to be provided in the shape of debentures and deposits with State guarantee. Further capital will also be accumulated by the funding of profits, as apart from a small bonus to debenture-holders and depositors, all surplus will remain in the bank. Provision is made for government by boards of trustees, on which both employers and employed would be represented. A guarantee and capital of 50 millions sterling is proposed, £25,000,000 guaranteed by the United Kingdom, £6,000,000 each by Canada and Australia, £2,000,000 each by New Zealand and South Africa, and £1,000,000 each by Newfoundland and eight Dependencies and Possessions. The objects are stated thus:—

To strengthen and to extend producing and manufacturing industries already established in the Empire.

To assist in the foundation and development of new industries therein.

To assist by credit facilities in the sale of their products.

To assist them in procuring materials, machinery, and facilities from other parts of the Empire.

To assist in the acquisition within the Empire by its citizens of control and utilisation of its own products.

The foregoing to apply only to companies, firms, and individuals of British origin, whose registration is within the British Empire.

The methods by which the bank would carry out its objects are:—

Making advances by way of cash credits against such security or guarantee as the trustees shall deem sufficient.

Accepting drafts made against shipments or deliveries of industrial products or of materials.

Buying and selling bills of exchange against collateral security.

Issuing letters of credit.

Discounting trade bills.

Purchase of secured time payment accounts or by advances upon the same.

To assist and co-operate with other financial institutions in underwriting the share and debenture issues of present or future industrial undertakings.

To collect and collate information likely to be useful to its customers.

Sterling Workers.—On Friday night and Saturday, at mass meetings of the night and day workers, who assembled in the canteen and new rest room, the managing director of the Sterling Telephone and Electric Co., Ltd., Mr. Guy Burney, who was accompanied by Mr. E. Cholerton (works manager) and Mr. A. W. James (assistant works manager), gave an address of encouragement and congratulation.

Mr. Len Evans, the honorary secretary of the Rifle Section of the Sterling Athletic and Social Club, has been the recipient of a Christmas gift from the members of the section.

During the past few weeks the employees of the Sterling Works, by voluntary collections for deserving objects, have subscribed over £200.

The members of the Sterling Ladies' Foothall Section (A.A.S.C.), who have gone through the first half of the season undefeated, made a Christmas gift to A. Coach.

LIGHTING AND POWER NOTES.

Bath.—The Electric Lighting Committee reports that an offer has been received for the purchase of the Diesel engine plant, but before making any recommendation the Committee has instructed the engineer to inquire if it is possible to obtain the plant he would require to replace the Diesel engine, if sold, in readiness for next winter's load.—*Bath Herald*.

Belfast.—**LABOUR DIFFICULTY.**—On the 21st inst., about 100 men in the Corporation's electrical department went on strike for what is now known as the "Hills' bonus." The strike caused some disorganisation in the lighting and tramway systems, for when the electrical employees decided to "down tools," the coal carters at once struck in sympathy. The lighting and the tramways are carrying on fairly under the circumstances. The electrical department is in communication with the Ministry of Munitions on the subject.

According to Monday's *Times* the dispute was settled on Saturday. **PLANT EXTENSION.**—On the advice of Sir John Snell, it has been decided to scrap a turbo-generator at the power station, which has given considerable trouble. Fortunately, a big turbo-generator is, with the approval of the Minister of Munitions, to be released for the service of the Corporation. Its cost will be about £30,000, and with erection and supplementary plant, &c., the total cost will be about £60,000. The Electrical Committee is anxious to have the new power station at the harbour erected as soon as possible; as an alternative, it may be erected at the end of the Queen's Road on a site originally intended for a gas works.

Canada.—The Imperial Trade Correspondent at Toronto (Mr. F. W. Field) reports that the Ontario Hydro-Electric Power Commission has now in hand preparations for the establishment of its extensive electric generating plant at Chippewa Creek, near Niagara Falls, Ontario.

The Commission is at present only engaged in transmitting electric power from producing companies at Niagara Falls to customers throughout the Province, who take the current and distribute it. With the establishment of the generating plant the Commission will be in a position both to generate and distribute power.

It is first proposed to construct a canal between Chippewa Creek and Queenston, Ontario, at an estimated cost of \$9,000,000, after which the power house will be built and the plant installed. In view of the scarcity of labour and other considerations, the Commission has decided not to employ contractors, but will purchase the equipment necessary to carry on the work, and will undertake the construction of the plant as a public enterprise. The estimated cost of the equipment is \$1,000,000.—*Board of Trade Journal*.

Dublin.—**WAGES.**—At a special meeting of the Corporation it was agreed that the Electricity Committee should adjust on a satisfactory basis the application for increased wages by the technical staff of the electricity department. The Electricity Committee has decided to give the members of the engineering staff the awards granted by the Committee on Production.

East Ham.—**PRICE INCREASE.**—The Electricity Committee recommends increased charges as follows:—Current supplied to general consumers (including public lighting), an additional 13½ per cent. upon pre-war prices, making a total increase of 33½ per cent.; current supplied to tramway undertaking, an additional 10 per cent. upon pre-war charges, making a total increase of 20 per cent.

Haslingden.—**BULK SUPPLY.**—The Council has given notice to the Corporations of Accrington and Rawtenstall to terminate the agreement for the supply of electricity in bulk from December 31st, 1918.

Huddersfield.—**PRICE INCREASE.**—The T.C. has amended a minute of the Electricity Committee, so that the pre-war charges for electrical power and lighting should be increased to an amount to be decided from the date of the December readings of the meters.

Kidderminster.—**PROPOSED POWER STATION.**—At the last meeting of the T.C. the deputy town clerk laid before the members details of a scheme for erecting a large electrical power station on the banks of the Severn, at Stourport. A Bill, entitled the Worcestershire, Shropshire and Staffordshire Electrical Power Bill is being promoted, and Mr. J. A. Lycett, the managing director of the company, in a letter informed the Council that the station, when erected at Stourport, would be the largest power station in England. A member (Mr. Thursfield) said it was important that the progress of the Bill should be watched before Parliament. Ultimately the letter was referred to the General Purposes Committee.

Liverpool.—**DOCK LIGHTING.**—The Mersey Docks and Harbour Board has under consideration a scheme for the electrical illumination of the dock estate.

Luton.—**PLANT EXTENSION.**—The T.C. is to consider a report from the electrical engineer upon the urgent need for extending the electricity station buildings, and providing additional plant to meet the increasing and prospective demand for electricity.

Manchester.—**WAGES.**—As a result of the arbitration proceedings, the Corporation employes in the gas, electricity, water, and tramways departments will receive increases of from 12s. to 16s. per week as from January 1st next.

Rawtenstall.—**PRICE INCREASE.**—The T.C. has revised public lighting charges as from January 1st—viz., a standing charge of £5 per annum per kW. installed, plus secondary charges of 2d. to ½d. per unit, the latter for all above 60,000 units. Private lighting rates are also to be advanced 25 per cent.

Scarborough.—**PRICE INCREASE.**—The Electric Supply Co. announces that after the present meter readings the price of electricity for lighting will be 7d. per unit, for power 2½d. per unit, and for heating and cooking 1½d. per unit.

Southend-on-Sea.—**PLANT EXTENSION.**—The L.G.B. has informed the Council of its willingness to grant, when circumstances permit, the Council's request for sanction to borrow £15,520 for the provision of additional generating plant after the war.

Stratford-on-Avon.—**PRICE INCREASE.**—The General Purposes Committee has recommended by nine votes to four that the Electricity Co. be allowed to increase the price of current from 6d. to 6½d. per unit for the period of the war and a year after, and this has been ratified by the T.C.

Swansea.—At a recent meeting of the T.C., Alderman Martin moved for a reconsideration of the report of the Electricity Committee in regard to the proposed supply to the Harbour Trust, on the ground that the proposed terms would not be remunerative; this was denied in committee, Colonel Sinclair (chairman) and the borough treasurer both urging the advantage of securing the large consumers. The amendment was rejected by a large majority, and the report adopted.

Whitehaven.—**PRICE INCREASE.**—The T.C. has added a war charge of 20 per cent. in the price of current for lighting and power, from January 1st next.

TRAMWAY AND RAILWAY NOTES.

Blackpool.—**TRAFFIC FIGURES.**—The Corporation tramway receipts continue to show remarkable increases. From April 1st to December 13th the receipts were £93,782, which is £12,719 more than last year, and considerably higher than in any previous year. During the past month the receipts per car-mile were 3d. more than last year.

Continental.—**SPAIN.**—Application has been made to the Ministerio de Fomento for a concession to construct an electric tramway between Mataro and Argemona.

East Ham.—**FARE REVISION.**—It is proposed in the New Year to abolish return fares on certain routes, and the West Ham Council is to be approached with a view to abolishing return fares on through-running routes.

Halifax.—**WAGES.**—The tramway employes have made application for a further increase of wages. The present rate is 15s. per week, with bonus, above the pre-war rate; if the application is granted the increase will amount to £1 per week above the pre-war wages.

Huddersfield.—It was resolved by the T.C., last week, that sailors and soldiers should not in future be allowed to ride free on the cars between 12 noon and 2 p.m. and 5 and 6.30 p.m. On the suggestion of the transport authorities the Committee would allow every facility for the carrying of tradesmen's parcels on the cars.

Hull.—**WOMEN DRIVERS.**—The Tramways Committee has decided to appoint a number of suitable women as drivers for the period of the war, in view of the lack of efficient men drivers.

Lancashire.—A conference of a number of Lancashire tramway authorities was held at Manchester last week, but the men's representatives intimated that they would not accept the proposal of a modified service on Christmas Day, and they declined to submit any counter proposals.

LANCASHIRE AND CHESHIRE WAR WAGES.—Over 20 Lancashire and Cheshire authorities are concerned in the award just made by the Committee of Production, on the application of the National Union of General Workers, for a further advance in wages, bringing them up to 20s. a week over pre-war wages. Previously a war bonus of 9s. was being paid, and the offer to raise this to 12s. was declined. The Committee has now granted an award of 7s. per week, making the pay 16s. a week, to commence in January.

Leeds.—A Committee has been appointed to consider the question of the alteration of stopping places and diversion of traffic on the several routes, so that the traffic may be more expeditiously got away from the centre of the city. The question is to be brought before the Ministry of Munitions at an early date.

London.—**L.C.C.**—**TRAMWAY TRAFFIC CONGESTION.**—At the last meeting of the Council the chairman of the Highways Committee said the congestion was due to shortage of material for repairs and shortage of motormen. Wherever possible, motormen were not taken for the Army unless substitutes were provided, but there was no prospect of getting men back from the Front. As to the difficulty at the Victoria terminus, the Committee had asked the Ministry of Munitions to help it in the laying of loop lines, but, owing to the objections of the Commissioner of Police, it was not considered advisable to carry out the scheme.

WOMEN DRIVERS.—The Commissioner of Police is in communication with the War Office, Ministries of Munitions, Labour and National Service, on the subject of the issue of licenses to women to act as drivers of tramway-cars in the metropolitan district.

Rawtenstall.—**FARE REVISION.**—The T.C. is to approach the B. of T. with a view to a general increase in tramway fares.

Snowstorm in the West Riding.—On Sunday and Monday the Huddersfield and Halifax cars only reached West Vale with the greatest difficulty, whilst at Keighley the railless traction service to Oakworth had to be suspended entirely on Monday.

TELEGRAPH AND TELEPHONE NOTES.

New Zealand.—According to the report of the New Zealand Post and Telegraph Department for the year 1916-17, there was a steady extension of telegraphic and telephonic facilities in that period. Forty new offices were opened, bringing the total number up to 2,409 on March 31st last. Ten new telephone exchanges were opened, and two closed. The telephone exchange

system includes 3,897 miles of line and 142,469 miles of wire. The working of the wireless stations continued to be satisfactory. Improved methods of detecting signals by means of the ultraudion were introduced at Awanui, Wellington, and at Auckland; apparatus for other stations has been procured, and will shortly be brought into use. The signals of stations using damped and undamped waves invariably come in of readable strength from American, Asiatic, and European stations. The use of the detecting apparatus with a particular combination of the receiving circuits has demonstrated that daylight signals from stations using the ordinary wave-lengths can be rendered plainly audible, which, by the ordinary methods and the use of the crystal detector, could not be heard.—*Financial Times*.

Holland.—The firm of Siemens-Schuckert has just entered into a £116,500 contract with the Netherlands Government for the installation of a wireless telegraph service between Holland and the Dutch East Indies.

Poulsen Wireless System.—The Italian Government has taken over Valdemar Poulsen's Wireless patent. The owners of the Italian patent are a group of English financiers.

CONTRACTS OPEN AND CLOSED.

OPEN.

Argentina.—February 23rd, 1918. Rosario Municipality. Establishment of telephone service within the municipal radius. Conditions on application.

Bolton.—January 15th. Electricity Committee. One 7,500-KW. turbo-alternator with condensing plant. See "Official Notices" December 7th.

Keighley.—January 9th. Electricity Department. Introduced draught plant. See "Official Notices" December 21st.

Manchester.—January 16th. Electricity Committee. Rotary converter or motor converter plant. See "Official Notices" to-day.

Tipperary.—January 11th. New battery for the Union electric lighting plant. See "Official Notices" December 21st.

CLOSED.

Government Contracts.—List of new contracts placed November, 1917:—

WAR OFFICE.

Electric cables.—General Electric Co., Ltd.
Chassis, petrol and electric.—Tilling-Stevens, Ltd.
Dynamos. Electric Construction Co., Ltd.
Generating sets.—Austin Motor Co., Ltd.; W. H. Dorman & Co., Ltd.; Electric Construction Co., Ltd.; Smart & Brown.
Rubber and insulating tape.—Aucots Vale Rubber Co., Ltd.; Hooper's Telegraph and India-Rubber Works, Ltd.; India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; C. Macintosh & Co., Ltd.
Iron wire. Lancashire Wire Co., Ltd.; Rylands Bros., Ltd.; Whitecross Co., Ltd.
Works services electric lighting.—Edmundson's Electricity Corporation, Ltd.; Norris, Henley & Gardner, Ltd.

INDIA OFFICE.

Dynamos. J. Stone & Co., Ltd.

H.M. OFFICE OF WORKS.

Engineering services electric light and power wiring, Avonmouth and Barry Docks Grain Stores, T. Clarke & Co., Ltd.; Cardiff Grain Stores electric light and power supply, Land Bros. & Co.; New County Hall, Food Ministry, electric wiring, V. C. Middleton.

POST OFFICE.

Telephone apparatus.—Automatic Telephone Manufacturing Co., Ltd.; British L. M. Ericsson Manufacturing Co., Ltd.; Peel-Comer Telephone Works, Ltd.; Sterling Telephone and Electric Co., Ltd.; Western Electric Co., Ltd.
Testing apparatus.—Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
Submarine cable.—Siemens Bros. & Co., Ltd.
Telegraph cable. Cradock Electric Co., Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; India-Rubber, Gutta-Percha, and Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; New Gutta-Percha Co., Ltd.
Telephone cable. Connolly Bros., Ltd.
Dry cells.—Siemens Bros. & Co., Ltd.
Gutta-percha cells.—Siemens Bros. & Co., Ltd.
Telephone cords.—Siemens Bros. & Co., Ltd.
Telegraphic ironwork. Bullers, Ltd.
Telephone mouthpieces.—Siemens Bros. & Co., Ltd.
Insulator spindles. Bullers, Ltd.; Ginst, Keen & Nettlefolds, Ltd.
Cable suspenders. T. H. Bangen, Son & Co.
Telephone sets.—Western Electric Co., Ltd.
Telephone terminals. Parker, Winder & Achurch, Ltd.
Bronze wire. T. Bolton & Sons, Ltd.; British Insulated and Helsby Cables; Shropshire Iron Co., Ltd.; F. Smith & Co. (incorporated in the London Electric Wire Co. and Smiths, Ltd.).
Lead and flame-proof wire.—C. Macintosh & Co., Ltd.
Galvanised iron wire.—Dorman, Long & Co., Ltd.; Johnson & Phillips, Ltd.; Rylands Bros., Ltd.; Whitecross Co., Ltd.

London.—**POPULAR.**—The entry headed "Stepney" in our last issue requires correction. For *Stepney* read *Peplar*. The amount of Messrs. Bruce Peebles's tender was £3,850, not £3,580.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, December 28th. At 8 p.m. At 39, Victoria Street, S.W.1. Paper on "Water Circulation in Boilers," by Mr. H. Josling.

Friday, January 4th. At 8 p.m. At 39, Victoria Street, S.W. Paper on "Some Aspects of Lubrication," by Mr. H. E. Cosgreave.

Royal Institution of Great Britain.—Saturday, December 29th. At 8 p.m. At Albemarle Street, Piccadilly, W.1. Christmas Lectures, "Our Useful Servants: Magnetism and Electricity"; "Electricity and Electric Currents" (II). Tuesday, January 1st, "The Electric Current as a Heater and Chemist" (III). Thursday, January 3rd, "Electricity as an Illuminator and Doctor" (IV). Saturday, January 5th, "Electric Dynamos, Motors, Transformers and Railways" (V), by Prof. J. A. Fleming, F.R.S.

ELECTRICITY SUPPLY ORGANISATION.

FOR some time past the future of electricity supply in Britain has been the *pièce de résistance* of British electrical journalism, and naturally so, for apart from the broader aspects of the matter, it must be recognised that any great extension of supply facilities will, with a moderate amount of business organisation, result in unparalleled prosperity to by far the most important section of the electrical industry. As regards the actual steps taken to secure this future, the past year or two has been marked by conference and negotiation, by a hopeful measure of co-operation, and not least by the realisation on the part of the Government of the invaluable character of the services which an adequate supply of electricity can render in promoting the prosperity of the nation.

It is at least certain that the various committees which have taken this matter in hand will amongst them evolve a scheme or schemes for the production and distribution of electricity on more advantageous terms and on a much more extensive scale than has been possible in the past—more one cannot say at present.

So much for the technical aspect of the matter, the importance of which will be granted. But what of the other side—the equally important question of providing the indispensable market for the commodity which we hope to see in universal use?

Can we claim to have made the slightest effort to secure the greatly extended outlet for the vastly increased amount of energy which should be available if our schemes mature, and on which, in fact, the maturing of such schemes absolutely depends? We think not; we are in effect preparing to hurry up production, while leaving sales to take care of themselves—an inconsistent procedure which will not commend itself to the commercial mind for one moment. The future of electricity supply absolutely depends on the commercial stability of the great undertakings which may arise from our present efforts; business in hand and business in prospect are essential to satisfactory finance; the business end of electricity supply, especially the potential demand for electricity, is the foundation on which all our schemes for the future depend. Yet we cannot point to any concerted action whatever by the supply industry of Great Britain, with a view to securing its position in this respect. The electricity supply situation at the moment appears to be as follows:—

PRODUCTION OF ELECTRICITY ON A LARGE SCALE.

SALE OF ELECTRICITY ON A LARGE SCALE.

We have the Board of Trade Electrical Supply Committee; the Interconnection Committees of Lancashire and Cheshire, Yorkshire, West of Scotland, South Wales, West of England, North-East Coast, Devon and Cornwall, &c., and the Provincial Electric Supply Committee, backed by the I.E.E., the Municipal Electrical Association, and the Associated Power Companies, working for the unification and co-ordination of supply by interconnection, bulk supply, and the utilisation of available waste heat sources, to the end that an abundant supply of electricity shall be available for all classes of consumer in the United Kingdom.

?

Let us make no mistake: if the schemes at present under consideration are ever realised, the electric supply industry of Britain will become the *greatest industrial organisation in the country*. A great and organised business will have to be developed from the initial stages represented by some hundreds of supply undertakings, which are isolated units as regards their commercial management, and have no effective organisation for the co-operative effort which is obviously indispensable to the success of the larger project.

Looking round at our potential business, we may say as regards:—

Lighting.—At the present time a generous estimate of electricity consumers is $2\frac{1}{2}$ to 3 per cent. of the population supplied: the comparable figures for gas consumers are 25 to 29 per cent., so that there are, roughly, ten times as many consumers of gas. As we know that the majority of the latter are lighting consumers, it follows that we have only touched the fringe of the possible electric lighting business of domestic consumers.

Cooking and Heating.—Pioneering efforts have been fairly successful, especially with large installations, a recent estimate placing the latter at about 400 installations, of 22,000 KW.: domestic electric cooking, satisfactory, though in its initial stages, awaits co-ordinated effort and organised manufacturing and salesmanship: domestic electric heating has progressed with the rise in fuel values, but is only in the initial stage, while domestic water heating as a popular proposition is strictly a problem of the future.

Domestic Power.—Practically untouched: a very small motor, which is not a toy, and yet sells at a reasonable price, is badly needed.

[Generally, it may be said that the domestic consumer has been practically unexploited. Take an actual example: A consumer who used 400 units per annum for lighting, increased his consumption to 7,000 units a year, with electric cooking and heating, and thermal-storage water heating added, doubling his load factor and paying an average of $\frac{3}{4}$ d. per unit, the rates being—l., 5d.; c. and h., 1d.; t.s., 0.3d.]

The war has emphasised the importance of "domestic engineering" as a means of avoiding labour strain in the household. Due to the lack of initiative of the supply industry, the enormous advantages of electricity for light, power, and heating are not realised by the general public, while the architectural profession, on which much depends, has made no special study of the influence of electrical methods on domestic economy.]

Factory Driving.—This is the most progressive branch of electricity supply, but still offers immense scope for development, if Dr. Crowley's statement that only one-half of 1 per cent. of the power required by our textile factories is purchased from supply undertakings is any indication.

Mr. Robertson, at the last I.M.E.A. Conference, assumed that 13 million H.P. were employed in factories at the present time, and Mr. Selvey showed that if only half this were supplied electrically under average conditions, some 8,500 million units per annum would be required, which contrasts with the present output of all statutory undertakings, for all purposes, of 2,000 million units per annum. The result of intensive development of considerable areas, with concentrated and scattered coal, iron, and steel industries, can be judged from the work of the N.E. Coast power companies. As regards individual cities, we have a recent estimate from Leeds that nearly 40 per cent. of the power used in the city is supplied electrically: in Bury, a textile centre, Mr. Watson estimated that 20 per cent. of the power used was electrical.

In 1906, a canvass of factory power users in the County of London showed a total of 208,800 H.P., or 156,000 KW.: in 1913, Mr. Frank Bailey stated that the electrical power connections in that area amounted to 135,000 KW., or 86 per cent. of the foregoing amount.

Power estimates must, however, be treated with reserve: industrial power requirements are constantly growing, and factories show a tendency to move outside town areas.

Industrial Heating.—In its initial stages: it was estimated that 90 electric steel furnaces were in use in January, 1917, as against 7 in 1910. [It is stated that the electric furnace load at 51 steel mills in the U.S.A. amounts for 300 million units per annum.] Industrial low-temperature heating for baking, drying, annealing, tempering, melting, &c., also for electric welding, brazing, &c., offers great possibilities for development, and is little appreciated as yet in this country.

Electrochemical Work.—An established industry on a small scale; modern views on the development of the carbide, nitrate and other chemical industries will, if they materialise, lead to an unprecedented expansion of electricity supply for such purposes in the future if the price of energy can be brought low enough.

Electric Tramway Traction.—Offers little scope for development, under present legislative conditions.

Electric Railway Traction.—One of the most important fields of future electrical development: partial suburban electrification at London, Manchester, Liverpool, and Newcastle: no main line electrification yet undertaken.

Electric Vehicle Traction.—In its initial stage. About 1,000 vehicles in use, or on order, as against 150 in 1914.

Offers enormous opportunity for development: progress due to organised effort of Electric Vehicle Committee of Great Britain, but its advantages still unrealised by the carrying public.

While we have only roughly surveyed the position, it is possible to deduce from it the fact that huge opportunities exist for future business in electricity supply: much of this business is, no doubt, a legacy of the *laissez faire* conditions existing in the electrical industry in the past, and the latter would, as a whole, have been incomparably better off to-day had initiative, enterprise, and patriotic support for its objects been more conspicuous features of its policy.

We shall never realise the progressive future which has been sketched out for us unless our electricity suppliers abandon the haphazard individual methods of the past, and adopt some common-sense proposal for establishing a community of interests, to develop their general business policy and popularise their dealings with the public.

The sale of electricity depends on the appreciation of the public, and the supply industry must realise that the latter is virtually in partnership with it, and demands to be taken into its confidence sufficiently to appreciate what it is doing and why it is doing it.

Now, while the private interests of the various elements composing the electricity supply industry in this country may not be reconcilable to any extent—and the petty jealousy of adjacent municipal authorities is quite as serious an obstacle to harmony as the rivalry of municipal and company interests—yet the business interests of all concerned, as regards their dealings with the public, present a sufficient similarity to justify the formation of a suitable organisation to give common expression to these common aims at least.

Whether this organisation is on the lines of the British Commercial Gas Association, or of the American Society for Electrical Development, or is a British counterpart of the more ambitious American National Electric Light Association, is immaterial at the moment, so long as an association is formed which is representative of the supply industry as a whole, for the purpose of directing and supporting the efforts of our undertakings to develop electricity supply with a view to the benefit of all.

We have in our midst several associations connected with electricity supply. If the strongest of these—for someone must make the first move—were to invite the others to join it in a preliminary discussion of the subject, this would serve, if no other purpose, at least to enlighten us on the peculiar conditions, which we have evidently overlooked, but which presumably exist, to prevent a great industry—the members of which have one common object in view—from adopting methods which every comprehensive industry finds it essential to adopt, and which, in fact, American central-station interests adopted many years ago in their dealings with the public.

It may be that there are still many in the industry with a limited outlook, many who do not realise that from little private plants, supplying a favoured few, our undertakings are growing into public utility corporations with responsibilities of a national character and Government interest behind them, whose business is not only the sale of energy but also to serve the public in all matters appertaining to electricity supply. To all such we appeal to take the broad view: it is the turn of the big town to-day, but it may be the turn of the small one to-morrow, if it offers the facilities and enterprise which are attractive to new industries. Above all, we would urge those engineers who favour the mole in their methods of dealing with the public to remember a certain old American saying that:

He who whispers down a well
About the goods he has to sell,
Won't reap the gleaming, golden dollars
Like him who climbs a tree and hollers.

Electric Postal Vans in Switzerland.—The Postal Authorities of Zurich have lately put in service a couple of electric motor vans, built by Messrs. A. Tribelhorn, of Feldbach, who are described as the only manufacturers of this type of automobile in Switzerland. Similar vehicles are also said to be in hand for the Postal Service in Geneva.

Electricity and the Growth of Crops.—According to the report of the Development Commissioners for the year ending March 31st last, among the grants made was one of £1,330 to the Imperial College of Science and Technology for an investigation into the effect of electrical discharge on the growth of crops,

OUR HALF-YEARLY INDEX.

As it is necessary to effect every possible economy in paper consumption, the Index to Vol. 81 of the *ELECTRICAL REVIEW*, which will be printed in the course of a few weeks, will be supplied only to those who, through the post, specially apply for it. To such it will be supplied for 3d. post free. Any reader or advertiser at Home or Abroad who requires a copy for binding, or for other purposes, is asked to make application therefor promptly to: The Publisher, *ELECTRICAL REVIEW*, 4, Ludgate Hill, London, E.C. 4.

NOTES.

Educational.—**BIRMINGHAM UNIVERSITY.**—At the annual distribution of certificates at Warwick School, Sir Oliver Lodge, in congratulating the successful boys, said he was much impressed by the almost luxurious provision in the school for the teaching of chemistry and physics. He hoped this development in scientific instruction would, among other things, blossom in the application of science to agriculture, for the teaching of which there would shortly be a chair at Birmingham University. The one thing that had been neglected in this country was the scientific and thorough cultivation of the land, with the aid of which the country might nearly feed itself. He hoped Mr. Fisher's Education Bill would be passed without too much delay and that Mr. Fisher would deal with the Universities, because education needed to be reconstructed from top to bottom.

The A.E.G.—Apart from the political remarks on the general situation which Herr Walter Rathenau made, at the request of certain shareholders, at the recent general meeting of the A.E.G., very little information of external interest is reported in the German newspapers as having been laid before the assembly. As in former years, a small minority condemned the accumulation of such large disclosed and undisclosed reserve funds, it being urged that a higher dividend than 12½ per cent. should be paid, seeing that at the present quotations the shares only yield about 5 per cent. The question of the disposal of the large interests held in the Electro Works was explained by the chairman at some length, and the impression to be formed from his observations, is that if the company has made some financial sacrifice in transferring the undertaking to the Government, the directors are glad to be relieved of what had become a burden under the effects of the war. A third matter referred to was raised by a representative of the staff, who advocated the grant of an increased war bonus to the employes, but the chairman ruled that the subject could not be discussed in general meeting, as it was one for the managers and the Committees or the Conciliation Boards. The political part of the chairman's speech closed with the remark that "our foreign business lies in strong hands in which we trust." Such an observation was undoubtedly true all over the world prior to the outbreak of war. It is, we believe, none the less true now in so far as neutral countries are concerned, particularly in South America, owing to the formation of native companies, the German interests in which it will be difficult for transmarine States to eradicate, if they are fully disposed to take this step in those cases where South American countries have recently joined the Allies or discontinued diplomatic relations with Germany.

Magneto Flash Lamps.—Referring to our article on this subject, published on October 26th, Mr. F. Westmoreland, from whose article in the *Model Engineer and Electrician* we obtained the illustrations of an actual example, points out that the drawings were made and supplied to him by Mr. Thos. Hindle, of Manchester, the owner of the lamp. We understand that the question of manufacturing such lamps in this country is under consideration.

The Effect of Heat on Celluloid.—A new publication of the U.S. Bureau of Standards (Technologic Paper No. 98), entitled "Effects of Heat on Celluloid and Similar Materials," contains a study of the behaviour of celluloid, and of pyroxylin plastics in general, when heated to different temperatures, commencing in the neighbourhood of 100° C. Above this temperature the heat of decomposition may raise the temperature of the mass to the ignition point. At 170° C. decomposition takes place with explosive violence. Pyroxylin plastics can be ignited by momentary contact with bodies having a temperature of 130° C. and upwards. The rate of combustion is five to ten times that of poplar, pine, or paper under the same conditions. The vapours evolved during the decomposition of pyroxylin plastics are poisonous and extremely combustible, and may be ignited by the heat of decomposition. A copy of the paper may be obtained by those interested by addressing a request to the Bureau.

Tracing Linen for Bandages.—Understanding that tracing linen used for plans is useful for bandages for wounded soldiers, Westminster City Council has authorized the engineer to go through the old plans and dispatch to the hospitals any old tracing linen of no further use as official records.

Many of our readers are probably in possession of large quantities of old tracings which could thus be usefully turned to account.

Volunteer Notes.—**COUNTY OF LONDON VOLUNTEER ENGINEERS (FIELD COMPANIES).**—Headquarters, Balderton Street, Oxford Street, W. 1.

Orders for the week ending January 5th, 1918, by Lieut.-Colonel C. B. Clay, V.D., commanding:—

Officer for the Week.—Lieut. C. E. Campbell.

Next for Duty.—Lieut. W. J. A. Watkins.

Monday, December 31st, 1917.—No. 3 Company, 6.30—8.30. Recruits' drill, 6.30—8.30. Signalling Section, 6.30—8.30.

Tuesday, January 1st, 1918.—Lecture on "Demolitions," 6.30, by Capt. Fleming. Physical drill, 7.30.

Wednesday, January 2nd.—No. 1 Company drill, knotting, and lashing, 6.30—8.30. Recruits' drill, 6.30.

Thursday, January 3rd.—No. 2 Company drill, knotting, and lashing, 6.30—8.30. Recruits' drill, 6.30. Signalling Section, 6.30—8.30. Ambulance Section, 6.30—8.30. Medical examination of recruits, 6.30—8.30.

Friday, January 4th.—Musketry, 5.30—8.

Saturday, January 5th.—Entrenchments, &c., 2.45—4.45. Recruits' drill, 2.45—4.45.

Sunday, January 6th.—Commandant's parade at Waterloo Station (opposite No. 10 Platform), 8.45 a.m., for work at Esher. Uniform, haversacks, and water bottles and mugs. Mid-day rations to be carried.

Note.—All drills and parades will be at Headquarters unless otherwise stated. Recruits will attend for engineering instruction with the companies.

(By order) MALEOD YEARSLEY, Capt. and Adjutant.

Communication with Aircraft.—It is reported that the French Army has recently introduced a novel form of miniature searchlight, operated by electricity and equipped with a telescope. When in use the searchlight is held in the hands of the operator, so as to bring the telescope into sighting position. The searchlight is aimed at the aircraft with which communication is to be established and maintained, and the operator then sends the messages by means of a tapping key on the side, causing long and short flashes of light to spell out the words or numerals in the telegraph code used. By means of the telescope the operator is able to see the distant flashes of the answering searchlight, and in this manner two-way communication is maintained as long as desired. The new signalling equipment is light in weight, consisting of but the searchlight and battery, and therefore readily portable.—*Aircraft.*

A Hut for Signal Service Officer Cadets.—The Administration Officer at the Headquarters of the Signal Service Officer-Cadet Company, R.E., Lieut. F. S. Paterson, R.E. (late of Messrs. Johnson & Phillips) informs us that the present establishment includes Canadians, Australians, South Africans, and men from other parts of the world, as well as from the British public schools. During his course the Officer-Cadet has to become technically efficient, besides undergoing a strenuous training, and there is an urgent need for accommodation to enable the Cadets to study during the evenings and the week ends, as the technical knowledge of modern methods and apparatus for communication that they must acquire is very extensive and detailed. Lieut. Paterson, therefore, appeals for a hut for, say, 100 Cadets, with a suitable equipment for the purpose described above. The Signal Service Officer-Cadet Company is closely associated with the electrical industry, and its members are worthy of the strongest support. We earnestly commend the matter to the notice of our readers, especially those engaged in the instrument and cable-making trades, to whose sympathies the project should appeal. Lieut. Paterson's address is Cadet Company, R.E., Haynes Park, Bedford.

Institution and Lecture Notes.—**Royal Institution.**—The official list of lecture arrangements up to Easter, 1918, has been issued, and contains announcements of the following events:—

At 5.30 p.m.

Friday, January 18th.—"Studies on Liquid Films," by Prof. Sir James Dewar, F.R.S.

Friday, January 25th.—"The Motion of Electrons in Gases," by Prof. J. S. Townsend, F.R.S.

Friday, February 8th.—"Science and Ethics," by Principal E. H. Griffiths, F.R.S.

Friday, March 8th.—"Vibrations: Mechanical, Musical, and Electrical," by Prof. E. H. Barton, F.R.S.

Friday, March 22nd.—"Radiation from System of Electrons," by Prof. Sir J. J. Thomson, Pres. R.S.

At 3 p.m.

Tuesdays, February 25th and March 5th.—"The National Physical Laboratory: (1) A National Laboratory of Industrial Research; (2) A National Proving House and Standardising Laboratory," by Sir R. T. Glazebrook, F.R.S.

Saturdays, January 19th and 26th.—"The Chemical Action of Light," by Prof. W. J. Pope, F.R.S.

Saturdays, February 16th, 23rd, March 2nd, 9th, 16th, 23rd.—"Problems in Atomic Structure," by Prof. Sir J. J. Thomson, Pres. R.S.

The first of the series of six Christmas Juvenile Lectures on "Our Useful Servants: Magnetism and Electricity," was delivered by Prof. J. A. Fleming, F.R.S., yesterday afternoon.

Institution of Electrical Engineers.—A meeting of the NEWCASTLE-UPON-TYNE LOCAL SECTION was held on December 18th, the chairman, Mr. A. H. Marshall, presiding. A reception was held by the President of the Institution, Mr. C. H. Wordingham, who was supported by Mr. Marshall, and, subsequently, the President addressed the gathering. After having thanked the members for their very cordial reception, he said he felt that it was desirable that the Local Sections should be cognisant of what was going on in London. There was a persistent tendency on the part of a section of the electrical Press to belittle the Institution, which he did not think was conducive to its best interests, but was rather mischievous. Constructive criticism was a good thing, and there was nothing he liked better than honest criticism, but when they saw the Council of the Institution always attacked, and it seemed that it could not do right, there grew up a feeling which spread like a canker, and the members felt that the Council was no good. The influence of that section of the Press was not beneficial, but undoubtedly mischievous. If the Institution were to progress, they must have loyal support. They had seen various organisa-

tions go ahead, and he thought the reason for it was to be found in their extremely pushful policy. That Institution could not afford to sit down and wait for something happening, but must go ahead. At the present time, if they wanted to deal with any question they were not able to command the whole of the sections of the industry; he did not know why, but they could not. It was, therefore, necessary to get them together. He felt it was essential to carry all sections of the industry in anything they had to do. In adopting such a pushful policy they must take risks, but nothing was more deadening than the feeling that they must not attempt so and so because "it might fail"; or because "years ago they had tried it, and it had failed," or because some questioned its wisdom—they must take some risks. The first step, he thought, to a wider influence, and a better position, was to obtain a Charter. He referred to that in his inaugural address, and he found he had the Council with him. If they could, they would go in for a Royal Charter. Referring to some of the activities of the Institution, and speaking of research work, the President said the question of insulating materials had been before them even before the war, and the outbreak had greatly emphasised the need of research upon this question. A Joint Committee had been formed of three members of the B.E.A.M.A. and three of their members, and their harmonious efforts were making steady progress. The relations between their Research Committee and that of the B.E.A.M.A. were wholly cordial. He had suggested the appointment of a research organiser, a man of scientific training, with engineering experience, whose function would be, not to interfere with anything that was existing, but to act as a go-between, to co-ordinate the work, and to give some impetus to it. It was impossible for the chairman of the Committee, or for the permanent officials, to give the time that was needed. The research organiser would see that the research workers had the facilities they required, and the materials they required, in proper form and carefully prepared. There had also been a good deal of hard work done with regard to standardisation. This included high-pressure switchgear, and he thought it would be most unfortunate if British standards were not fully borne in mind. The purely British switchgear produced in that neighbourhood had set before it a maximum ideal of switchgear. The margin of safety was greater than in general practice, but either that margin of safety was necessary or not, and in that connection a great deal of research work was required. He thought it would be an excellent idea if there could be set up in that district an Advisory Committee able to undertake research work into switchgear, with a view to advising the Committee on this matter. The President concluded with a reference to the desirability of the establishment of a Proving House, which would only give its hall-mark to gear produced by British makers, and which would show that that type of article had conformed to the standards laid down by the Standards Committee. The President was cordially thanked for his address, on the motion of Mr. H. W. Clothier.

Association of Mining Electrical Engineers (West of Scotland Branch).—On Saturday, January 12th, Mr. J. H. C. Brooking will read a paper on "Cable Complaints." There will be a display of cable joint-boxes and a demonstration of repairing of cable trailing cable.

Appointments Vacant.—Shift engineer, for the Lancashire Electric Power Co. (£17 per month); Head of the Electrical Engineering Department of the Loughborough Technical Institute (£220 + £30 war bonus); mains assistant, for the Borough of Dover Electricity Department; district electrical engineer, for the War Department, South Irish District; teacher for the training of disabled soldiers in electrical work (£4) for the Middlesex Education Committee. See our advertising pages to-day.

A Novel Use for a Motor-Car Electric Lighting Set.—The testers at the Fiat Motor Works in Turin, Italy, have discovered a new use for the electric lighting sets on motor-cars, which will doubtless be of interest, and serve as an example, to car owners in this country. These men are called upon to test cars in extremes of weather and temperature, and as motor chassis under test cannot be fitted with wind-screens, the problem of keeping warm while driving on Alpine roads is one of no small order. The Fiat testers are now, consequently, being supplied with electrically-heated gloves, the necessary current being drawn from the electric lighting equipment on the car. The gloves have resistance wires set in the back, between two layers of thin sheet asbestos; connection is made to the electric light terminals at the most convenient points, and the fine flexible wires are attached to the wrist of the gloves by means of press-on buttons. The wires are of sufficient length not to interfere in any way with driving, and the current passing through the resistance is said to keep the hands at a warm temperature even on the coldest day. When it is necessary for the driver to leave the steering wheel of the car, the wires can be instantly disconnected from the gloves merely by a pull on the press-button connections. A similar method of obtaining warmth has been adopted by military aviators, whose clothing is now electrically heated on much the same plan.

The Functions of a Borough Electrical Engineer.—As we go to press we have received the following letter:—

"My attention has been called to a letter in your last issue purporting to be signed by Mr. H. Brand, and headed 'The Functions of a Borough Electrical Engineer.'

"In fairness to the borough electrical engineer, the public should know the true facts, which are as follows:—

"My company had an inflated claim made against it by Mr. Brand, who, when he could not get his exorbitant demand satisfied, issued a summons in the East Gravesend County Court

"The matter, on behalf of the company, was placed in the hands of Mr. George Clinch, solicitor, who advised a quite reasonable amount being paid into Court, and that a subpoena should be issued for the attendance of Mr. Melnes as an expert. This was done, and Mr. Melnes was served, and therefore was bound, under a very heavy penalty, to attend. He had no option.

"The judgment shows very clearly what the Judge thought of Mr. Brand's claim.

"ARTHUR GREEN,

"Manager and Secretary, Grand Theatre of Varieties (Gravesend), Ltd.

"Gravesend, December 24th, 1917."

[We are pleased to publish this letter, which gives an entirely different aspect to Mr. Melnes's connection with the case. We may add that, according to our present information, far from knowing "absolutely nothing of the case," Mr. Melnes was consulted by the theatre company as to the working of certain electrical apparatus, and advised the company as to the repairs that were necessary, before the work was entrusted to Mr. Brand: he was, therefore, fully conversant with all the circumstances and in a proper position to give professional evidence as to the facts.—EDS. *ELEC. REV.*]

Explosion at Krupp's Power Station.—Press dispatches from Holland state that an explosion which occurred at the electric power station at Krupp's, at Essen, seriously damaged the building, also that the works were set on fire.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Central Station and Tramway Officials.—At a meeting of the Birmingham Electric Supply Committee on December 19th, MR. ERNEST JOHN JENNINGS, the secretary of the St. Marylebone electric supply undertaking, was selected to be recommended to the City Council at their meeting on January 8th for appointment as secretary of the electric supply department, in succession to Mr. Howard Foulds, who leaves at the end of the year to take up his new position in London. There were 266 applicants for the post, and three candidates were interviewed by the Committee. Mr. Jennings, who is 46 years of age, has held his present position at Marylebone for 13 years. Previously he was in the employ of the St. Pancras electricity undertaking. At the same meeting the Lord Mayor presented to MR. FOULDS a copy of the following resolution, engrossed on vellum, and signed by the Lord Mayor and the chairman of the Committee:—

Resolved unanimously, that the Electric Supply Committee of Birmingham receive with great regret the resignation of Mr. Howard Foulds as secretary of the electric supply department, and desire to place on record their high appreciation of the energy, ability, and tact with which he has successfully performed the duties of that office since his appointment, which has covered a period of over seven years. This period has witnessed an exceptional development in the operations of the electric supply undertaking, first, owing to the extension of the city and the absorption of the Aston Manor and Handsworth electric supply undertakings, as well as carrying the operations of the department into a large portion of the areas of Yardley and King's Norton; and, secondly, owing to the exceptional demand for electrical energy which has arisen during the progress of the present war. The work that has fallen upon the shoulders of Mr. Foulds has been heavy and responsible, and the Committee are pleased to recognise that he has fulfilled the demands made upon him to their complete satisfaction; they consider that the department has gained in efficiency by his efforts, and he will leave behind him a record of work which will be remembered and appreciated by the Committee and his colleagues, and they assure him that he enters upon his new appointment with their best wishes for his future prosperity.

Riford U.D.C. has confirmed the engagement of MR. W. GREENWOOD as temporary third engineer in charge, at £150 per annum and war bonus.

The Heston and Isleworth E.C. recommends that the salary of MR. E. W. JAMES, power station engineer, be increased to £250 per annum, rising by annual increments of £25 to £300; and that MR. T. W. GANDER, mains foreman, be granted an increment of £12 10s. per annum, with subsequent increases of £12 per annum to a maximum of £200.

MR. RUDOLPH THOMSON, shift engineer at the power station of the Lancashire Electric Power Co., has been appointed charge shift engineer at the L.C.C. generating station at Greenwich, at £250 per annum, rising to £300 per annum.

Barnes U.D.C. has increased the salary of the assistant electrical engineer to £300 a year, plus a war bonus of 7½ per cent. per annum.

MR. J. RENSCHAW, of the Bury Corporation electricity works, has been appointed chief assistant at the Fleetwood electricity works.

It is announced in the *Financial News* that MR. F. DUDLEY DOCKER, C.B., of the Metropolitan Carriage, Wagon, and Finance Co. Board, has joined the directorate of the British Westinghouse Electric and Manufacturing Co., following the financial interest taken by the Metropolitan Co. in the British Westinghouse Co., whose American-held shares the first-named company lately acquired.

MR. J. W. DARLING has resigned his position with Messrs. Jonas Brook & Bros., Meltham Mills, and has joined the staff of Messrs. John Baker & Co. (Rotherham), Ltd., at Kilnburst Steel Works, as electrical engineer.

General.—The *Times* announces the engagement of **LIEUT.-COLONEL ARTHUR FAWCUS, M.C.**, second son of the late Mr. James Fawcus, to Miss Alexandra James, of West Dean, Chichester.

MR. C. J. HUNT, chief engineer to Messrs. Bruce Peebles & Co., Ltd., was married on 22nd inst. to Miss Marion V. Lambert, of Edinburgh. Mr. Hunt was presented with a case of cutlery by the officials and staff.

Roll of Honour.—**RIFLEMAN H. ALLEN**, 11th K.R.R., served his apprenticeship in the composing department of the *ELECTRICAL REVIEW*, in which he was employed continuously for about 16 years. He fell in action on September 20th, 1917, aged 29 years. He was an ardent supporter of the (B.P.) Boy Scout movement, being mainly in training in founding the 1st Scout London (1st of Own) Troop, and their first Scoutmaster. He was of a quiet and unassuming disposition, and his loss is much regretted by all who knew him. In a letter to his relatives an officer of his unit comments on his bravery and on his popularity amongst his comrades.

ACTING-CAPTAIN and **ADJUTANT V. C. RUSSELL** (Suffolk Regiment), younger son of Mr. Stuart A. Russell, works manager of the India-Rubber Co., Silvertown, has been awarded the Military Cross. Early this year, Captain Russell (then Second Lieut.) was wounded for the second time. He had then been twice mentioned in dispatches. **PRIVATE A. E. HAFENDEN** (Lancashire Regiment), formerly in the general office of the same company, was killed in action on October 22nd. **PRIVATE E. T. S. MORRIS** (London Regiment), of the same department, has been gassed.

LIEUT. W. H. GOULDSTONE, R.F.C., who has been mentioned in dispatches by Sir Douglas Haig, was up to his enlistment in the Navy, early in 1915, on the staff of the electrical engineer at West Ham. He served in the Dardanelles, and in August, 1916, was transferred to the R.F.C. He was recently wounded, and is in hospital at Eaton Square, W.

SAPPER DONALD TEE, R.E., who was on the staff of the Chichester electric light works, has been killed whilst engaged under heavy fire repairing a communication wire.

CORPORAL H. P. ARNOLD, R.E., who was in the turbine works of the B.T.H. Co. at Rugby, has fallen in action.

PRIVATE FRANK CORNALL, King's Liverpool Regiment, who has been wounded in action, was employed at Blackpool electricity works.

FLIGHT SERGT. T. HAROLD AMES, R.F.C., has been gazetted Second Lieutenant. Enlisting early in 1915, he has seen active service in most of the air raids on the South-East Coast as gunner observer, being wounded during one. He was apprenticed to Mr. Thomas Barton, electrical engineer, Blackburn.

CITY NOTES.

Vera Cruz Electric Light, Power, and Traction Co., Ltd.

MR. V. W. YORKE, in addressing the annual meeting, referred to the difficulties that had arisen in preparing the accounts. The two years which they covered had been the most difficult in the company's history. The net results showed a loss of only £702. During the entire period the exchange value of the Mexican paper currency continued to depreciate, but negotiations with the State authorities for increasing the tariffs and the tramway fares compensated to some extent for exchange losses. During the year 1916 the net earnings were some \$12,500 higher than in 1915. It had not been possible to make any provision for depreciation of plant and machinery except for the operation of the first mortgage debenture sinking fund. There was a substantial figure to the credit of depreciation and general reserve account which had not been drawn on in any way. The company continued to receive its power from the hydro-electric plant of the Puebla Tramway, Light & Power Co., and except for intervals of short duration, when that company's transmission line had been out of service on account of the activity of rebels in the district, the supply had been continuous. In 1915 out of 6½ millions K.V.-hours consumed only 351,000 were generated by their own plant, and in 1916 out of practically the same consumption their own plant generated 115,000. The steam turbine plant, which was installed temporarily pending the completion of the Puebla Co.'s transmission line, had been disposed of on satisfactory terms. The company's property had been maintained in good condition, and many improvements had been made in the tramway tracks. New car barns, offices, and shops were in the course of construction, and many new ornamental posts for street lighting had been installed. Although the conditions of the country were by no means settled, the outlook for the current year was extremely satisfactory. All sections of the company's business showed improved results as compared with the year prior to the revolutionary disturbances. For the month of September this year, as compared with the corresponding month of the previous year, the total K.V.-hours delivered had increased 110 per cent., and the number of consumers of light had increased 110 per cent., and there was an increase in H.P. (in motors) connected of 52 per cent. In the tramways section the

number of passengers carried had increased 70 per cent. to upwards of half a million passengers per month. The total gross revenue in Mexico showed an increase of 94 per cent., and although expenses were necessarily higher on account of increased wages, additional taxation, &c., the net earnings showed a satisfactory increase of 65 per cent. He was not without hope that when the accounts for this year were completed it might be possible to recommend a resumption of dividends on the ordinary shares. There were now very few enterprises in Mexico which had not been compelled, through no fault of their own, to default on their obligations during recent years, while this company had not only met the interest and sinking fund on its debentures out of profits as it had fallen due, but might now, unless the unexpected happened, return to a dividend-paying basis.

Richardsons, Westgarth and Co., Ltd.

A reorganisation scheme is under discussion. A circular has been distributed among the shareholders by the managing director (Mr. D. B. Morison), in which he replies to what he describes as "unfair and misleading" statements made in another circular which had been issued by a stockbroker and a shipowner of West Hartlepool. In the course of his statement Mr. Morison refers to the Contrallo patents as follows:—"The Contrallo patents were offered in the first instance to the company, but in view of the great speculative cost of developing world patents and the special expert staff involved, the Board decided not to exercise their option, but to retain their preferential manufacturing rights. The inventions were then developed by Mr. Morison and a few friends, and subsequently the Contrallo Co. was formed. Upwards of £50,000 have been spent to date in proving the inventions and developing the business, no part of which has been contributed by Richardsons, Westgarth & Co. The business is now of such importance that an agreement for the joint manufacture of certain Contrallo apparatus has just been entered into between Vickers and Richardsons, Westgarth & Co. which, asserts Mr. Morison, is calculated to largely benefit both companies."

According to the *Financial Times*, the reconstruction scheme was rejected at a meeting of preference and ordinary shareholders on Friday last, and a committee of shareholders is to confer with the directors with a view to formulating a scheme that would be generally acceptable.

The scheme proposed the reduction of the capital to £717,500 by reducing the value of the preference shares to 14s., and that of the ordinary to 7s.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.

At the annual meeting, held on December 20th, Major LEONARD DARWIN, who presided, said that the net profits, after providing for doubtful debts and war contingencies reserve, amounted to £162,149, which had enabled them to restore another £50,000 to the reserve fund, which now stood at £150,000, the figure at which it stood before the first withdrawal in 1911. It was satisfactory to have entirely retrieved the losses made in 1911 and 1914. Regarding the £30,000 for an officers' and employees' staff fund, the question of instituting such a fund had been under the consideration of the board for some time, and it had also been in the minds of some of the shareholders. There was no doubt that after the war the necessity and usefulness of such a fund would become even more apparent and pressing, as doubtless there would be many cases arising as the result of the war which they were sure the shareholders would wish them to treat as generously as possible. To act thus would be impossible unless such a fund were now established. Hitherto the company had done nothing to provide such a fund for its employees, and considering the time the firm had been in existence, and the position which it held, they considered it most desirable that this omission should be rectified now that the opportunity had arisen. It was true that two of the past directors, Mr. Robert Gray and Mr. J. Y. Buchanan, had endowed a staff fund, which now amounted to over £9,000, but such a sum did not go far in the case of a firm which employed over 4,000 hands. Of course, the existence of this proposed fund would not constitute a claim for every employee, as such, to the proceeds of the fund. The directors, or the trustees whom they appointed to administer the funds, had entire discretion in its administration, for it would only be possible for a body thus constituted to obtain all the information necessary to ensure a wise distribution of benefits. The record of the year had been one of plentiful Government orders, and an equally plentiful supply of obstacles in the way of getting material and labour to execute them. The terrible explosion at Silvertown at the beginning of the year fortunately did little personal injury to their hands beyond a slight amount of damage from broken glass, &c., causing some interruption to work. They had made a claim against the Government in respect to this damage, and they hoped that it would shortly be liquidated. They heard last year of the loss of their remaining cable-ship, the *Dacia*. He stated then that the question of replacing her was engaging the attention of the board. To build a ship at the present time, when there were so many claims on the yards for tonnage, was, of course, out of the question. They might, no doubt, be able to purchase a ship of a kind not likely to be of much service for general freights, but which would

adequately fulfil their present requirements. Unfortunately, however, if they did so they would be left with a very costly ship on their hands for their future work in peace time. The foreign branches on the whole had done well, and Persan had made a good profit, in spite of the many difficulties in regard to labour and material, which were specially acute in France. All the company's available cash had been invested in War Loan and War Bonds, both of which were accepted in payment of Excess Profits Duty. They had lately been in correspondence with the Inland Revenue with regard to this duty on the profits on the year ended September 30th, 1916, and had accepted their assessment. As long as the war lasted they hoped to have plenty of Government work, but when Peace was declared an anxious period would be in store for all those firms who had lost much of their usual trade through the making of munitions. They had set aside a certain amount for those troublous days, but if, as might well happen, it should prove insufficient, they must hope that the Government would come to the assistance of themselves and other firms who had been put to disadvantage by the performance of national work. The extra profits from war work would assuredly have been sufficient to see them through all their future difficulties if they were not nearly all to be taken from them. He could not finish without again calling the attention of the shareholders to the excellent work done under most trying circumstances by their much depleted staff. They had done their utmost to meet the increased demand on their energy, and they had done this largely out of a spirit of patriotism.

**Edison Swan
Electric Co.,
Ltd.**

Mr. C. JERMYN FORD presided, on December 19th, at the annual meeting. He said that the new capital, consisting of £100,000 preference shares, was issued in June last, shortly before the date of the

balance sheet. Loans now stood at £14,000, against £27,000 at the date of the previous balance sheet. The reserve account now stood at £40,000, against £15,000 in the previous balance sheet, bringing it almost up to the same figure at which it stood four years ago, when the whole of the fund was applied in reduction of various assets then standing on the credit side of the balance sheet. They had expended £3,402 on new buildings, mainly in respect of additions to the lamp works, making them more efficient and capable of a considerably increased output, and they would possibly have to make a further considerable outlay on this part of the works. The item of "plant and machinery" had also increased by £7,500 for the same reason. Stocks had risen to the extent of £315,000, which was mainly due to the enhanced cost of raw materials, coupled with the increased price of labour upon that portion of this item which consisted of work in progress. Sundry debtors stood at £123,000, an increase of nearly £20,000, a large percentage of the total sum owing to them being in respect of Government contracts. With regard to the profit and loss account, at the first glance the results of the trading for the year might seem to be unsatisfactory, but during the past year the company had carried on its operations under probably the most disadvantageous circumstances which it could possibly have to face. It had been pointed out at every annual meeting at which he had presided, that the need of additional working capital was very seriously prejudicing the company's position, rendering it unable to take full advantage of any increased trading which it might obtain, and for the last few years the position had become steadily worse in this respect. During the year under review it arrived at its climax, therefore the earnings disclosed could not be a surprise to them. That portion of the new money brought in by the preference share issue, of which up to the date of the balance sheet they had received about £60,000, was not at their disposal until practically a few days before the close of the financial year, as the allotment of the shares did not take place until June 1st, and the balance sheet carried them to the 30th of that month. Under these circumstances, of course, they received no practical benefit from this money in the period; the only way it really benefited them was that they were able to clear off a very large amount of their outstanding indebtedness for goods supplied, &c., otherwise the item of sundry creditors would stand at a very much higher figure. This shortness of working capital had also affected them in two other ways; first, they had been unable to take full advantage of discounts on goods purchased, which they might otherwise have done had they been able to pay promptly for them, and he estimated that the losses under this head amounted to somewhere about £8,000; and secondly, they had not been able, for the same reason, to purchase these goods as advantageously as they might have done had they had the ready money to do so. Then the profits which would, under normal conditions, have been earned at the branches abroad, had been seriously affected by reason of the fact that it had been impossible to obtain shipping freights in order to keep these branches fully supplied with stock, and, whilst the current expenses abroad had increased, as everything had increased (a world-wide complaint), they had not been able to sell a correspondingly increased amount of goods, and, unfortunately, he did not think that this condition of affairs could possibly be remedied so long as the present difficulty of shipping goods continued. He told them last year that they had increased their operations in the Colonies, and that they were building up a good business there, but since then the ques-

tion of shipping freights had become far more difficult than one could have foreseen. The profit derived from the manufacture of electric lamps had also suffered, partly from the rise in the cost of labour and materials, and partly from the fact that a very large number of their old and skilled hands had left the works to take up the manufacture of munitions, and they had been forced to fill their positions with unskilled hands, whom they had had to train. This difficulty had for the moment been practically overcome, and the sale of lamps for the past six months had largely increased. The price of the lamp was only raised in May last, a month or two before the accounts closed, whereas during the whole period the costs of manufacture had increased by about 33 per cent., for the reasons before stated. Generally speaking, they had been manufacturing all classes of their products under very difficult conditions. They quoted prices based upon current rates of labour and raw materials, adding such a percentage as they were able to against the contingency of higher prices for labour and raw materials which might come into force before the contract was completed, but the constant demands of labour for increased wages and the incessant rise in the price of raw materials made it practically impossible to provide for all these contingencies when contracts were entered into, and the profits had suffered accordingly. In spite of the additional capital brought into the business by the preference issue, the cash position was far from being comfortable. Owing to war conditions and the heavy rise in all raw materials, a large amount of capital was required to run a business of this character, and, as their turnover had materially increased in recent months, they had to conserve their cash resources in every direction. The question of a small dividend payment on the ordinary shares was the subject of a good deal of discussion, and the board naturally were anxious to recommend one directly they could see their way to do so. Some might consider that, instead of carrying forward £13,266, they should apply a portion of this in the payment of a small dividend upon the "A" shares, but they must bear in mind that they still owed the bankers about £35,000, and it was incumbent upon them to reduce this as far as possible. Then they had over £7,000 to pay away shortly for munitions levy. On January 1st there was the interest upon the first debenture stock to be met, which amounted to about £7,700, and on February 1st there was the dividend upon the new preference shares, absorbing between £2,000 and £3,000. A dividend of only 2 per cent. upon the "A" shares would absorb £7,600, and therefore, under these circumstances, they had to go very closely into the cash position. They had suffered heavily during the last few years from the shortage of cash working capital, and now that they were getting into a better position it behoved them to be very careful that they did not run short again. For all these reasons they felt that, as regarded an immediate dividend, they must go a little slow, and they did not therefore see their way to recommend it at the present juncture. He trusted they would not consider that his was too gloomy a view of the position, but they must realise that all these facts, coupled with the great shortage of working capital which they had to face, made it impracticable for them to show better results. However, the new money had undoubtedly improved the position and earning capacity, and, with the very considerable increase in the output of lamps which they had now achieved, should make it possible for them, in the absence of unforeseen circumstances, to make a better showing for the current year. Practically the whole of the engineering side of the works had been, and was still, occupied with Government work. They had experienced a loss of profit of approximately £2,500 in consequence of having received no dividend in the past year on the holding of deferred shares in Altrincham Electric Supply. This concern suffered during the past year from the operations of the Daylight Saving Bill, and from general economies in use of current for domestic lighting purposes, and the high price of coal. He was glad to say, however, that this had now been to a great extent counter-balanced by some important contracts entered into for the supply of current for power purposes, and he was looking forward to far more satisfactory results for the current year. In regard to the question of the splitting of the existing £5 shares, which was fully set out in the scheme placed before them relating to the creation of the preference shares, an extraordinary general meeting would be held immediately following the meeting to sanction the cancellation of the remaining liability of £2 upon some of the partly-paid £5 shares, and should they pass the resolutions an application would be made to the Court at the earliest possible moment to obtain an order to confirm the reduction of capital, and at the same time the shares would be split into the denomination of £1 each.

Mr. E. B. ELLICE CLARK, in seconding the motion, said that with regard to the Munitions Levy of £7,266, the board considered it was not too strong a term to say it was an almost unjustifiable levy. The levy was based on pre-war profits, and as they knew, unfortunately for the company, for a few years before the war they were in low water, and made very small profits, and in one year they actually made a loss. The company voluntarily placed its resources at the service of the Government, which must interfere to some extent with its ordinary business, and they considered the levy was an exaction. They had to remember they were engaged in an industry which was of great service to the

country; whereas companies selling fripperies were making large profits, and were not called on to pay so much in view of the profits they were making before the war.

An extraordinary meeting followed, and the resolution dealing with the rearrangement of capital was carried.

Spanish & General Wireless Trust.—According to the *Morning Post*, Mr. Godfrey Isaacs presided at the annual general meeting held last week. He said that the Spanish business, in which they were very largely interested, was developing very satisfactorily, and a very substantial increase would be made to their producing powers in the early future. There was every reason to contemplate that the next twelve months would produce a very satisfactory balance sheet. In that case, there was reason to believe that it might be thought wise in Spain to declare a dividend. If this were done their Company—the Spanish and General—must benefit very substantially. The possibilities of business during the past year had been practically nil in consequence of the conditions which had prevailed. They did, however, continue some negotiations in Russia, where they considered a very substantial business would be done after the war, but in consequence of recent events the figures which related to their interest in this business stood in the balance sheet as “debtors and debit balances.” That particular business had not been formally completed, and he dare not, at the present moment, express any opinion as to when it would be completed, or as to what would happen in Russia.

Costa Rica Electric Light & Traction Co., Ltd.—For the year ended June 30th, 1917, the net earnings in Costa Rica, after charging all expenses incurred, amount to £14,381, a decrease of £1,830 on the year. The net deficit is £3,827. This unfavourable result is chiefly due to the serious depreciation of the Costa Rica currency, the “Colon” only representing at present half its nominal gold value.

As all supplies have to be paid for in gold, the rise in the rate of exchange has automatically increased the expenses. The greatly enhanced cost of all stores, caused by the war, has also contributed to the decreased profits of the undertaking. In spite of the general depression in Costa Rica resulting from the stoppage of exports and dislocation of trade, the volume of the company's business has been maintained to an unexpected degree, and, but for the rate of exchange, would, even in the past year, have yielded a surplus after providing for all expenses. The power plant at El Brazil has worked well throughout the year. During the year the gold premium has averaged 200 per cent., as against 140 per cent. for the previous year.

Blackpool, St. Anne's & Lytham Tramways Co., Ltd.—The annual meeting was held at Blackpool last week, Mr. Geo. Nicolson presiding. The directors reported that necessary repairs would be carried out when labour and materials were available, and provision had been made on this account. The traffic receipts were £59,028, less £16,066 paid to the Blackpool Corporation, making the net amount, £42,962, and other receipts brought the total to £44,421. After the payment of expenses, there was a credit balance of £11,287. The directors recommend a distribution of the full year's interest of 5 per cent. on the debenture stock. The renewals account amounts to £10,727. In congratulating the shareholders upon the successful year's working, the chairman mentioned that practically all their available staff had joined the Army, and the cars were now entirely conducted by women.

Mr. C. H. Moore seconded the motion, which was carried. Subsequently a resolution was passed authorising the directors to establish an officers' and employees' staff fund.

W. & T. Avery, Ltd.—Interim dividend on the ordinary shares of 5 per cent., less tax.

Marconi International Marine Communication Co., Ltd.—Interim dividend of 5 per cent., equal to 1s. per share, less income-tax.

STOCKS AND SHARES.

FRIDAY EVENING.

The Stock Exchange broke up for its Christmas holidays with considerable strength in all the markets. A buying movement started in Consols, spread to Home Railway Stocks, and made its influence felt in practically every department of the House. No particular reason developed for this change, but this did not make it in the least welcome, and the disappointing feature was the difficulty to get stock with which to supply the suddenly persistent buyers.

The Home Railway market has assumed a much brighter complexion as a consequence of quite a small demand for the coming issue. Apparently, a few investors have noticed that Home Railways return tempting yields at the present time, and, for the moment, that is to say, to discount some of the possibilities which may materialise after the war. Investment had not spread to the Undergrounds up to the time of the House dispersing for the Christmas holidays, but that it did so early in the New Year is tolerably certain, provided strength is maintained amongst the steam stocks.

Home electricity shares show no changes at all throughout the day, but there has been some inquiry for the manufacturing companies, and the early dullness in the group is shown

by British Aluminium ordinary, which went back to 32s., at which price a return on the money comes to just over 6½ per cent. The Iron and Steel divisions have started to rally, and an appreciable recovery set in amongst rubber shares, assisted by a rise in the price of the material to half-a-crown per lb.

Mexican Light & Power common shares have been marked down to 5 points at 17½, and the severe slump in other Mexican issues, to which we made detailed reference last week, has not been counteracted by any recovery, notwithstanding the fact that Mexican stocks and shares as a whole are a slightly better market, or, as it might be more correct to say, a slightly less weak one. British Columbia 4½ per cent. Debenture has fallen 2 points, and Brazil Traction weakened to 15½. The Anglo-Argentine Tramways stocks are dull on the announcement that the directors have decided to postpone the payment of a dividend on the First Preference, and the price of these shares has again fallen an eighth to 2½.

Globe Ordinary are better in the telegraph department, where other stocks maintain their prices well, although Great Northern lost the £1 which they put on last week, the price reacting to 36. Marconis have come into demand again, due principally to the declaration of an interim dividend of 5 per cent. on Marconi Marines. This had the effect of strengthening the price of the last named to 52s., while Americans rose to 24s., and Canadians to 11s. The telephone market throughout is firm.

Having regard to the shortage of time and paper, the brevity of the market report may possibly be excused this week. Which same brevity makes no difference to the cordiality of the wish, to those who have the patience to read these notes, that they may enjoy a Peaceful and Prosperous New Year.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.						
	Dividend		Price	Rise or fall this week.	Yield p.c.	
	1915.	1916.	Dec. 21, 1917.			
Brompton Ordinary	10	9	6½	—	26 18	6
Charing Cross Ordinary ..	5	5	4	—	6 5	0
do. do. 4½ Pref.	4½	4½	83	—	5 18	4
Chelsea	4	4	22	—	5 9	1
City of London	8	8	18½	—	6 0	9
do. do. 6 per cent. Pref. ..	6	6	10½	—	5 18	6
County of London	7	7	11	—	5 7	8
do. do. 6 per cent. Pref. ..	6	6	10½	—	5 18	6
Kensington Ordinary	7	6	6½	—	5 11	7
London Electric	8	Nil	1	—	Nil	
do. do. 6 per cent. Pref. ..	6	4	3½	—	5 6	8
Metropolitan	8	8	8½	—	4 12	4
do. do. 4½ per cent. Pref. ..	4½	4½	23	—	6 13	4
St. James' and Pall Mall ..	8	8	7	—	5 14	6
South London	5	5	8	—	6 13	4
South Metropolitan Pref. ..	7	7	21/6	—	6 10	6
Westminster Ordinary	7	7	6½	—	5 9	8
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	6	6	95	—	5 5	0
do. do. 8½ Pref.	8½	1½	23½	—	6 8	4
Chile Telephone	8	8	7½	—	5 11	4
Cuba Sub. Ord.	6	7	9½	—	7 11	4
Eastern Extension	8	8	15	—	5 6	8
Eastern Tel. Ord.	8	8	150½	—	5 6	4
Globe Tel. and T. Ord.	7	7	13½	+ ½	5 1	10
do. do. Pref.	6	6	10½	—	5 17	1
Great Northern Tel.	22	24	26	— 1	6 11	6
Indo-European	13	13	62½	—	5 8	10
Marconi	10	16	8½	—	4 17	10
Oriental Telephone Ord. ..	10	10	8	—	3 6	8
United R. Plate Tel.	8	8	5½	—	5 17	5
West India and Pan.	6d.	6d.	1½	—	8 9	6
Western Telegraph	7	8	15½	—	5 6	6
HOME RAILS.						
Central London, Ord. Assorted	4	4	60½	—	6 12	
Metropolitan	1	1	21½	—	4 11	0
do. do. District	Nil	Nil	15½	—	Nil	
Underground Electric Ordinary	Nil	Nil	12	—	Nil	
do. do. "A"	Nil	Nil	5½	—	Nil	
do. do. Income	6	4	81	—	4 18	9
FOREIGN TRAMS, &c.						
	Dividend					
	1915.	1916.				
Adelaide Sup. 5 per cent. Pref.	6	6	4½	—	6 3	1
Anglo-Arg. Trams, First Pref. ..	5½	5½	22	— ½	—	
do. do. 2nd Pref.	5½	—	2½	—	—	
do. do. 5 Deb.	5	5	66½	—	7 10	8
Brazil Traction	4	4	45½	—	—	
Bombay Electric Pref.	6	6	92	—	6 4	9
British Columbia Elec. Ry. Pfee.	5	5	44½	—	11 15	4
do. do. Preferred	Nil	Nil	30	—	Nil	
do. do. Deferred	Nil	Nil	28	—	Nil	
do. do. Deb.	4½	4½	65	— 2	7 11	8
Mexico Trams 5 per cent. Bonds	Nil	Nil	82½	—	Nil	
do. do. 6 per cent. Bonds ..	Nil	Nil	84½	—	Nil	
Mexican Light Common	Nil	Nil	17½	— 5½	Nil	
do. do. Pref.	Nil	Nil	29	—	Nil	
do. do. 1st Bonds	Nil	Nil	92½	—	—	
MANUFACTURING COMPANIES.						
Babcock & Wilcox	15	15	3½	—	4 14	1
British Aluminium Ord.	7	10	11½	— ½	6 5	9
British Insulated Ord.	17½	20	8	—	6 13	4
British Westinghouse Pref. ..	7½	7½	22½	—	5 11	4
Callenders	20	20	11½	—	6 18	0
do. do. 6 Pref.	5	6	4½	—	6 1	8
Castner-Kellner	22	20	87½	—	6 17	8
Edison Swan, fully paid	—	—	2½	—	Nil	
do. do. 4 per cent. Deb. ..	4	4	75½	—	5 6	0
Electric Construction	7½	7½	1½	—	6 13	4
Gen. Elec. Pref.	6	5	10½	—	5 14	8
do. do. Ord.	10	10	19½	—	5 1	3
Heuley	25	25	16½	—	7 11	6
do. do. 4½ Pref.	4½	4½	4	—	5 12	2
India-Rubber	10	10	14½	—	6 15	7
Telegraph, Con.	20	20	41½	—	5 15	7

* Dividends paid free of income-tax.

INSTALLATION "D": CONNECTED MARCH, 1915.
CLASS—STAFF FEEDING.

One double oven range, 13.3 kw. One 12-gallon boiling pan, 6 kw. One pudding steamer, 2 kw. One grill, 4 kw. One oval fish fryer, 2 kw. One 4-gallon urn, 3 kw. One hot cupboard, 2.5 kw.
Total loading of whole equipment, 32.8 kw.

The following table shows the details of consumption, cost of maintenance, &c., on the installations referred to:—

Installation.	Period of observation.	Consumption in units.	Average number of meals per week.				Cost of maintenance per 1,000 units consumed.	kw. connected.	Remarks.
			Breakfasts.	Lunches.	Teas.	Total.			
"A"	10 months	122,052	389	5,186	3,943	9,518	1s. 6½d.	247.6	
"B"	1 year	97,140	204	1,480	1,270	2,944	2s. 9d.	130.9	
"C"	1 year	21,141	211	452	328	991	2s. 9½d.	40.5	
"D"	1 year	20,690	48	371	221	640	4s. 6½d.	32.8	See below.

Remarks.—"A." In addition to the figures of meals, there is a weekly average of 600 Bovril and hot drinks. The list

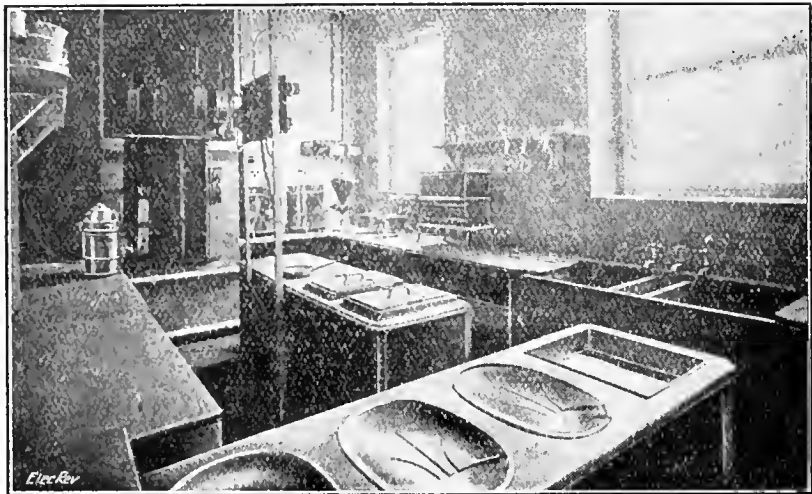


FIG. 7.—DINING ROOM SERVERY, INSTALLATION "A."

of the quantity of food cooked is a weekly average. From tests taken, the consumption of energy per person served, including staff, is 0.29 unit per meal.

"B." The list of the quantity of food cooked and consumed on an average day gives a good indication of the nature of the work performed. There are, however, several items carried out by the apparatus which do not come under the heading of cooking for the staff. The estimated consumption of electricity per person is 0.5 unit per meal.

"C." No list of food cooked has been obtained from this installation, but the consumption of electricity per person per meal is 0.41 unit.

"D." In addition to the number of meals provided, there is a weekly average of 16 Bovril and hot milks, and 50 lb. of bread baked and nine suppers. There are also occasions when large quantities of food are cooked and consumed at other places, a list of which is given. The consumption of electricity per person catered for is 0.51 unit. The cost of maintenance on this installation is high because during the last 18 months the apparatus has been catering for 100 per cent. more people than originally intended.

In conjunction with these figures, one must also consider the advantages of electrical cooking, from the economy of labour and food, simplicity of operation, the less fire risk, the saving on utensils, cleanliness, and the less floor space required as compared with coal, gas, or steam.

The details of operation of the supplementary plant at installation "B" are not included in this analysis, or in the part showing the nature of the load, as they are used mostly for warming up food.

In the analysis, all elements, &c., that have been supplied free under guarantee have been included at their ordinary costs. Workmen's time has been omitted in order to make a true comparison with these installations close to the workshop.

MAINTENANCE ANALYSIS OF INSTALLATIONS "A," "B," "C," AND "D."

Installation.	Oven.	Elements.					Vegetable steamer.	Wiring faults.	Earthing faults, terminals, &c.
		Hot-plate.	Grill.	Urn.	Hot cupboard.	Fish fryer.			
"A"	4	2	7	—	—	—	—	17	4
"B"	20	16	25	5	2	3	7	27	25
"C"	—	22	1	1	—	—	—	14	3
"D"	2	28	28	—	—	—	—	17	2

Average quantity of food cooked and consumed at installation "A" per week:—

1,362 lb. of roast meat, 140 birds (average weight 3 lb. each), 282 grills, 300 lb. of sausages, 35 gals. of soup, 2,162 portions of fish, 140 lb. of Yorkshire pudding, 2,940 lb. of potatoes, 10½ pecks of peas, 63 cabbages, 84 lb. of turnips, 56 lb. of carrots, 56 lb. of milk pudding (in dry state), 884 portions of ham and eggs on toast, 1,150 cups of coffee, 15 gals. of water boiled from 150 deg. F., 1,265 portions of hot sweets, 112 lb. of scones, 42 lb. of pastry.

Average quantity of food cooked and consumed at installation "B" per day:—

73½ lb. of roast beef, 34 lb. of haricot mutton, 10 gals. of potato soup, 21 lb. of peas boiled, 10 lb. of beans boiled, 112 lb. of potatoes, ¼ gal. of vegetable stock, 6 gals. milk pudding, 1 gal. of hot milk, 2 hams boiled (28 lb.), 80 eggs fried and poached, 1 side of bacon (grilled and fried), 100 gals. of water boiled from cold, 22 lb. of chops grilled, 67 slices of toast, 10 gals. of coffee, 2 lb. of Quaker oats.

Average monthly list of food prepared on the apparatus at installation "D" and consumed at other places:—

218 lb. of boiled beef, 98 lb. of roast beef, 77 lb. of boiled ham, 230 lb. of bread, 50 gals. of water boiled from cold, 50 teas, 21 lb. of beetroot, 16 lb. of cake.

A comparison of the initial costs of installations "A" and "B" with electrical apparatus, gas apparatus, and a mixture of coal, gas, and steam apparatus, is given in the following table

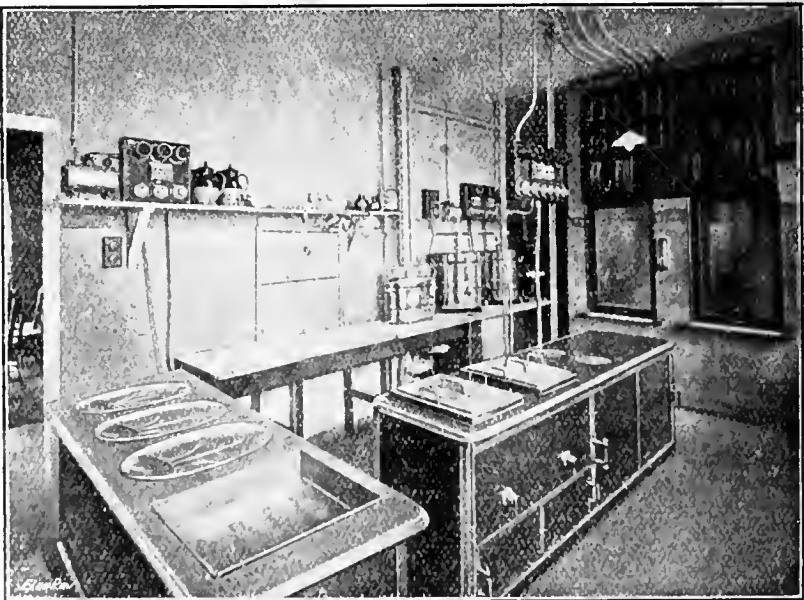


FIG. 8.—SMOKE ROOM SERVERY, INSTALLATION "A."

(the cost of connecting up the apparatus to the source of supply is in each case included):—

Installation.	Electricity.			Gas.			Coal, gas and steam.		
	£	s.	d.	£	s.	d.	£	s.	d.
"A"	1,116	19	0	1,169	0	0	1,275	0	0
"B"	566	6	0	488	0	0	536	0	0
"C"	108	12	0	98	10	0	—	—	—
"D"	111	12	6	104	8	0	—	—	—

In the case of gas apparatus, the warming cabinets and portable fish fryers in installation "A" have been omitted.

as it was impossible to obtain prices for them. It is doubtful, however, if they could be supplied for gas heating. In the case of the coal, gas, and steam apparatus at the same installation, oven roasting, pastry baking, and grilling would be carried out by coal or coke (with the exception of the grills in the serveries, which would be done by gas); the hot cupboards and steamers by steam, and the remainder of the apparatus would be heated by gas.

On installation "B," under coal, gas, and steam apparatus, coal or coke would be used for the treble oven range and grilling, gas for the cabinet roaster and fish fryers, and the

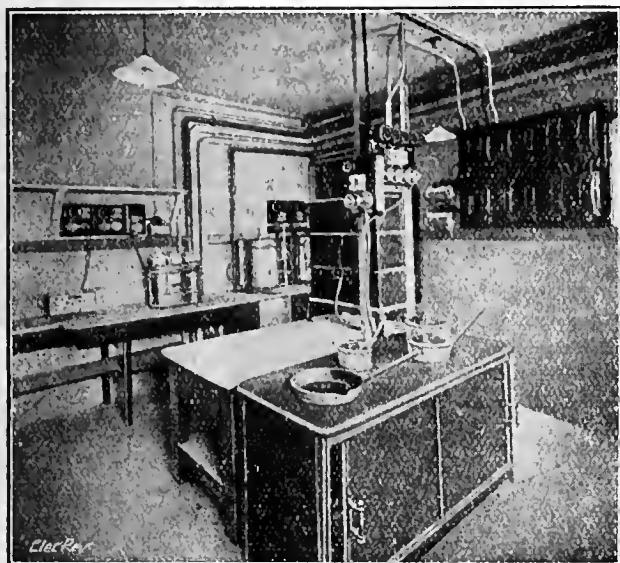


FIG. 9.—CAFE SERVERY, INSTALLATION "A."

remainder of the apparatus would be heated by steam.

The author is indebted to the Falkirk Iron Co., Ltd., for supplying the prices of the apparatus for coal, gas, and steam.

The difference in the initial cost is not so much with an installation of coal, gas, and steam, as with gas alone, but it would be impossible to use gas apparatus only on installation "A," for instance, owing to the restricted space. The first cost is not the only cost to be considered, and should never be looked upon as the predominant factor.

When the working comparisons are considered, electricity has the advantage in almost every detail, the following being a few of the essential items which in the majority of cases when carefully gone into offer sufficient advantages to outweigh any difference in capital cost:—

1. Cleanliness and absence of fumes.
2. Constant heating value, also the facility of reducing the heat to a definite degree, which is impossible with either coal, gas, or steam.
3. Reduced labour costs as compared with coal or steam.
4. Less floor space required, owing to the fact that electrical apparatus can be installed in almost any position, and in some cases mounted on tables or one above the other. Less floor space means less rent.
5. Economy in food, owing to less shrinkage of meat and less waste of food.
6. Saving on the renewal of kitchen utensils.

There are many other incidental advantages, but the above are in themselves sufficient to justify the installation of electrical apparatus.

Fig. 6 shows the lay-out of a canteen kitchen designed and in course of construction by the author. It will be observed that arrangements have been made to carry out efficiently the preparation of food for cooking by the use of auxiliary plant—meat and vegetable choppers, potato peelers, &c. The kitchen is situated between the dining rooms, the plant being designed to supply the cooked food for 1,500 persons at one sitting. Special attention has been given to ensure quick service, and the washing-up arrangements are such that plates, &c., are cleaned with a minimum of handling. The total load connected is approximately 350 kw.

The charts reproduced in fig. 10 show the nature of the loads on the respective installations, the lower chart being a summation of the other four.

These charts of supply should be of special interest to central-station engineers, as they indicate how similar installations will affect the load on their stations and networks. They also form a guide as to what one may expect in the future when the majority of large kitchens are run by electricity. In the author's opinion this is only a question of time.

It is, of course, assumed that the central-station engineer, or the sales engineer, has a thorough knowledge of cooking apparatus and their performances before he starts his campaign; if not, either the services of an expert must be secured, or any attempt to increase the cooking load must be

postponed until he has mastered the subject. The best way of buying his experience—and it can only be bought—is to erect a trial installation where he can closely watch its behaviour; by so doing he is getting his information first hand, from which he can lay his plans for future developments. If those engineers who have not yet attempted the large cooking business will look around their districts, they will be surprised to see the enormous amount of revenue that awaits them from large staff-feeding establishments, cafés, restaurants, &c., which will fully justify the first trial installation.

DISCUSSION AT LEEDS.

The paper was discussed by the YORKSHIRE LOCAL SECTION on December 18th. Mr. GILLOTT reiterated his remarks in London as to the necessity of co-operation between the central-station authorities and manufacturers, and the formation of an advisory committee, subsidised by both parties, to prepare campaigns, conduct demonstrations, and draw up schemes for submission to clients under expert guidance.

Mr. J. SHEPHERD, opening the discussion, said that, speaking merely as an engineer, and one who did not know much about kitchens, he thought that, whilst electricity was eminently suitable for cooking operations in small kitchens, some of the applications which had been illustrated as having been made in large kitchens were not so suitable for electrical operations as for steam. He did not think that the heating of very large hot-plates or cupboards, or the boiling of large quantities of water, or the making of large stews could be done as economically by electricity as by steam. Whilst this was not of consequence in the small kitchen, it was of considerable moment in the large kitchen.

Mr. T. ROLES said the illustrations indicated that wonderful strides had been made in electrical cooking during the last few years. He agreed that it was very necessary that there should be co-operation between the supply companies and the manufacturers, and thought that the municipal engineer

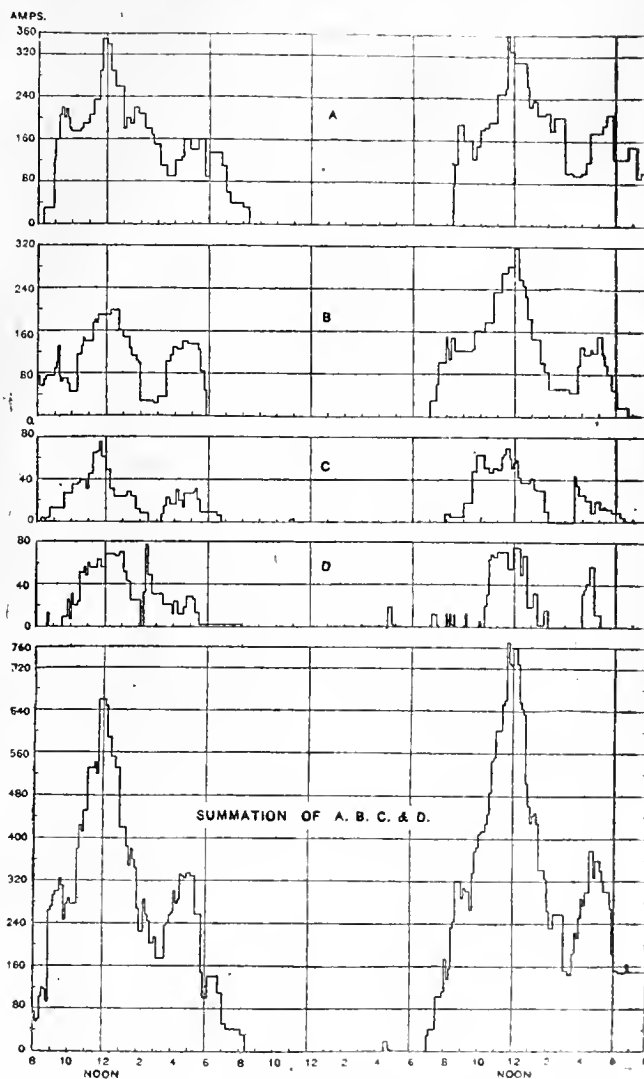


FIG. 10.—LOAD CURVES, AT 240 VOLTS.

should also be included. An important difficulty to get over still was that of overcoming the objection that electrical apparatus cost so much more than the other apparatus for cooking purposes. He thought that the author was quite right in saying that the services should be run in duplicate, with a separate switch and fuse for each piece of apparatus. Domestic cooking had suffered very much in the past from the

fact that a whole range had only one fuse. He thought that the difference between an installation for a restaurant and that for a staff-feeding establishment, which the author had emphasised, was important, and that it was very necessary that the actual requirements should be ascertained very precisely before the installation was put down. It would be extremely interesting if they could get to know how the load curve of cooking affected the general load curve.

Mr. W. M. SELVEY said he thought this question of the cooking load might turn out to be one of the most important matters that the supply engineer had to consider. The important thing for the engineer was to know whether the cooking load would dovetail in with the rest of the load or whether it would be overlapping and merely intensifying the peak load.

Mr. C. E. ALLSOP spoke of the importance of a sufficiency of hot-cupboard space in the restaurant installation. He asked for the author's opinion on the thermometer in the use of ovens, the question of indicating lamps, the matter of pin-contacts, and the degree of pressure which was advisable.

Mr. H. W. WALKER said he thought that, in cooking installations, hardly enough attention had been paid to the matter of ventilation. He had failed to satisfy himself as to the amount of economy achieved by electrical cooking in regard to the shrinkage in meat.

Mr. W. B. WOODHOUSE said he had not the slightest doubt that, owing to the diversified apparatus now in operation, electric cooking was a sound commercial proposition, and compared very favourably with gas or steam. Steam heating might be very good if there was a steady use of it, but the load curves shown indicated that the cooking demand was very far from constant, and for the greater part of the day there would be a heavy loss in the steam. The tendency now, he thought, was for the lighting load in electricity supply to become relatively unimportant. There were cases in which the lighting load was less than 5 per cent. of the total.

Mr. GILLOTT, in reply, said he thought Mr. Woodhouse had answered the point in regard to steam. A good deal depended on whether or not steam was there already for another purpose. Undoubtedly the electrical was the cheaper form of apparatus for large kitchens in regard to maintenance costs. The running costs of gas were higher than those of electricity. An important matter in putting in an installation was to know with as much exactness as possible what it was required for. If in such matters engineers could not secure the services of an expert they should be guided by the chef. In regard to the relationship of the cooking-load curve to the general-load curve, they found in Newcastle that the cooking load came on just when it was wanted, and it served to fill the gaps. The cooking load was going to be a very big thing, and those engineers who did not look after it were going to lose money materially. Wiring troubles were getting much less than they used to be, but they were not yet down quite as low as he would like them to be. He did not approve of the use of thermometers, but got better results by teaching people how to use the apparatus. He mentioned an important case in which the instruction of a lady demonstrator had the effect of reducing the electricity consumption by 33 per cent. He thought that the best indicating lamp was an ordinary 8-c.p. lamp. Pin contacts he had discarded five years ago for reasons which he described. As to voltage, he thought the best results were got from a low voltage. In regard to ventilation, if there was too much of it the advantage of low shrinkage of meat food was liable to be lost. He had carried out tests showing as low a shrinkage in meat as 5 per cent., but he did not claim better than 15 or 20 per cent. in speaking to customers. In the most conclusive way, by tests of which he gave full details, it had been proved that the shrinkage in weight of meat was less in the case of electrical cooking than in that of any other process, and that the yield of fat—which was so valuable nowadays that in one notable case on record the yield of the sale of it more than paid the cost of the electricity used—was larger by the use of electricity in cooking than by any other process.

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS W. P. THOMPSON & CO., Electric Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

- 18,281. "Liquid rheostats." BRITISH WESTINGHOUSE ELECTRIC & MANUFACTURING CO. December 10th (U.S.A., December 26th, 1916.)
- 18,283. "Electric-current controllers." J. ANDERSON & G. ELLISON. December 10th
- 18,285. "Signalling and train-stopping apparatus." L. H. WHITEHEAD. December 10th
- 18,325. "Device for testing electric ignition of internal-combustion engines." F. W. MURRAY. December 11th
- 18,339. "Telephone transmitters." A. MAER. December 11th
- 18,343. "Miners' electric handlamps." A. H. RAILING & A. E. ANGOLD. December 11th
- 18,349. "Electrical separation of suspended particles from gaseous bodies." H. A. BURNS. December 11th
- 18,357. "Ignition devices for internal-combustion engines." F. L. HOLLISTER. December 11th
- 18,378. "Spark-gap devices." F. L. HOLLISTER. December 11th
- 18,379. "Ignition dynamo." F. L. HOLLISTER. December 11th
- 18,407. "Electrically-operated apparatus for displaying advertisements, &c." J. A. BIRBY, W. CLOSK & F. G. PALMER. December 12th

- 18,413. "Electric transformers." SIEMENS SCHUCKERTWERKE. December 12th. (Germany, July 9th.)
- 18,418. "Electro-deposition." C. W. DENNY. December 12th.
- 18,427. "Electric welding." S. WHYTE. December 12th.
- 18,429. "Welding metals." S. WHYTE. December 12th.
- 18,438. "Multiple electric switches." V. E. JOYCE & PARK ROYAL ENGINEERING WORKS. December 12th.
- 18,441. "Electric dry cells." H. DE LA T. FENTON PHILLIPS. December 12th.
- 18,442. "Electric transformers." BRITISH THOMSON-HOUSTON CO. & F. W. COOKE. December 12th.
- 18,449. "Machines for applying caps to electrode rods of batteries." S. L. CASELLA. (U.S.A., January 2nd.) December 12th.
- 18,453. "Electric cables." CALLENDER'S CABLE & CONSTRUCTION CO. AND W. WILLIAMS. December 12th.
- 18,476. "Fittings for incandescent electric lamps." F. QUARMBY. December 13th.
- 18,487. "Electric cables." PIRELLI & CO. December 13th. (Italy, March 26th.)
- 18,489. "Portable lamps for signalling taxi-cabs, &c." J. H. STRINGER. December 13th.
- 18,490. "Electric recording instruments." E. FAWCETT. December 13th.
- 18,494/5/6. "Engine starters." V. BENEIX. December 13th.
- 18,497. "Engine starters." F. B. DEHN (Eclipse Machine Co.). December 13th.
- 18,501. "Telephone systems." AUTOMATIC TELEPHONE MANUFACTURING CO. (U.S.A., December 15th, 1916.) December 13th.
- 18,502. "Telephone systems." AUTOMATIC TELEPHONE MANUFACTURING CO. (U.S.A., January 8th.) December 13th.
- 18,533. "Headgear for telephone, &c., receivers." H. W. METCALFE. December 13th.
- 18,536. "Methods of operating flaming arc lights for projectors." SPERRY GYROSCOPE CO. (U.S.A., December 18th, 1916.) December 13th.
- 18,542. "Spark plugs." H. J. BERRY. December 13th.
- 18,564. "Electric switches." ELECTRIC & ORDNANCE ACCESSORIES CO. AND J. ETCHELLS. December 14th.
- 18,567. "Electric switch plugs." R. CRUST. December 14th.
- 18,568. "Electric motors of the movable-coil type." R. BEATTIE. December 14th.
- 18,595. "Automatic and semi-automatic telephone systems." AUTOMATIC ELECTRIC CO., AUTOMATIC TELEPHONE MANUFACTURING CO. & F. C. TOMLINS. December 14th.
- 18,597. "X-ray tubes." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.) December 14th.
- 18,600. "Mercury switches." G. W. STEPHENSON. December 14th.
- 18,603. "Projector arc lamps." J. BROCKIE AND JOHNSON & PHILLIPS. December 14th.
- 18,610. "Automatic electric switches for polyphase currents." H. F. JOEL. December 14th.
- 18,613. "Flashlamps." C. J. HARVEY & H. W. HOOPER. December 14th.
- 18,621. "Audion or lamp relay or amplifying apparatus." M. LATOUR. (France, November 30th, 1916.) December 14th.
- 18,627. "Magnet compasses for aerial navigation, &c." A. L. NEALE, A. V. PARIS & H. YEOMANS. December 14th.
- 18,641. "Means for locking incandescent electric lamps to holders." H. SMITH. December 15th.
- 18,649. "Electric pocket-lamp." E. G. PHOEBUS COMP. (Switzerland, March 7th.) December 15th.
- 18,657. "Electric arc striker." BRIAN, FORREST & CO., J. C. BRIAN AND T. A. FORREST. December 15th.
- 18,682. "Condensers." O. R. VERITY. December 15th.
- 18,683. "Electric cable grips." W. T. HENLEY'S TELEGRAPH WORKS CO., E. MOOR & W. H. NICHOLS. December 15th.
- 18,689. "Method of transforming anthracite coke, &c., rich in carbon into a product suitable for manufacture of carbon electrodes." S. E. SIEURIN. December 15th.
- 18,700. "Electric current rectifiers." H. S. MILLS & H. WADE. December 15th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

- 11,377. APPARATUS FOR AUTOMATICALLY CONTROLLING FROM A DISTANCE VARIABLE-SPEED OR REVERSIBLE ENGINES. L. J. Creplet. October 4th, 1915. (101,699.)
- 16,540. BRUSH-LIFTING AND SHORT-CIRCUITING DEVICES ON INDUCTION MOTORS AND THE LIKE. T. H. Hurst & Brush Electrical Engineering Co. November 18th, 1916. (111,324.)
- 16,566. APPARATUS FOR PRODUCING PERFORATED STRIP BY ELECTRICAL CURRENT IMPULSES. H. H. Harrison and Creed & Co. November 18th, 1916. (111,326.)
- 16,737. RADIO-TELEGRAPH AND TELEPHONE STATIONS. F. G. Simpson. November 22nd, 1916. (111,332.)
- 16,835. MINE SIGNALLING SYSTEMS. J. DAVIS & SON AND W. H. DAVIS. November 24th, 1916. (111,339.)
- 16,897. MEANS AND APPARATUS FOR AUTOMATICALLY RENDERING DEFECTIVE TELEGRAPHIC SIGNALS UNIFORM, AND FOR STORING THEM UP PREPARATORY TO TRANSMISSION. November 24th, 1916. (111,343.)
- 16,907. CONNECTION OF ELECTRIC CABLES TO JUNCTION BOXES OR LIKE APPARATUS. British Insulated & Helsby Cables, Ltd., and R. W. Blades. November 25th, 1916. (111,344.)
- 16,992. "Electric motor controllers." E. C. R. MARKS (Mercury Manufacturing Co., U.S.A.) November 27th, 1916. (111,347.)
- 17,189. PROTECTION OF ELECTRIC SUPPLY OR DISTRIBUTION SYSTEMS IN WHICH SPLIT OR PARALLEL CONDUCTORS ARE EMPLOYED. Electric Improvements, Ltd., Callender's Cable & Construction Co., Ltd., and T. O. Callender. November 30th, 1916. (111,351.)
- 17,553. ELECTRICAL SWITCHES. R. W. BELL. December 7th, 1916. (111,361.)
- 17,912. WELDING OF PLATES. Quasi Arc Co. & W. L. Cole. December 13th, 1916. (111,363.)
- 18,541. ELECTRICAL HEATING APPARATUS FOR PERMANENTLY WAVING HAIR ON THE HEAD. E. F. SUTT. December 28th, 1916. (111,372.)

1917.

- 180. MAGNETO-ELECTRIC MACHINES. M-L. Magneto Syndicate, G. A. Lister and E. A. Watson. January 4th, 1917. (111,373.)
- 788. CARBON HOLDERS OF ELECTRIC ARC LAMPS. W. L. Humphries. January 16th, 1917. (111,382.)
- 860. ELECTRIC BATTERIES. H. D. Henry. January 17th, 1917. (111,383.)
- 1,577. MAGNETO DEVICES FOR INTERNAL-COMBUSTION ENGINES. Villiers Engineering Co., G. Funck & F. H. Farrer. January 31st, 1917. (111,394.)
- 2,026. TROLLEY HEADS FOR ELECTRIC TRACTION. W. Pickersgill & J. H. Pitt. February 10th, 1917. (111,396.)
- 2,621. ELECTRICAL MASSAGE APPLIANCES. E. Peckham. July 4th, 1917. (111,399.)



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